



Leica TPS1200+/TS30/TM30

Technical Reference Manual

Version 8.5
English

- when it has to be **right**

Leica
Geosystems

Introduction

Purchase



Congratulations on the purchase of a TPS1200+/TS30/TM30 series instrument.

To use the product in a permitted manner, please refer to the detailed safety directions in the User Manual.

Product identification

The type and the serial number of your product are indicated on the type plate.
Enter the type and serial number in your manual and always refer to this information when you need to contact your agency or Leica Geosystems authorized service workshop.

Type: _____

Serial No.: _____

Symbols

The symbols used in this manual have the following meanings:

Type	Description
	Important paragraphs which must be adhered to in practice as they enable the product to be used in a technically correct and efficient manner.

Trademarks

- CompactFlash and CF are trademarks of SanDisk Corporation
 - Bluetooth is a registered trademark of Bluetooth SIG, Inc
- All other trademarks are the property of their respective owners.

Validity of this manual

This manual applies to TPS1200+ and TS30/TM30 instruments.

Due to the different instruments and equipment, some parts of the manual may not be valid. Where there are differences between the instruments they are clearly described.

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Description

- The instrument can be protected by a **Personal Identification Number**.
- If the PIN protection is activated, the instrument will always prompt for a PIN code entry after starting up and before **TPS1200+/TS30/TM30 Main Menu** comes up.
- If a wrong PIN has been typed in five times, a **Personal Unblock** code is required.
- Refer to "18.6 Start Up & Power Down" for information on activating PIN protection.
- This chapter explains the workflow of entering PIN and PUK.

Access

- **TPS1200+/TS30/TM30 Enter Security PIN Code** is automatically accessed during starting up the instrument when **<Use PIN: Yes>** in **CONFIGURE Start Up & Power Down, PIN Code** page and a PIN has been defined before. Refer to "18.6 Start Up & Power Down".
- **TPS1200+/TS30/TM30 Enter Security PUK Code** is automatically accessed during starting up the receiver when a wrong PIN code has been typed in five times.

TPS1200+/TS30/TM30

Enter Security PIN Code



PIN Code : [REDACTED]

OK (F4)

To accept the PIN code and to continue with the subsequent screen.



SHIFT QUIT (F6)

To turn off the instrument.

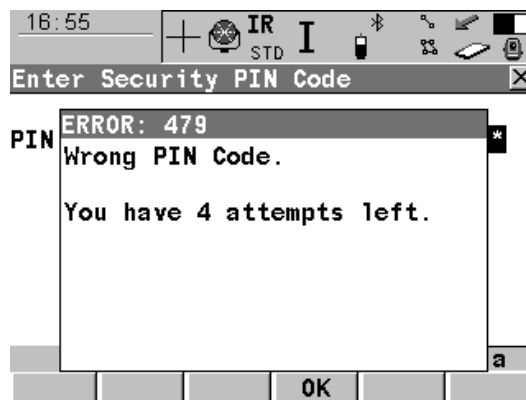
Description of fields

Field	Option	Description
PIN Code	User input	The PIN code as previously defined in CONFIGURE Start Up & Power Down, PIN Code page. The correct PIN code must be typed in within five attempts or the PUK code is required.

Next step

IF the PIN code entered is	THEN
correct	TPS1200+/TS30/TM30 Main Menu is displayed. Refer to "4 Main Menu".
wrong	refer to paragraph " TPS1200+/TS30/TM30 Enter Security PIN Code Error: 479".
wrong the fifth time	the PUK code is required. Refer to paragraph " TPS1200+/TS30/TM30 Enter Security PIN Code Error: 478".

TPS1200+/TS30/TM30
Enter Security PIN Code
Error: 479



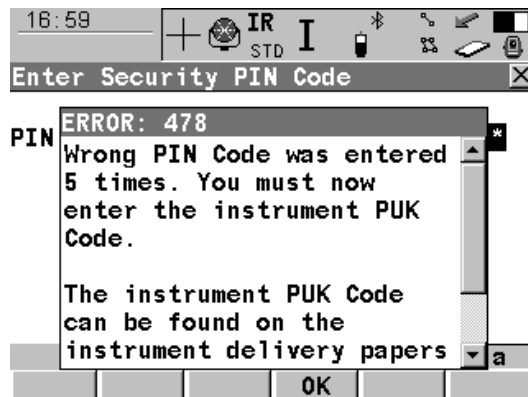
OK (F4)

To return to **TPS1200+/TS30/TM30 Enter Security PIN Code** where a PIN code can be typed in again.

Next step

IF the PIN code entered is	THEN
correct	TPS1200+/TS30/TM30 Main Menu is displayed. Refer to "4 Main Menu".
wrong the fifth time	the PUK code is required. Refer to paragraph "TPS1200+/TS30/TM30 Enter Security PIN Code Error: 478".

TPS1200+/TS30/TM30 Enter Security PIN Code Error: 478



OK (F4)

To continue with the subsequent screen.

Next step

OK (F4) to access **TPS1200+/TS30/TM30 Enter Security PUK Code**.

TPS1200+/TS30/TM30
Enter
Security PUK Code



PUK Code : [REDACTED]

Serial No. : 1

OK (F4)

To accept the PUK code and to continue with the subsequent screen.



SHIFT QUIT (F6)

To turn off the receiver.

Description of fields

Field	Option	Description
PUK Code	User input	The PUK code as generated by Leica Geosystems. - For receivers delivered with firmware version 2.10 or higher, the PUK code comes with the receiver. - For receivers delivered with firmware versions lower than v2.10, contact a Leica representative to obtain a PUK code.
Serial No.	Output	The serial number of the receiver. This is needed to obtain PUK from Leica Geosystems.

Next step

IF the PUK code entered is	THEN
correct	the old PIN code is cleared and the PIN protection is deactivated. TPS1200+/TS30/TM30 Main Menu is displayed. Refer to "4 Main Menu".
wrong	GPS1200+ keeps asking for the correct PUK code. SHIFT QUIT (F6) to turn off the receiver.

2.1

Hot Keys

Description

- Two levels of hot keys exist:
 - The first level are the keys **F7**, **F8**, ..., **F12** and **F13**, the user definable Smartkey
 - The second level is the combination of **SHIFT** and **F7**, **F8**, ..., **F12**

Functionality

- Hot keys provide a shortcut for quickly and directly carrying out functions or starting application programs assigned to the keys. The assignment of functions and application programs to hot keys is user configurable.
- Refer to "18.2 Hot Keys & User Menu" for the configuration of hot keys.

Using the hot keys

- The first level is accessed by pressing **F7**, **F8**, ..., **F12** or **F13**, the user definable Smartkey, directly.
- The second level is accessed by pressing **SHIFT** first followed by **F7**, **F8**, ..., **F12**
- Hot keys can be pressed at any time. It is possible that a function or application program assigned to a hot key cannot be executed in certain situations.

Define hot key/user menu step-by-step

This step-by-step description shows how to assign the **CONFIGURE Coding & Linework** screen to the **F7** key and to the first line of **TPS1200+/TS30/TM30 User Menu: Job Name**.

Step	Description
1.	Select Main Menu: Config...\General Settings...\Hot Keys & User Menu .
2.	CONFIGURE Hot Keys & User Menu

Step	Description
	For Hot Keys/Shift Hot Keys select < F7: CONF Coding & Linework Settings >. For User Menu select < 1: CONF Coding & Linework Settings >.
3.	CONT (F1).
4.	CONT (F1).
5.	Press F7 to access CONFIGURE Coding & Linework . OR Press USER and 1 to access CONFIGURE Coding & Linework .

User definable Smartkey

The user definable Smartkey is located next to the right hand fine drives. It enables fast and comfortable recording of measurements. Being equipped with a soft touch key located in the instruments turning axis allows highest precision measurements. All functions and application programs that can be assigned to the hot keys can be assign to the user definable Smartkey including NONE.

2.2

USER Key

Description

The **USER** key opens the user defined menu.

User defined menu

The user defined menu can be configured to contain the most used functions or application programs. The user defined menu can not be accessed while in a **CONFIGURE XX** screen. Refer to "18.2 Hot Keys & User Menu" for the configuration of the user defined menu.

Functionality of the user defined menu

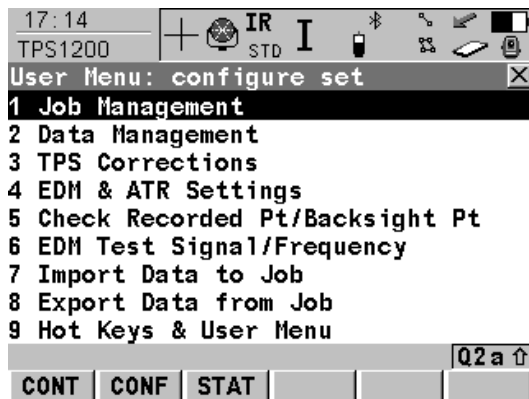
Selecting an option in the menu carries out the function or starts the application program assigned to the option.

Access

Press **USER** to access **TPS1200+/TS30/TM30 User Menu: Job Name**.

TPS1200+/TS30/TM30 User Menu: Job Name

This is an example of what a user defined menu can look like. The softkeys and their order is fixed. The functions and application programs which are assigned to the individual places in the user defined menu can differ depending on the configuration.



CONT (F1)

To execute the selected function.

CONF (F2)

To configure the user menu.

STAT (F3)

To access the **Status Menu**.

Define **USER** key step-by-step

To define the **USER** key is the same as for the hot keys. Refer to paragraph "Define hot key/user menu step-by-step".

3.1

Overview

Description

Frequently used settings can be accessed quickly and changed with three key strokes. For example press **SHIFT USER** and **1** to turn the ATR on or off. The change is immediately applied and the screen where **QUICK SET Change Settings to:** was accessed from opens. The workflow is not interrupted.

This screen displays the possible settings to change to. All possible settings have two states and allow very quick setting changes. Highlight a field and press **ENTER** to change to the displayed setting or press the number next to the function.



Changes made on the **QUICK SET Change Settings to:** screen are stored in the active configuration set.

3.2

QUICK SET Change Settings to:

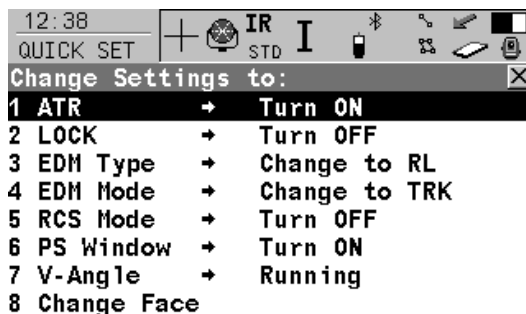
Access

Press **SHIFT USER**.

QUICK SET Change Settings To:

The appearance of the **QUICK SET Change Settings to:** screen may change, depending on whether the instrument is equipped with motorisation, ATR, reflectorless EDM or Power-Search.

Refer to "33 Functions" for information on functions and to "17 Config...\Instrument Settings..." for information on instrument settings.



COMPS (F1)

To turn the instrument using compass readings.

Hz/V (F2)

To turn the instrument to a specific entered position.

JSTCK (F3)

To turn the instrument using the arrow keys.

CHKPT (F4)

To check a point or the instrument orientation.

L.GO (F5) or L.INT (F5)

Unavailable for Smart-Station/TM30/TS30+SmartAntenna.

L.GO (F5) to start an ATR search, to set **<Automation: LOCK>** and to lock onto the reflector.

L.INT (F5) to interrupt LOCK.

PS (F6)

Unavailable for TM30.

Starts a prism search with PowerSearch.

Description of fields

Field	Option	Description
ATR	→ Turn ON	To activate ATR, <Automation: ATR> .
	→ Turn OFF	To deactivate ATR, <Automation: None> .
LOCK	→ Turn ON	Unavailable for Smart-Station/TM30/TS30+SmartAntenna. To activate LOCK, <Automation: LOCK> .
	→ Turn OFF	To deactivate LOCK, <Automation: None> .
EDM Type	→ Change to IR	To activate measurements to reflectors, <EDM Type: Reflector (IR)> .
	→ Change to RL	To activate reflectorless measurements, <EDM Type: Reflctrless (RL)> . Deactivates ATR and LOCK, <Automation: None> .
EDM Mode	→ Change to TRK	To activate tracking with continuous measurements, <EDM Mode: Tracking> .
	→ Change to STD	To activate single measurements, <EDM Mode: Standard> .
RCS Mode	→ Turn ON	To activate RCS mode and LOCK, <Use Interface: Yes> in CONFIGURE RCS Mode , <Automation: LOCK> .
	→ Turn OFF	To deactivate RCS mode, <Use Interface: No> in CONFIGURE RCS Mode .

Field	Option	Description
PS Window	→ Turn ON	To activate the PowerSearch window, <PS Window: On> . Prisms are searched for with PowerSearch in the PS window when PS (F6) is pressed. Unavailable for TM30.  If <PS Window: On> is selected and reflectorless measurements is still set, <EDM Type: Reflctrless (RL)> , then this is changed to measurements to reflectors, <EDM Type: Reflector (IR)> .
	→ Turn OFF	To deactivate the PowerSearch window <PS Window: Off> . A 360° search is performed when PS (F6) is pressed.
V-Angle	→ Hold	The displayed value for the vertical angle is held after DIST (F2) and until REC (F3) is pressed, <V-Angle: Hold after DIST> .
	→ Running	The displayed value for the vertical angle is updated after DIST (F2) is pressed, <V-Angle: Running> .  Be aware that after restarting the instrument this setting remains and is not changed.
Change Face	no choices	To change the face of the telescope.

Next step

IF	THEN
a setting is to be changed	type the selection number in front of the item or highlight the item and press ENTER .
the instrument is to be automatically turned to a specific position	COMPS (F1) , Hz/V (F2) or JSTCK (F3) to access the subsequent screen. Refer to "3.3 Quick Setting Functions".
a point or the instrument orientation is to be checked	CHKPT (F4) to access the QUICK SET Check Recorded Pt/Back-sight Pt screen. Refer to "3.3 Quick Setting Functions".
prism is to be locked onto	press L.GO (F5) to activate LOCK and start an ATR search. Refer to "3.3.5 L.GO (F5)/L.INT (F5)".
LOCK is to be interrupted	press L.INT (F5) to interrupt LOCK. Refer to "3.3.5 L.GO (F5)/L.INT (F5)".
PowerSearch is to be started	PS (F6) to search for a prism with PowerSearch. Refer to "3.3.6 PS PowerSearch".

3.3

3.3.1

Quick Setting Functions

Orientation With Compass

Description

By using a conventional magnetic compass while remotely controlling the instrument, it is possible to determine the general direction towards which the instrument should turn in order to perform a target search to locate the prism.

Access

Press **COMPS (F1)** in the **QUICK SET Change Settings to:** screen. Refer to "3.2 QUICK SET Change Settings to:".

OR

Press a hot key configured to access the screen **QUICK SET Orientation With Compass**. Refer to "2.1 Hot Keys" for information on hot keys.



Orientation with compass step-by-step

The instrument must be connected to a radio to be remote controlled with the RX1200.

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	PROG. Select Setup application program to set up the instrument.	46
2.	Main Menu: Survey CONT (F1) to access SURVEY Survey Begin .	
3.	CONT (F1) to access SURVEY Survey: Job Name . Turn the telescope until <Hz: 0.0000 g> .	

Step	Description	Refer to chapter
4.	Look through the telescope with <Hz: 0.0000 g> to select an object which is easily recognisable.	
5.	Standing at the instrument point the compass to the selected object and turn the rotating dial until the "N" lines up with the north end of the compass needle.  The compass dial must not be turned once the "N" is lined up with the north end of the compass needle.	
6.	Go to the reflector.	
7.	SHIFT USER to access QUICK SET Change Settings to:.	
8.	QUICK SET Change Settings to: COMPS (F1) to access QUICK SET Orientation With Compass.	3.3.1
9.	QUICK SET Orientation With Compass From the reflector aim the "N" of the compass towards the instrument. Read the horizontal angle as pointed to by the north end of the compass needle. <Hz-Compass:> The horizontal angle read from the compass while aiming to the instrument. <V-Compass:> If the compass works as a clinometer, those values can also be used.  The horizontal and vertical angle reads from the compass are always displayed in degree regardless of the system settings.	

Step	Description	Refer to chapter
10.	CONT (F1) to access SURVEY Survey: Job Name. The instrument turns to the reflector. For <Automation: ATR> an ATR measurement is performed. If no prism was found, the instrument turns to the position typed in for <Hz-Compass:> and <V-Compass:>. For <Automation: LOCK> the instrument locks on the prism and the LOCK icon is displayed. Refer to TPS1200+/TS30/TM30 System Field Manual for information on icons. If no prism was found, the instrument turns to the position typed in for <Hz-Compass:> and <V-Compass:>.	

3.3.2

Positioning Hz/V

Description

The **QUICK SET Positioning Hz/V** screen is used when the instrument is remote controlled and the telescope should be turned to a certain direction.

On the **Absolute** page, angular values for **<Hz-Angle:>** and **<V-Angle:>** related to the set orientation can be typed in.

On the **Relative** page, angular difference values for **<ΔHz:>** and **<ΔV:>** relative to the current telescope position can be typed in. These values are added to the current telescope position to calculate the new direction for the telescope to turn to.

Access

Press **Hz/V (F2)** in the **QUICK SET Change Settings to:** screen. Refer to "3.2 QUICK SET Change Settings to:".

OR

Press a hot key configured to access the screen **QUICK SET Positioning Hz/V**. Refer to "2.1 Hot Keys" for information on hot keys.

Hz/V positioning step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description
1.	QUICK SET Change Settings to:
2.	Hz/V (F2) to access QUICK SET Positioning Hz/V, Absolute page.
3.	- To position with absolute Hz/V angles continue with step 4. - To position with relative Hz/V angles continue with step 6.
4.	QUICK SET Positioning Hz/V, Absolute page <Hz-Angle:> Oriented horizontal direction for the instrument to turn to.

Step	Description
	<V-Angle:> Vertical direction for the instrument to turn to>.
5.	Continue with step 8.
6.	PAGE (F6) to access QUICK SET Positioning Hz/V, Relative page.
7.	QUICK SET Positioning Hz/V, Relative page <ΔHz:> Angular difference for the horizontal angle to turn to. <ΔV:> Angular difference for the vertical angle to turn to.
8.	CONT (F1) . The instrument turns to the reflector. For <Automation: ATR> an ATR measurement is performed. If no prism was found, the instrument turns to the position typed in for <Hz-Angle:> and <V-Angle:> or <ΔHz:> and <ΔV:> . For <Automation: LOCK> the instrument locks on the prism and the LOCK icon is displayed. Refer to TPS1200+/TS30/TM30 System Field Manual for information on icons. If no prism was found, the instrument turns to the position typed in for <Hz-Angle:> and <V-Angle:> or <ΔHz:> and <ΔV:> .

3.3.3

Move by Joystick

Description

In **QUICK SET Move by Joystick** the instrument can be turned using the arrow keys on the keyboard of the instrument or the RX1200 or the arrow keys displayed on the touch screen. When **QUICK SET Move by Joystick** is accessed, the EGL is turned on automatically. When leaving the screen, the EGL is turned off.

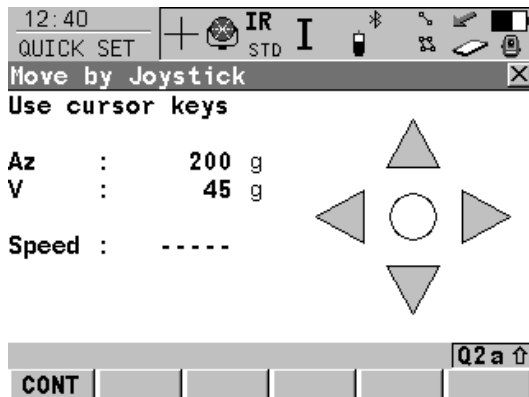
Access

Press **JSTCK (F3)** on the **QUICK SET Change Settings to:** screen. Refer to "3.2 QUICK SET Change Settings to:".

OR

Press a hot key configured to access the screen **QUICK SET Move by Joystick**. Refer to "2.1 Hot Keys" for information on hot keys.

QUICK SET Move by Joystick



CONT (F1)

To exit **QUICK SET Move by Joystick**.

Description of fields

Field	Option	Description
Speed	Output	Displays the rotating speed of the instrument. Press the same arrow key to change the speed from ----- to slow to medium to fast.

Next step

CONT (F1) to exit the **QUICK SET Move by Joystick** screen.

Move by joystick step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description
1.	QUICK SET Change Settings to:
2.	JSTCK (F3) to access QUICK SET Move by Joystick .
3.	QUICK SET Move by Joystick Use the arrow keys to start the telescope movement. Press an arrow key again to speed up the movement. Press any of the other arrow keys while the instrument turns to stop the movement.
	The behaviour of the touch screen when working with the RX1200 is similar. Additional to the arrow keys a stop key is displayed as a round key in the middle of the arrow keys. Press the stop key to stop the instrument movement.

3.3.4

Check Recorded Point / Backsight Point

Description

- The **QUICK SET Check Recorded Pt/Backsight Pt** screen is to check if a measured point is identical to a point already stored in the job or if the instruments orientation to a backsight point is still correct.

Access

Press **SHIFT USER** and **CHKPT (F4)**.

OR

Press a hot key configured to access **QUICK SET Check Recorded Pt/Backsight Pt**.
Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**.

Refer to "2.2 USER Key" for information on the **USER** key.

QUICK SET Check Recorded Pt/Backsight Pt

12:42

QUICK SET

Check Recorded Pt/Backsight Pt

Point ID : 1

Reflector Ht : 0.000 m

Reflector : Leica Circ Prism

ΔAzimuth : -0.0006 g

ΔHoriz Dist : -0.000 m

ΔHeight : -75.015 m

STORE DIST SETBS MORE LAST

STORE (F1)

To exit **QUICK SET Check Recorded Pt/Backsight Pt**.

DIST (F2)

To measure a distance.

SETBS (F3)

To set the station and orientation of the instrument by taking a single measurement to a known backsight point. Refer to "46.6.3 Known Backsight Point".

MORE (F5)

To display additional information.

LAST (F6)

To recall <Point ID:> of the last checked point.

SHIFT POSIT (F4)

To position to the selected point.

For <Automation: ATR>, the instrument does an ATR search.

For <Automation: LOCK> the instrument tries to lock on to a reflector.

Next step

Refer to paragraph "Check point step-by-step" for information on how to check a recorded point.

Check point step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description
1.	QUICK SET Change Settings to:
2.	CHKPT (F4) to access QUICK SET Check Recorded Pt/Backsight Pt.
3.	QUICK SET Check Recorded Pt/Backsight Pt <Point ID:> Point ID to be checked. <Calculated Az:> Calculated azimuth between station and backsight point. <Current Az:> Current orientation. <ΔAz:> Difference between calculated azimuth and current orientation.

Step	Description
4.	POSIT (F5) to position to the point.
5.	DIST (F2) to measure a distance.
	SETBS (F3) to set the station and orientation of the instrument by taking a single measurement to a known backsight point.
6.	CONT (F1) to return to the screen QUICK SET Change Settings to: was accessed from.



If a stored point was checked, the **<Point ID:>** for that point is remembered and recalled when **LAST (F6)** is pressed.

3.3.5

L.GO (F5)/L.INT (F5)

L.GO (F5)

When **L.GO (F5)** is pressed, an ATR search is performed, the instrument locks onto the reflector without a measurement. **<Automation: LOCK>** is set. Unavailable for SmartStation/TM30/TS30+SmartAntenna.



L.GO (F5) can be used to lock onto a prism located on an unstable surface for example on a boat or near to the instrument.

L.INT (F5)

When the instrument is locked onto the prism this lock can be interrupted with pressing **L.INT (F5)**. Unavailable for SmartStation/TM30.



L.INT (F5) can be used to interrupt the instrument from being locked onto the reflector, for example, to mark a ground point.



Distances to side shot points cannot be measured while the lock mode is interrupted with **<Automation: LOCK>**.

3.3.6

PS PowerSearch

Description



When **PS (F6)** is pressed, the instrument searches for the prism with PowerSearch. Refer to "33.2.2 PowerSearch" for more information on the functionality of PowerSearch.

This Quick Setting is independent from a hot key definition for the direction which the instrument turns during the search routine.

3.4

3.4.1

Working examples

Working Example 1 - ATR

Description

Application: Measure points with ATR.

Working technique: Application program Survey.

Goal: Find prism with ATR.

Requirement

<Automation: ATR>.

Prism search with ATR step-by-step

Step	Description
1.	Press ALL (F1) in SURVEY Survey: Job Name .  Press DIST (F2) to measure a distance.
2.	The instrument searches for the prism with ATR search in the ATR window.
3.	If a prism was found - Distance and angles are measured and stored. - The instrument points in the direction of the prism and does not follow the prism when it is moving.
4.	If no prism was found The instrument turns to the starting position of the ATR search.

3.4.2

Working Example 2 - LOCK

Description

Application: Measure points with LOCK.

Working technique: Application program Survey.

Goal: Find prism with LOCK activated.

Requirement

<Automation: LOCK>.

This working example can also be applied if the instrument is remotely controlled by an RX1200.

This working example can not be applied for if the instrument is remotely controlled by an SmartStation. This working example can not be applied for TM30 instruments.

Prism search with LOCK step-by-step

Step	Description
1.	Press ALL (F1) in SURVEY Survey: Job Name .  Press DIST (F2) to measure a distance.  Press L.GO (F5) to lock onto the reflector without measurement.
2.	The instrument searches for the prism with ATR search in the ATR window.
3.	If a prism was found - Distance and angles are measured and stored. - The instrument locks on to the prism and follows its movements. The LOCK icon is displayed.
4.	If no prism was found The instrument turns to the starting position of the ATR search.

3.4.3

Working Example 3 - Loss of LOCK

Description

Application: Points were measured with LOCK until loss of lock.

Working technique: Application program Survey.

Goal: Prism search after loss of lock.

Requirements

- **<Automation: LOCK>**
- The instrument is locked onto the prism.
- The instrument is remotely controlled by an RX1200.
- **<Predict for: 3 s>**

Prism search after loss of LOCK step-by-step

Step	Description
1.	Move the prism behind an object to make the instrument lose lock.
2.	The prism path is predicted for three seconds. The instrument turns with the calculated velocity and direction of the lost prism during this time.
3.	If a prism was found during prediction, • the instrument locks on to the prism and follows its movements. The LOCK icon is displayed.

Step	Description
4.	If no prism was found during prediction, a search is started depending on the setting of <Search with:> in CONFIGURE Automatic Prism Search • For <Search with: No Search>: No search is started. • For <Search with: ATR>: An ATR search is started in a dynamic ATR window which is calculated depending on the velocity of the prism. • For <Search with: PowerSearch> and <PS Window: On>: The prism is searched for with PowerSearch in the PS window. • For <Search with: PowerSearch> and <PS Window: Off>: The prism is searched for with PowerSearch in a dynamic PS window
5.	If prism was not found with <Search with:>, • The instrument telescope stays at the end position of prediction. • The EGL is activated.
	Refer to "3.4.2 Working Example 2 - LOCK" for information on how to enable lock.

3.4.4

Working Example 4 - PS

Description

Application: Search for a prism with PowerSearch.

Working technique: Application program Survey.

Goal: Find prism with PowerSearch.

Requirement

<PS Window: Off>

Prism search with PS step-by-step

Step	Description
1.	QUICK SET Change Settings to: PS (F6).
2.	The instrument searches for the prism with PowerSearch. The search consists of a short swing in anti-clockwise direction followed by a complete 360° turn in the other direction.
3.	If a prism is detected the movement is stopped and an ATR search is performed. For <Automation: None> the ATR is turned off again. For <Automation: ATR> measurements can be performed. For <Automation: LOCK> the instrument locks onto the reflector and follows the movement of the prism.
4.	If no prism was found, the instrument telescope turns to the start position of the search.

4.1

Main Menu Functions

Description

The main menu is normally the first screen displayed when the instrument is switched on. If the PIN protection is active, **TPS1200+/TS30/TM30 Enter Security PIN Code** is displayed first. After typing in the correct PIN code, the main menu is displayed.



If desired, the instrument can be configured to start up with a user defined screen. Refer to "18.6 Start Up & Power Down".

TPS1200+/TS30/TM30 Main Menu



CONT (F1)

To select the highlighted option and to continue with the subsequent screen.

Description of the main menu functions

Main menu function	Description	Refer to chapter
Survey	To start measuring.	4.2
Programs...	To select and start application programs.	4.3
Manage...	To manage jobs, data, codelists, configurations sets, reflectors and coordinate systems.	4.4
Convert...	- To export data from a job on the instrument to a file on the CompactFlash card in a customised ASCII format or in DXF format. - To import ASCII, GSI or DXF data from a file on the CompactFlash card to a job on the instrument. - To copy points between jobs.	4.5
Config...	To access all configuration parameters related to a survey, the instrument, the interfaces and Smart-Station.	4.6
Tools...	- To format the memory device. - To upload files relevant for the instrument functionality, for example, firmware and language files. - To transfer non data related files between instrument and CompactFlash card. - To perform arithmetic operations such as addition, subtraction, multiplication, division, statistical functions, trigonometric functions, conversions or roots.	4.7

Main menu function	Description	Refer to chapter
	- To view files on the CompactFlash card or the internal memory. - To manually type in a licence key. - To calibrate the instrument.	

4.2

Survey

Access

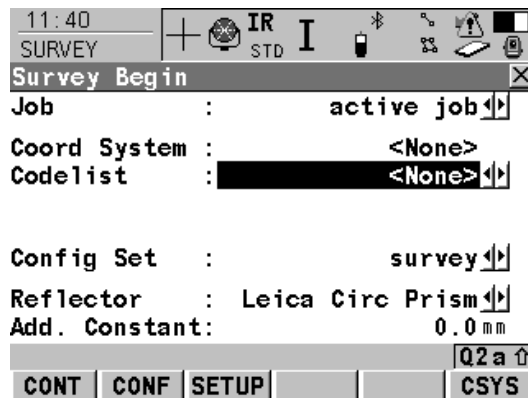
Select **Main Menu: Survey**.

Description

Survey provides the functionality used to perform the survey.

SURVEY

Survey Begin



11:40
SURVEY

Survey Begin

Job : active job

Coord System : <None>

Codelist : <None>

Config Set : survey

Reflector : Leica Circ Prism

Add. Constant: 0.0 mm

Q2a

CONT CONF SETUP CSYS

CONT (F1)

To accept settings and to continue with screen **SURVEY Survey: Job Name**.

CONF (F2)

To configure auto point and remote point measurements functionality.

SETUP (F3)

To set up station. Accesses **SETUP Station Setup**.

CSYS (F6)

To change the coordinate system. Refer to "10.4.1 Creating a New Coordinate System" for information on defining a coordinate system. Not available for **<Use Auto CrdSys: Yes>** configured in **CONFIGURE Additional Rover Settings**. Refer to "22.1.1 Configuration of Real-Time".

Next step

For **Main Menu: Survey**

Refer to chapter 48

4.3

Programs...

Access

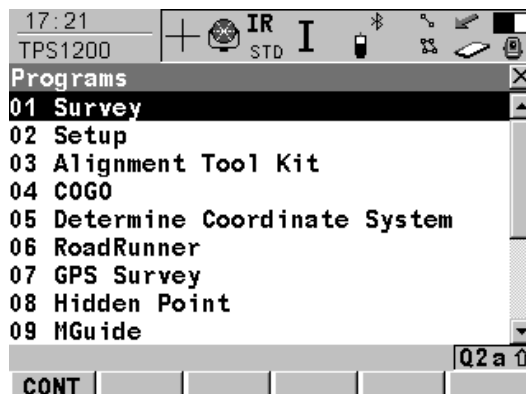
Select **Main Menu: Programs....**
OR
Press **PROG.**

Description

Programs... accesses the application programs menu. The screen of the application programs menu is called **TPS1200+/TS30/TM30 Programs**.

TPS1200+/TS30/TM30 Programs

The application programs menu contains all loaded application programs including Survey and Setup. They are listed in the order in which they were loaded.



CONT (F1)

To select the highlighted option and to continue with the subsequent screen.

Next step

For **Main Menu: Programs...\Survey**
For **Main Menu: Programs...\Setup**

Refer to chapter 48
Refer to chapter 46

For Main Menu: Programs...\Alignment Tool Kit	Refer to the separate manual
For Main Menu: Programs...\ICOGO	Refer to chapter 37
For Main Menu: Programs...\Determine Coordinate System	Refer to chapter 38
For Main Menu: Programs...\GPS Survey	Refer to chapter 41
For Main Menu: Programs...\Hidden Point	Refer to chapter 42
For Main Menu: Programs...\IMGuide	Refer to the separate manual
For Main Menu: Programs...\Reference Line	Refer to chapter 43
For Main Menu: Programs...\Reference Plane	Refer to chapter 44
For Main Menu: Programs...\RoadRunner	
 This program could contain the following: • RoadRunner • RoadRunner Tunnel • RoadRunner Rail	Refer to the separate manual Refer to the separate manual Refer to the separate manual
For Main Menu: Programs...\Sets of Angles	
 This program could contain the following: • Sets of Angles • Monitoring	Refer to chapter 45 Refer to chapter 45
For Main Menu: Programs...\Stakeout	Refer to chapter 47
For Main Menu: Programs...\Survey Cross Section	Refer to chapter 51
For Main Menu: Programs...\Traverse	Refer to chapter 52
For Main Menu: Programs...\Volume Calculations	Refer to chapter 53

4.4

Manage...

Access

Select **Main Menu: Manage....**

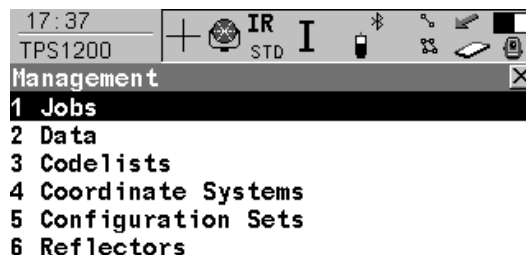
Description

Manage... is used to manage the following:

- jobs.
- data.
- codelists.
- coordinate systems.
- configuration sets.
- reflectors.

Management functions include creating, selecting, editing and deleting.

TPS1200+/TS30/TM30 Management



CONT (F1)

To select the highlighted option and to continue with the subsequent screen.

Next step

For **Main Menu: Manage...\Jobs**

Refer to chapter 5.

For **Main Menu: Manage...\Data**

Refer to chapter 6.

For **Main Menu: Manage...\Codelists**

Refer to chapter 7.

For **Main Menu: Manage...\Coordinate Systems**

Refer to chapter 10.

For **Main Menu: Manage...\Configuration Sets**

Refer to chapter 11.

For **Main Menu: Manage...\Reflectors**

Refer to chapter 12.

4.5

Convert...

Access

Select **Main Menu: Convert....**

Description

Convert... provides access to data exchange options.

TPS1200+/TS30/TM30

Convert Data



CONT (F1)



To select the highlighted option and to continue with the subsequent screen.

Next step

For **Main Menu: Convert...\Export Data from Job**

Refer to chapter 13.

For **Main Menu: Convert...\Import Data to Job**

Refer to chapter 14.

For **Main Menu: Convert...\Copy Points Between Jobs**

Refer to chapter 15.

4.6

Config...

Access

Select **Main Menu: Config...**
OR
Press **USER** and then **CONF (F2)**.

Description

Config... accesses all configuration parameters related to a survey, the instrument, the interfaces and SmartStation. Any changes made are stored in the configuration set.

TPS1200+/TS30/TM30 Configuration: Configuration Set



CONT (F1)



To select the highlighted option and to continue with the subsequent screen.

Next step

For Main Menu: Config...\Survey Settings...	Refer to chapter 16
For Main Menu: Config...\Instrument Settings...	Refer to chapter 17
For Main Menu: Config...\General Settings...	Refer to chapter 18
For Main Menu: Config...\Interfaces...	Refer to chapter 20
For Main Menu: Config...\SmartStation...	Refer to chapter 22

4.7

Tools...

Access

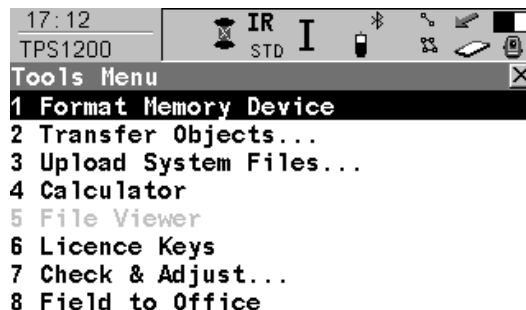
Select **Main Menu: Tools....**

Description

Tools... provides functionality which is not directly related to surveying data.

TPS1200+/TS30/TM30

Tools Menu



CONT (F1)



To select the highlighted option and to continue with the subsequent screen.

Next step

For **Main Menu: Tools...\Format Memory Device**
For **Main Menu: Tools...\Transfer Objects...**
For **Main Menu: Tools...\Upload System Files...**
For **Main Menu: Tools...\Calculator**
For **Main Menu: Tools...\File Viewer**
For **Main Menu: Tools...\Licence Keys**
For **Main Menu: Tools...\Check & Adjust...**
For **Main Menu: Tools...\Field to Office...**

Refer to chapter 23
Refer to chapter 24
Refer to chapter 25
Refer to chapter 26.
Refer to chapter 27.
Refer to chapter 28
Refer to chapter 29
Refer to chapter 30

5.1

Overview

Description

Jobs

- structure surveying projects.
- contain all points, lines, areas and codes that are recorded and stored.
- can be downloaded to LGO for post-processing or for data transfer to a further program.
- can be uploaded from LGO, for example, for stakeout operations.
- may be stored on the CompactFlash card or internal memory, if fitted.

Type of jobs

- Data jobs. Explained in this chapter.
- DTM jobs. Refer to "47.4.5 Staking Out a DTM".
- Road jobs. Refer to the TPS1200+ RoadRunner Manual.

Default job

A job called **Default** is available on the instrument after formatting the memory device, inserting a previously formatted CompactFlash card or deleting all jobs from **MANAGE Jobs (Device)**.

Active job

The active job is the one data is stored to. One job is always considered the active job. After formatting the memory device, the job **Default** is used until a user defined job is created and selected.

When a job becomes active, then the sort and filter settings of this job are saved in the SystemRAM. If the CompactFlash card is formatted then these last used sort and filter settings are used for the job **Default**.

5.2

Accessing Job Management

Access

Select **Main Menu: Manage...\Jobs**.

OR

Press a hot key configured to access the screen **MANAGE Jobs (Device)**.

Refer to "2.1 Hot Keys" for information on hot keys.

OR

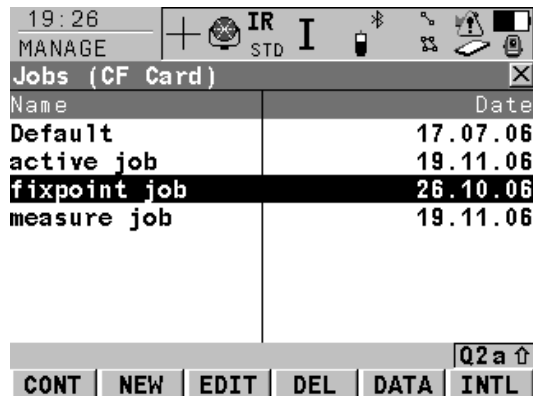
Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

OR

From a choicelist in some screens, e.g. the **XX Begin** screen of application programs.

MANAGE Jobs (Device)

Listed are all jobs stored on the CompactFlash card or in the internal memory, if fitted, depending on the current device.



Name	Date
Default	17.07.06
active job	19.11.06
fixpoint job	26.10.06
measure job	19.11.06

CONT NEW EDIT DEL DATA INTL

CONT (F1)

To select the highlighted job and to return to the screen from where this screen was accessed.

NEW (F2)

To create a job. Refer to "5.3 Creating a New Job".

EDIT (F3)

To edit the highlighted job. Refer to "5.4 Editing a Job".

DEL (F4)

To delete the highlighted job.

DATA (F5)

To view, edit and delete points, lines and areas stored with the job. Points, lines and areas are shown on separate pages. Selected sort and filter settings apply. Refer to "6.3 Point Management".

CFCRD (F6) or INTL (F6)

Available for instruments with internal memory. To change between viewing jobs stored on the CompactFlash card or internal memory.

Next step

IF a job	THEN
is to be selected	highlight the desired job. CONT (F1) closes the screen and returns to the screen from where MANAGE Jobs (Device) was accessed.
is to be created	NEW (F2) . Refer to "5.3 Creating a New Job".
is to be edited	highlight the job and EDIT (F3) . Refer to "5.4 Editing a Job".

5.3

Creating a New Job

Access

Refer to "5.2 Accessing Job Management" to access **MANAGE Jobs (Device)**.

Create job step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	In MANAGE Jobs (Device) highlight a job. The settings of this job, including sort and filter settings, are applied to the new job.	5.2
2.	NEW (F2) to access MANAGE New Job .	

11:51
MANAGE
New Job
General | CodeList | Coord System | Avge
Name : new job
Description :
Creator :
Device : CF Card
STORE PAGE Q2 a

STORE (F1)

To store the settings and to return to the screen from where **MANAGE New Job** was accessed.

PAGE (F6)

To change to another page on this screen.

Step	Description	Refer to chapter
3.	MANAGE New Job, General page <Name:> A unique name for the new job. The name may be up to 16 characters long and may include spaces. Input required. <Description:> Two lines for a detailed description of the job. This can be for example, work to be performed or the classes contained in the job. Input optional. <Creator:> The person's name who is creating the new job. Input optional. <Device:> The device on which the new job will be stored. Depending on the instrument options, this may be an output field.	
4.	PAGE (F6) changes to the Codelist page.	
5.	MANAGE New Job, Codelist page <Codelist:> Choosing a codelist copies the codes to the job.	8
6.	PAGE (F6) changes to the Coord System page.	
7.	MANAGE New Job, Coord System page <Coord System:> Choosing a coordinate system attaches it to the job. All other fields on this screen are output fields. They depend on the transformation type of the selected coordinate system.	10.4
8.	PAGE (F6) changes to the Avge page.	
9.	MANAGE New Job, Avge page	

Step	Description	Refer to chapter
	In order to check measurements, the same point can be measured more than once. If activated, an average or an absolute difference is calculated. <Averaging Mode:> Defines the averaging principles for multiple measured points. <Averaging Mode: Average> computes the average for the position and the height. Points exceeding the defined limits are marked with ¶ in MANAGE Edit Point, Mean page. <Averaging Mode: Absolute Diffs> computes the absolute differences between two points selected from a list of measured points which are all stored with the same point ID. The selection determines the availability of the subsequent fields for setting the acceptable averaging limits or absolute differences. - For <Averaging Mode: Average>: <Method:> The method used for computing the average. <Method: Weighted> calculates a weighted average while <Method: No Weighting> is calculating an arithmetic average. <Points to Use:> The type of points which will be taken into account for averaging. <Avge Limit Pos:> and <Avge Limit Ht:> The acceptable difference for the position and height components. - For <Averaging Mode: Absolute Diffs>:	6.3.4

Step	Description	Refer to chapter
	<Points to Use:> The type of points which will be taken into account for absolute differences. From <Easting:> to <Cartesian Z:> The acceptable absolute differences for each coordinate component. For <Averaging Mode: Off>: No other fields are available.	
10.	STORE (F1) creates the new job and returns to MANAGE Jobs (Device) .	

5.4

Editing a Job

Access

Refer to "5.2 Accessing Job Management" to access **MANAGE Jobs (Device)**.

Edit job step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	In MANAGE Jobs (Device) highlight a job to be edited.	
2.	EDIT (F3) to access MANAGE Edit Job: Job Name, General page.	
3.	MANAGE Edit Job: Job Name, General page <Name:> Rename the job. <Device:> Cannot be edited. The remaining functionality on this page is identical with the creation of a new job.	5.3
	DATA (F5) accesses MANAGE Data: Job Name . To view, edit and delete points, lines and areas stored with the job. Points, lines and areas are shown on separate pages. Selected sort and filter settings apply.	6.2
	SHIFT LOG (F5) accesses MANAGE Data Log: Job Name . To view, edit and delete points, lines and areas stored with the job. Points, lines and areas are sorted by time in one list.	6.5
4.	PAGE (F6) changes to the Codelist page.	
5.	Are codes stored in the job?	

Step	Description	Refer to chapter
	- If no, continue with step 6. - If yes, continue with step 8.	
6.	No codes are stored in the job. MANAGE Edit Job: Job Name, Codelist page <Codelist: <None>> This default setting can be changed. Choosing a codelist copies the codes to the job. All codelists from Main Menu: Manage...\Codelists can be selected.	8
7.	PAGE (F6) changes to the Coord System page. Continue with step 10.	
8.	Codes are stored in the job. MANAGE Edit Job: Job Name, Codelist page <Codelist:> If codes had been copied from a System RAM codelist, the name of the codelist is displayed. If codes have been typed in, then the name of the active job is displayed.	
	IMPRT (F2) adds additional codes from a new codelist to the job. The name of this codelist is copied to the job.	7
	SHIFT EXPRT (F2) copies codes from the job to an existing or new codelist.	7
	CODES (F4) views codes currently stored in the job.	5.5
9.	PAGE (F6) changes to the Coord System page.	
10.	MANAGE Edit Job: Job Name, Coord System page	

Step	Description	Refer to chapter
	The functionality on this page is identical with the creation of a new job	5.3
	The coordinate system of the job currently being used cannot be edited for <Use Auto CrdSys: Yes> configured in CONFIGURE Additional Rover Settings . All fields on this screen are output fields.	22.1.1
11.	PAGE (F6) changes to the Avge page.	
12.	MANAGE Edit Job: Job Name, Avge page The functionality on this page is identical with the creation of a new job.	5.3
	DATA (F5) accesses MANAGE Data: Job Name . To view, edit and delete points, lines and areas stored with the job. Points, lines and areas are shown on separate pages. Selected sort and filter settings apply.	6.2
	SHIFT LOG (F5) accesses MANAGE Data Log: Job Name . To view, edit and delete points, lines and areas stored with the job. Points, lines and areas are sorted by time in one list.	6.5
13.	STORE (F1) stores the changes and returns to the screen from where MANAGE Edit Job: Job Name was accessed.	

5.5

Managing Job Codes

Description

To view, edit, group and sort all codes currently stored in the job. The functionality of this screen is mainly the same as for **MANAGE Codes**. For simplicity, the functionality which is different from **MANAGE Codes** is explained here. Refer to "7.5 Managing Codes" for information on **MANAGE Codes**.

Access step-by-step

Available for jobs which have a codelist attached.

Step	Description
1.	Refer to "5.2 Accessing Job Management" to access MANAGE Jobs (Device) .
2.	In MANAGE Jobs (Device) highlight a job to be edited.
3.	EDIT (F3) to access MANAGE Edit Job: Job Name .
4.	In MANAGE Edit Job: Job Name , PAGE (F6) until the Codelist page is active.
5.	CODES (F4) to access MANAGE Job Codes .

MANAGE Job Codes

Code	Code Description
top	top of bank
toe	toe of bank
gum	gum tree

CONT NEW EDIT DEL MORE Q2 a ↑

CONT (F1)

To return to **MANAGE Edit Job: Job Name**, Codelist page.

NEW (F2)

To create a new code. Refer to "7.5.2 Creating a New Code".

EDIT (F3)

To edit the highlighted code. Accesses **MANAGE Edit Code** where new attributes can be added to a code and line styles can be changed. Refer to paragraph "MANAGE Edit Code".

DEL (F4)

To delete an existing code.

MORE (F5)

To display information about the code group, the code type, the code description and the quick codes if available.

SHIFT GROUP (F4)

To access **MANAGE Code Groups**. To view, create, activate and deactivate code groups. Refer to "7.6 Managing Code Groups".

SHIFT SORT (F5)

To access **MANAGE Sort Codes**. To sort codes by code name, code description, quick code or last used.

IF	THEN
the job codes do not need to be changed	CONT (F1) closes the screen and returns to the screen from where MANAGE Job Codes was accessed.
a new job code is to be created	NEW (F2) . Refer to "7.5.2 Creating a New Code".
an existing job code is to be edited	highlight the job code and EDIT (F3) . Refer to paragraph "MANAGE Edit Code".

17:20
MANAGE

IR STD

Edit Code

Code	:	c1
Code Desc	:	centre line
Group	:	group1
Code Type	:	Point
Linework	:	Begin Line
Line Style	:	
Attribute 1	:	

STORE NEW-A NAME

Q2 a

To store the code including any newly created attributes and to return to the screen from where **MANAGE Edit Code** was accessed.

To add a new attribute to a code.

Available for attributes for which an attribute name can be typed in. To highlight **<Attribute n:>** or the field for the attribute value. The name of **<Attribute n:>** can be edited and an attribute value can be typed in.

Manage...\Jobs

Type of code	Description
Point codes and Free codes	New attributes can be added with NEW-A (F2).
Line codes and Area codes	- New attributes can be added with NEW-A (F2). - The line style can be changed. This new line style is stored to the code. It can be decided whether or not to update the line style of all previously stored lines/areas with this code in this job.

6.1

Overview

Description

- Data is a generic term for points, lines and areas.
 - Data management is the administration of data stored in the active job. This includes
 - viewing data with their related information.
 - editing data.
 - creating new data.
 - deleting existing data.
 - filtering existing data.
-

Objects

- Objects
 - are points, lines and areas.
 - have a unique identification ID. This is the point ID, the line ID and the area ID.
 - may or may not have a code attached. This is either a point code, a line code or an area code depending on the type of object. Refer to "8 Coding" for information on coding.
-

6.2

Accessing Data Management

Access

Select **Main Menu: Manage...\Data**.

OR

Press a hot key configured to access the screen **MANAGE Data: Job Name**.

Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

OR

From a choicelist in some screens for example in application programs.

OR

Tap the line/area icon. Refer to the TPS1200+/TS30/TM30 System Field Manual for details on icons.



The objects listed on the pages belong to the currently active job. The objects listed and their order depend on the active sort and filter settings. An active filter for a page is indicated by **Y** to the right of the name of the page. Refer to "6.6 Point Sorting and Filters" for information about sort and filter settings.

MANAGE

Data: Job Name,
Points page

07:29	MANAGE	IR	STD	I					
Data: construction									
Points ▾	Lines (0)	Areas (0)	Map ▾						
Point			3D CQ	Class					
502			0.000	CTRL					
501			0.000	CTRL					
500			0.000	CTRL					
Q2 a ↑									
CONT	NEW	EDIT	DEL	MORE	PAGE				

CONT (F1)

To close the screen and return to the screen from where this screen was accessed.

NEW (F2)

To create a point.

EDIT (F3)

To edit the highlighted point.

DEL (F4)

To delete the highlighted point.

MORE (F5)

To display information about the codes if stored with any point, the time and the date of when the point was stored, the 3D coordinate quality, the class and the flag for Linework.

PAGE (F6)

To change to another page on this screen.

SHIFT LOG (F4)

To view points, lines, areas and free codes stored with the job sorted by time. Refer to "6.5 Data Log".

SHIFT FILT (F5)

To define sort and filter settings. Refer to "6.6 Point Sorting and Filters".

Next step

IF	THEN
a point is to be created	highlight the point and NEW (F2) . Refer to "6.3.2 Creating a New Point".
a point is to be edited	highlight the point and EDIT (F3) . Refer to "6.3.3 Editing a Point".
a line/area is to be managed	PAGE (F6) changes to the Lines (X) and Areas (X) page. Refer to paragraph "MANAGE Data: Job Name, Lines (X) page; MANAGE Data: Job Name, Areas (X) page".

MANAGE

**Data: Job Name,
Lines (X) page;**

MANAGE

**Data: Job Name,
Areas (X) page**

The explanations for the softkeys given below are valid for both pages.

The number in brackets next to the name of the page indicate the number of open lines/areas. Example: **Lines (2)/Areas (2)** means that two lines/areas are open.

07:31	IR	STD	I	1	0	0	0	0	0
MANAGE									
Data: construction									
Points ▾	Lines (1)	Areas (0)	Map ▾						
Line	Start Time	Open							
line003	07:30:56	Yes							
line002	07:30:52	No							
line001	07:30:33	No							
									Q2 a ↑
CONT	NEW	EDIT	CLOSE	MORE	PAGE				

CONT (F1)

To close the screen and return to the screen from where this screen was accessed.

NEW (F2)

To create a line/area. After storing the new line, all existing lines and areas which are open are closed.

EDIT (F3)

To edit the highlighted line/area.

CLOSE (F4) and OPEN (F4)

To change between the options in the **Open** column of the highlighted line/area.

MORE (F5)

To display information about the codes if stored with any line/area, the start time, the end time of when the last point was added to the line/area, the length of the line, the perimeter and the area of the area.

PAGE (F6)

To change to another page on this screen.

SHIFT DEL (F4)

To delete the highlighted line/area.

SHIFT FILT (F5)

To define sort and filter settings. Refer to "6.6 Point Sorting and Filters".

Description of columns

Column	Description
Line or Area	The listed lines/areas already stored in the active job.
Open	The status of a line/area. • Yes The line/area is open. Measured points are assigned to the line/area. • No The line/area is closed. Measured points are not assigned to the line/area. CLOSE (F4) and OPEN (F4) change between the options.

Next step

IF the line/area	THEN
management is completed	CONT (F1) closes the screen and returns to the screen from where this screen was accessed.
is to be opened	highlight the line/area and OPEN (F4) .
which was last used is to be opened	press a hot key configured to re-open last used line/area. This hot key can be used at any time. Refer to "2.1 Hot Keys" for information on hot keys.
is to be closed	highlight the line/area and CLOSE (F4) OR press a hot key configured to close all open lines/areas. This hot key can be used at any time. Refer to "2.1 Hot Keys" for information on hot keys.
is to be created	NEW (F2) . Refer to "6.4.2 Creating a New Line/Area".
is to be edited	highlight the line/area and EDIT (F3) to access MANAGE Edit Line: Line ID or MANAGE Edit Area: Area ID . Refer to "6.4.3 Editing a Line/Area".
is to be viewed	PAGE (F6) until the Map page is active. Refer to "35.5 Map Mode" for information about the functionality and softkeys available on the Map page.

6.3

6.3.1

Point Management

Terminology

Description

- This chapter describes technical terms related to data management.

Coordinate triplet

- A measured point consists of three coordinate components - two horizontal components and one vertical component. The generic term for the three coordinate components is coordinate triplet.
- Depending on the class, a point ID can contain more than one coordinate triplet of the same and/or of different classes.

Class

The class describes the type of coordinate triplet.

Description of classes

The following table shows the classes in descending hierarchical order.

Class	Characteristic	Description
CTRL	Type	Control points. Automatically assigned to entered points.
	Instrument source	TPS, GPS or LGO.
	Number of triplets	One.
ADJ	Type	Adjusted points using the adjustment program.
	Instrument source	LGO.
	Number of triplets	One.
REF	Type	• Station point set by Setup application program.

Class	Characteristic	Description
	Instrument source Number of triplets	Reference point received by a real-time rover. TPS, GPS or LGO. One.
AVGE	Type Instrument source Number of triplets	Averaged point calculated when more than one coordinate triplet of class MEAS exist for the same point ID unless <Averaging Mode: Off> . TPS or GPS. One.
MEAS	Type Instrument source Number of triplets	- Measured points with angles and distances. - Measured points differentially corrected using real-time phase, real-time code or post-processing. - Calculated from some application programs. TPS, GPS or LGO. Multiple. With more than one measured coordinate triplet, the average for the position and the height can be computed.
NAV	Type Instrument source Number of triplets	Navigated points using uncorrected code solutions of a single epoch or SPP positions. GPS. Multiple.
EST	Type	Estimated points from LGO.

Class	Characteristic	Description
	Instrument source Possible number of triplets	LGO. One.
NONE	Type Instrument source Possible number of triplets	Measured points with angles. TPS. Unlimited.

Sub class

The sub class describes certain classes in detail. It indicates the status of the position when a coordinate triplet was measured and how the coordinates were determined.

Sub class	Description	Instrument source
COGO	Indirect coordinate determination with application program COGO.	GPS or TPS
NONE	Direction is available but no coordinates. Height is available but no position coordinates.	TPS Level
TPS	Measured with distances and angles.	TPS
Fixed (Height)	Manually entered and fixed in height.	GPS or TPS
Fixed (Position)	Manually entered and fixed in position.	GPS or TPS
Fixed (Pos & Ht)	Manually entered and fixed in position and height.	GPS or TPS
GPS Code Only	Direct coordinate determination with code solution.	GPS

Sub class	Description	Instrument source
GPS Fixed	Direct coordinate determination with phase fixed solution.	GPS
GPS Float	Direct coordinate determination with autonomous solution coming from LGO.	GPS
Hidden Point	Indirect coordinate determination with hidden point measurements.	GPS or TPS
Additional sub classes for SmartStation with the ATX1230+ GNSS/GS12/GS09 antenna:		
GNSS Code Only	Direct coordinate determination with code solution.	GPS
GNSS Fixed	Direct coordinate determination with phase fixed solution.	GPS
GNSS Float	Direct coordinate determination with autonomous solution coming from LGO.	GPS

Source

The source describes the application program or functionality that generated a coordinate triplet and the method with which it was created.

Source	Originated from application program/functionality	Instrument source
ASCII File	Convert Data, Import ASCII/GSI Data to Job	GPS or TPS
Arc Base Pt	COGO, Arc Calculation - Base Point	GPS or TPS
Arc Centre Pt	COGO, Arc Calculation - Centre Point	GPS or TPS

Source	Originated from application program/functionality	Instrument source
Arc Offset Pt	COGO, Arc Calculation - Offset Point	GPS or TPS
Arc Segmt Pt	COGO, Arc Calculation - Segmentation	GPS or TPS
Backward Brg-Dist	Hidden point measurements, Backward Bearing and Distance	GPS
Bearing-Distance	Hidden point measurements, Bearing and Distance	GPS
Chainage-Offset	Hidden point measurements, Chainage and Offset	GPS
COGO Area Divsn.	COGO Area Division	GPS or TPS
COGO Shift/Rtn	COGO, Shift, Rotate & Scale (Manual) COGO, Shift, Rotate & Scale (Match Pts)	GPS or TPS
COGO Traverse	COGO, Traverse	GPS or TPS
Copied Point	Convert Data, Copy points between jobs	GPS or TPS
Cross Section	Survey Cross Section	GPS or TPS
Double Bearing	Hidden point measurements, Double Bearing	GPS
Double Distance	Hidden point measurements, Double Distance	GPS
GSI File	Convert Data, Import ASCII/GSI Data to Job	GPS or TPS
Hidden Point	Hidden Point, auxiliary points	TPS
Intsct (Brg Brg)	COGO, Intersection - Bearing - Bearing	GPS or TPS
Intsct (Brg Dst)	COGO, Intersection - Bearing - Distance	GPS or TPS
Intsct (Dst Dst)	COGO, Intersection - Distance - Distance	GPS or TPS

Source	Originated from application program/functionality	Instrument source
Intsct (4 Pts)	COGO, Intersection - By points	GPS or TPS
LandXML	Design to Field in LGO converting data from LandXML software to be used in the field	LGO
Line Base Pt	COGO, Line Calculation - Base Point	GPS or TPS
Line Offset Pt	COGO, Line Calculation - Offset Point	GPS or TPS
Line Segmt Pt	COGO, Line Calculation - Segmentation	GPS or TPS
None	No information on the source is available	GPS or TPS
RefLine (Grid)	Reference Line, staked out in a defined grid	GPS or TPS
RefLine (Meas)	Reference Line, measured	GPS or TPS
RefLine (Stake)	Reference Line, staked out	GPS or TPS
Ref Plane (Meas)	Reference Plane, measured	GPS or TPS
Ref Plane (Scan)	Reference Plane, scan	TPS
Road Runner	Road Runner	GPS or TPS
Sets of Angles	Sets of Angles	TPS
Setup (Known BS)	Setup, Known Backsight Point	TPS
Setup (Loc Rsct)	Setup, Local Resection	TPS
Setup (Ori&Ht)	Setup, Orientation and Height Transfer	TPS
Setup (Resect)	Setup, Resection	TPS
Setup (Resect H)	Setup, Resection Helmert	TPS

Source	Originated from application program/functionality	Instrument source
Setup (Set Az)	Setup, Set Azimuth	TPS
Srvy Auto Offset	Survey Auto Points, automatically recorded with offsets	GPS or TPS
Stakeout	Stakeout	GPS or TPS
Survey	Survey, measured	TPS
Survey (Auto)	Survey Auto Points, automatically recorded	TPS
Survey (Event)	Survey, Event input	GPS
Survey (Instant)	Survey, measured with <Pt Occupation: Instantaneous> in CONFIGURE Point Occupation Settings	GPS
Survey (Rem Pt)	Survey, Remote Point	TPS
Survey (Static)	Survey, measured with <Pt Occupation: Normal> in CONFIGURE Point Occupation Settings	GPS
Traverse	Traverse	TPS
Unknown	-	GPS or TPS
User Application	Customised application programs	GPS or TPS
User Entered	Manually entered point	GPS or TPS

Instrument source

The instrument source describes where the coordinate triplet was measured or entered. The options are **GPS**, **TPS**, **LGO** or **Level**.

Coordinate quality

Description

The **Coordinate Quality** is an indicator for the estimated quality of the point coordinates. The coordinate quality of the measurements is used in point averaging.

Column	Description
Est 3D CQ	Estimated 3D coordinate quality of computed position.
Est 2D CQ	Estimated plan coordinate quality of computed position.
Est 1D CQ	Estimated height coordinate quality of computed position.

Vertical angles are always assuming Zenith angles and not elevation angles. Standard deviations of circle readings relate to one face measurements.

$$\rho = \frac{200}{\pi}$$

TPS12_075

Standard deviation of circle reading

$$\sigma_{Hz, V} [\text{rad}] = \frac{\sigma_{Hz, V} [\text{gon}]}{\rho}$$

TPS12_076

$\sigma_{Hz, V}$ Standard deviation of circle reading if σ_{Hz}
= σ_V .
 σ_{Hz} : Standard deviation of horizontal circle
reading.
 σ_V : Standard deviation of vertical circle
reading.

Standard deviation of distance measurement

$$\sigma_D = c_D + \text{ppm} * D$$

TPS12_077

σ_D Standard deviation of distance measurement.

c_D Constant part of EDM accuracy.

ppm ppm part of EDM accuracy.

D Slope Distance.

1D estimated coordinate quality

$$1D \text{ CQ} = \sqrt{\sigma_D^2 * \cos^2 V + \sigma_{Hz, V}^2 * D^2 * \sin^2 V}$$

TPS12_072

1D CQ Estimated coordinate quality of the height.

V Zenith angle.

2D estimated coordinate quality

$$2D \text{ CQ} = \sqrt{\sigma_D^2 * \sin^2 V + \sigma_{Hz, V}^2 * D^2}$$

TPS12_073

2D CQ Estimated horizontal coordinate quality.

3D estimated coordinate quality

$$3D \text{ CQ} = \sqrt{\sigma_D^2 + \sigma_{Hz, V}^2 * D^2 * (1 + \sin^2 V)}$$

TPS12_074

3D CQ Estimated spatial coordinate quality.

Working Example 1

Instrument:

Angular accuracy:

EDM accuracy:

Slope distance:

Hz:

V:

TXA1202

$2'' = 6.1728 \cdot 10^{-4} \text{ gon} \Rightarrow \sigma_{Hz}, V = 2'' \cdot \sqrt{2}$

2 mm + 2 ppm for an IR measurement

150 m

210 gon

83 gon

1D CQ = 0.00207 m $\cong$ 2.1 mm

2D CQ = 0.00303 m $\cong$ 3.0 mm

3D CQ = 0.00367 m $\cong$ 3.7 mm

Working Example 2

Instrument:

Angular accuracy:

EDM accuracy:

Slope distance:

Hz:

V:

TXA1202

$2'' = 6.1728 \cdot 10^{-4} \text{ gon} \Rightarrow \sigma_{Hz}, V = 2'' \cdot \sqrt{2}$

2 mm + 2 ppm for an IR measurement

7000 m

210 gon

83 gon

1D CQ = 0.0927 m

2D CQ = 0.0972 m

3D CQ = 0.1343 m

Working Example 3

Instrument:	TM30
Angular accuracy:	$0.5'' = 1.5432 \times 10^{-4} \text{ gon} \Rightarrow \sigma_{Hz, V} = 0.5'' \cdot \sqrt{2}$
EDM accuracy:	1 mm + 1 ppm for precise mode
Slope distance:	150 m
Hz:	210 gon
V:	83 gon

1D CQ = 0.00054 m $\cong$ 0.5 mm
2D CQ = 0.00120 m $\cong$ 1.2 mm
3D CQ = 0.00132 m $\cong$ 1.3 mm

Working Example 4

Instrument:	TM30
Angular accuracy:	$0.5'' = 1.5432 \times 10^{-4} \text{ gon} \Rightarrow \sigma_{Hz, V} = 0.5'' \cdot \sqrt{2}$
EDM accuracy:	1 mm + 1 ppm for precise mode
Slope distance:	7000 m
Hz:	210 gon
V:	83 gon

1D CQ = 0.0209 m
2D CQ = 0.0229 m
3D CQ = 0.0311 m

6.3.2

Creating a New Point

Access

Refer to "6.2 Accessing Data Management" to access **MANAGE Data: Job Name**.

Create point step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	MANAGE Data: Job Name, Points page	
2.	NEW (F2) to access MANAGE New Point .	
3.	MANAGE New Point, Coords page <Point ID:> The name of the new point. The configured point ID template is used. The ID can be changed. • To start a new sequence of point ID's overtype the point ID. • For an individual name independent of the ID template SHIFT INDIV (F5). SHIFT RUN (F5) changes back to the next ID from the configured ID template. Enter a point ID and the coordinates.	
	COORD (F2) views other coordinate properties.	
	Negative geodetic coordinates are interpreted as being of the opposite hemisphere or other side of the central meridian. For example, entering -25 °N will be stored as 25 °S, entering -33 °E will be stored as 33 °W.	

Step	Description	Refer to chapter
	NORTH (F3) or SOUTH (F3) . Available for local geodetic or WGS 1984 geodetic coordinates when <Local Lat:> or <WGS 1984 Lat:> is highlighted. Changes between North and South latitude.	
	EAST (F3) or WEST (F3) . Available for local geodetic or WGS 1984 geodetic coordinates when <Local Long:> or <WGS 1984 Long:> is highlighted. Changes between East and West longitude.	
	SHIFT ELL H (F2) or SHIFT ORTH (F2) . Available for local coordinates. Changes between the ellipsoidal and the orthometric height.	
4.	PAGE (F6) changes to the Code page.	
5.	MANAGE New Point, Code page The setting for <Thematc Codes:> in CONFIGURE Coding Settings determines the availability of the subsequent fields and softkeys. For <Thematc Codes: With Codelist>: The codes from the job codelist are used. <Point Code:> All point codes of the job codelist can be selected. The description of the code is shown as an output field. The attributes are shown as output, input or choicelist fields depending on their definition.	16.3

Step	Description	Refer to chapter
	For <Thematc Codes: Without Codelist>: Codes for points can be typed in but not selected from a codelist. <Point Code:> The code to be stored with the point. A check is performed to see if a point code of this name already exists in the job. If so, the according attributes are shown. <Attribute n:> Up to eight attribute values are available.	
6.	Is <Thematc Codes: With Codelist>? - If yes, continue with the next row. - If no, continue with step 7.	
	NEW-A (F2) allows additional attributes to be created for this point code.	
	NAME (F3) or VALUE (F3) Available for attributes for which an attribute name can be typed in. To highlight <Attribute n:> or the field for the attribute value. The name of <Attribute n:> can be edited and an attribute value can be typed in.	
	LAST (F4) recalls the last used attribute values which were stored with this point code.	
	DEFLT (F5) recalls the default attribute values for the selected code.	
7.	STORE (F1) stores the new point entered and all associated information and returns to MANAGE Data: Job Name, Points page. The properties stored with the point are:	

Step	Description	Refer to chapter
	Class: CTRL Sub class: Fixed (Pos & Ht) Source: User Entered Instrument source: TPS	
	It may happen that a point with the same point ID exists in the job. If the codes and/or attribute values of the new and the existing point do not match, a screen opens where they can be corrected.	8.6

6.3.3

Editing a Point

Access

Refer to "6.2 Accessing Data Management" to access **MANAGE Data: Job Name**.

Edit point step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	In MANAGE Data: Job Name, Points page highlight a point to be edited.	
2.	EDIT (F3) to access MANAGE Edit Point: Point ID .  The visible pages on this screen depend on the properties of the point being edited.	
3.	MANAGE Edit Point: Point ID, Coords page It is possible to edit the point ID and for points of <Class: CTRL> and <Class: EST> also the coordinates. Other point related data is shown in output fields.  Points of <Class: REF> cannot be renamed.  Changing the point ID for a point of any class applies this new point ID to all other points with the same original name, regardless of class.	6.3.1
	MORE (F5) displays information about class, sub class, estimated 3D coordinate quality, time and date of when point was stored, instrument source and source.	6.3.1
	COORD (F2) views other coordinate types.	

Step	Description	Refer to chapter
	SHIFT ELL H (F2) or SHIFT ORTH (F2). Available for local coordinates. Change between the option to enter an ellipsoidal or an orthometric height. Changing the height type does not edit the point.	
4.	Is <Class: MEAS>? • If yes, continue with step 5. • If no, continue with step 7.	
5.	The edited point is <Class: MEAS>. PAGE (F6) changes to the Obs page.	
6.	MANAGE Edit Point: Point ID, Obs page For TPS points It is possible to edit the reflector height. The station from where the point was measured is shown in an output field.  The reflector height is shown and may be edited. Changing the reflector height recalculates the point height. The reflector type is shown in an output field. The distance variables ΔHz, ΔV, ΔSlop Dist are shown in an output field, whenever a measurement has been taken in both faces. For GPS points	

Step	Description	Refer to chapter
	The name of the real-time reference station from where the GPS point was measured, the name of antenna used to measure the point and the baseline values are shown in output/observations fields.	
	MORE (F5) Available for TPS points. Displays the horizontal angle or the azimuth from the point to the instrument.	
7.	PAGE (F6) changes to the Code page.	
8.	MANAGE Edit Point: Point ID, Code page The point code can be edited. All point codes in the job can be selected. The description of the code is shown as an output field. The attributes are shown as output, input or choicelist fields depending on their definition. The attribute values shown depend on <Attributes:> in CONFIGURE Coding & Linework. <Attributes: Last Used> shows the last used attribute values which are stored for this point code in the active codelist. <Attributes: Default Values> shows the default attribute values for this point code if existing.	8.2 and 8.3
	NEW-A (F2) allows additional attributes to be created for this point code.	

Step	Description	Refer to chapter
	NAME (F3) or VALUE (F3) Available for attributes for which an attribute name can be typed in. To highlight <Attribute n:> or the field for the attribute value. The name of <Attribute n:> can be edited and an attribute value can be typed in.	
	LAST (F4) recalls the last used attribute values which were stored with this point code.	
	DEFLT (F5) recalls the default attribute values for the selected code.	
9.	Is <Class: MEAS> and no offset point or <Class: NAV> ? • If yes, continue with step 11. • If no, continue with step 10.	
10.	Is <Class: AVGE> ? • If yes, continue with step 13. • If no, continue with step 15.	
11.	The edited point is <Class: MEAS> and no offset point or <Class: NAV> . PAGE (F6) changes to the Annots page.	
12.	MANAGE Edit Point: Point ID, Annots page The comments to be stored with the point can be edited. Continue with step 15.	
13.	The edited point is <Class: AVGE> .	

Step	Description	Refer to chapter
	PAGE (F6) changes to the Mean page.	
14.	MANAGE Edit Point: Point ID, Mean page All points of <Class: MEAS> of the same point ID are listed sorted by time. The settings in the Use column can be edited. All functionality and keys are explained in a separate section.	6.3.4
15.	STORE (F1) stores the changes and returns to MANAGE Data: Job Name.  An edited point retains the creation value for <Time:>.  Changing coordinates of a point which has been previously used in other application programs, for example COGO, does not update the application results.	
	It may happen that a point with the same point ID exists in the job. If the codes and/or attribute values of the new and the existing point do not match, a screen opens where they can be corrected.	8.6

Description

- In order to check measurements, the same point can be measured more than once. These measured points are assigned the class **MEAS**. The various measured coordinate triplets for one point can be recorded using the same point ID. If the averaging mode is activated, an average is calculated when more than one measured coordinate triplet is available for the same point ID.
- The averaged point is given the class **AVGE**. It is checked if the deviations of each single point are within the limits configured in **MANAGE New Job, Avge** page or in **MANAGE Edit Job: Job Name, Avge** page.
- After averaging, the **Mean** page becomes available in **MANAGE Edit Point: Point ID** and accessible from the Survey application program **SURVEY Survey: Job Name, Survey** page.
- Available functionality on the **Mean** page depends on the selected averaging mode.

Averaging**Averaging Mode**

The averaging mode defines the checks which are performed when more than one set of measured coordinates are recorded for the same point. The selected averaging mode also affects the behaviour of the instrument when editing a point and calculating averages.

Defining the averaging mode and configuring the limits

The averaging mode and the limits are configured in **MANAGE New Job, Avge** page or in **MANAGE Edit Job: Job Name, Avge** page. Refer to "5.3 Creating a New Job" and to "5.4 Editing a Job".

Description of averaging modes

Averaging mode	Description
Average	When more than one measured coordinate triplet is recorded for the same point, the average for the position and the height is computed. Depending on the selected averaging method, the average will be computed weighted or arithmetic (no weighting). The class AVGE is assigned to the averaged point. The horizontal and height distances from the measured points to the average are computed and displayed on the Mean page. A check is performed that the differences for the position and height components between the averaged point and the point being stored does not exceed the defined limits.
Absolute Diffs	What is described above for Average applies for Absolute Diffs. Additionally, the absolute difference between two points selected from a list of measured points which are all stored with the same point ID are computed and checked for being within the defined limits.
Off	Averaging functionality is turned off. With more than one measured coordinate triplet recorded for the same point, no average for the position and the height is computed.

Averaging with position only or height only points

Position only points, height only points and points with full coordinate triplets are handled in the averaging.

Access step-by-step

The **Mean** page can be accessed if

<Averaging Mode: Average> or **<Averaging Mode: Absolute Diffs>** is configured in **MANAGE New Job, Avge** page or in **MANAGE Edit Job: Job Name, Avge** page.

AND

more than one measured coordinate triplet is recorded for the same point using the same point ID.

Access within data management

Step	Description
1.	Refer to "6.2 Accessing Data Management" to access MANAGE Data: Job Name .
2.	In MANAGE Data: Job Name, Points page highlight a point to be edited.
3.	EDIT (F3) to access MANAGE Edit Point: Point ID, Mean page.

Access within Survey

Step	Description
1.	Main Menu: Survey to access SURVEY Survey Begin .
2.	CONT (F1) to access SURVEY Survey: Job Name, Survey page.
3.	SHIFT AVGE (F2) or SHIFT ABS (F2) to access SURVEY Edit Point: Point ID, Mean page.

MANAGE

Edit Point: Point ID, Mean page

All measured coordinate triplets recorded using the same point ID are shown.

10:35	IR	STD	I	1	0	
MANAGE						
Edit Point: 500						
Coords	Code	Mean				
Use	Time	dPos	dHt			
Auto	10:07:18	0.007	0.002			
Auto	10:06:56	0.002	0.002			
Auto	10:06:31	0.008	-0.004			
				Q2 a		
STORE	USE	EDIT	DEL	MORE	PAGE	

STORE (F1)

To store the changes and to return to the screen from where this screen was accessed.

USE (F2)

To change between the options in the **Use** column for the highlighted coordinate triplet. To include or exclude this triplet in or from the calculation of the average. Refer to "Description of columns" below.

EDIT (F3)

To view and edit the highlighted measured coordinate triplet. It is possible to edit the point ID and the reflector height without impact on all other classes of the point with the same original name. The coordinates are updated. Codes cannot be changed. The average point has the higher priority. A change in codes must be an overall change for the average point.

Example: One of the measured coordinate triplets has a wrong point ID and should not be included in the average. By editing the point ID, the point is renamed and no longer contributes to the average.

DEL (F4)

To delete the highlighted coordinate triplet. The average is recomputed.

MORE (F5)

To change between time and date of when the point was stored and the 3D coordinate quality.

PAGE (F6)

To change to another page on this screen.

SHIFT DIFFS (F5)

Available for **<Averaging Mode: Absolute Diffs>** and **Yes** is set in the **Use** column for exactly two measurements. To display the absolute coordinate differences. Differences exceeding the defined limit are indicated by ?.

Description of columns

Column	Description
Use	The use of a measured coordinate triplet in the averaging. • Auto The coordinate triplet is included in the averaging computation if within the averaging limit defined in MANAGE New Job, Avge page or in MANAGE Edit Job: Job Name, Avge page. • Yes The coordinate triplet is always included in the averaging computation even if it would fall outside the averaging limit defined in MANAGE New Job, Avge page or in MANAGE Edit Job: Job Name, Avge page.

Column	Description
	• No The coordinate triplet is never included in the averaging computation. • ----- The coordinate triplet cannot be included in the averaging computation. Automatically set by the system. USE (F2) changes between the options.
Time	The time the measured coordinate triplet was stored.
Date	The date the measured coordinate triplet was stored. The format is as defined in CONFIGURE Units & Formats, Time page.
dPos	The horizontal distance from the measured coordinate triplet to the average. <dPos: -----> indicates unavailable information, for example for a height only point.
dHt	The height distance from the measured coordinate triplet to the average. <dHt: -----> indicates unavailable information, for example for a position only point.
!	Available for measured coordinate triplets with Auto or Yes in the Use column if <Averaging Mode: Average> . Indicates an exceeding of the limits.

Next step

IF a measured coordinate triplet	THEN
is not to be viewed	STORE (F1) stores the changes and returns to MANAGE Data: Job Name .
is to be viewed	highlight a measured coordinate triplet and EDIT (F3) .

6.4

6.4.1

Line/Area Management

Overview

Description

A line/area consists of points and can be created/edited in **MANAGE Data: Job Name**. The individual points are measured within any application program. These can be all points. Points can be simultaneously assigned to one or more lines and/or areas.

A line/area can have

- a style for display in MapView.
- a code independent of the point code of the points comprising the line/area.



Points are assigned to a line/area when the line/area is open. Refer to "6.2 Accessing Data Management" for information on how to open a line/area.

6.4.2

Creating a New Line/Area



The functionality of all screens and fields are similar for the creation of both lines and areas. The step-by-step instructions for creating a new line can be applied for areas.

Access

Refer to "6.2 Accessing Data Management" to access **MANAGE Data: Job Name**.

OR

Press a hot key configured to access the screen **MANAGE New Line/MANAGE New Area**. Refer to "2.1 Hot Keys" for information on hot keys.

Create line step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	MANAGE Data: Job Name	
2.	PAGE (F6) until the Lines (X) page is active.	
3.	MANAGE Data: Job Name, Lines (X) page	
4.	NEW (F2) to access MANAGE New Line .	
5.	MANAGE New Line, General page <Line ID:> The name of the new line. The configured ID template for lines is used. The ID can be changed. • To start a new sequence of line ID's overwrite the line ID. • For an individual name independent of the ID template SHIFT INDIV (F5). SHIFT RUN (F5) changes back to the next ID from the configured ID template.	

Step	Description	Refer to chapter
	<Pts to Store:> The type of points which are used to form the line during a survey. Select between all points, measured points, auto points and offset points of type 1 or 2. <Line Style:> This is the line style in which lines/areas are represented in MapView and LGO. For <Line Code: <None>> on the Code page a line style can be selected from a choicelist. Otherwise the line style as defined for the selected line code is shown. Type in a number for the line, select the points to be stored with the line and select a line style if necessary.	49.1, 49.4
6.	PAGE (F6) changes to the Code page.	
7.	MANAGE New Line, Code page The setting for <Thematc Codes:> in CONFIGURE Coding & Line-work determines the availability of the subsequent fields and softkeys. For <Thematc Codes: With Codelist>: The codes from the job codelist are used. <Line Code:> All line codes of the job codelist can be selected. The description of the code is shown as an output field. The line style is shown as defined for the selected line code. It is the style in which lines/areas are represented in MapView and LGO. For <Line Code: <None>>, it can be changed. The attributes are shown as output, input or choicelist fields depending on their definition.	16.3

Step	Description	Refer to chapter
	- For <Themadc Codes: Without Codelist>: Codes for lines can be typed in but not selected from a codelist. <Line Code:> The line code to be stored with the point. A check is performed to see if a line code of this name already exists in the job. If so, the according attributes are displayed. <Attribute n:> Up to eight attribute values are available. Type in a code.	
8.	Is <Themadc Codes: With Codelist>? - If yes, continue with the next row. - If no, continue with step 9.	
	NEW-A (F2) allows additional attributes to be created for this line code.	
	NAME (F3) or VALUE (F3) Available for attributes for which an attribute name can be typed in. To highlight <Attribute n:> or the field for the attribute value. The name of <Attribute n:> can be edited and an attribute value can be typed in.	
	LAST (F4) recalls the last used attribute values which were stored with this line code.	
	DEFLT (F5) recalls the default attribute values for the selected code.	
9.	STORE (F1) stores the new line entered and all associated information and returns to MANAGE Data: Job Name, Lines (X) page.	

Step	Description	Refer to chapter
	The value for <Start Time:> with which the line is stored is the time when STORE (F1) was pressed. The same value is assigned to the value for <End Time:> until a point is added to the line.	6.4.3
	Any existing lines and areas which are open are closed.	

Creating lines/areas most efficiently

IF the task is to create	THEN
multiple lines/areas with subsequent line/area ID's	use the hot key/user menu function FUNC Create New Line (Quick)/FUNC Create New Area (Quick) . Pressing the hot key or selecting the function from the user menu creates and immediately stores the new line/area. For the line/area ID, the line/area ID template as defined in CONFIGURE ID Templates is used. The code and attributes are taken over from the last created line/area.
lines/areas with certain codes	use quick coding. The job codelist must contain quick codes for lines/areas. By tying the quick code a new line/area is created and immediately stored with that line/area code and attributes. For the line/area ID, the line/area ID template as defined in CONFIGURE ID Templates is used.

6.4.3

Editing a Line/Area



The functionality of all screens and fields are similar for the editing of both lines and areas. The step-by-step instructions for editing a new line can be applied for areas.

Access

Refer to "6.2 Accessing Data Management" to access **MANAGE Data: Job Name**.

Edit line step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	MANAGE Data: Job Name	
2.	PAGE (F6) until the Lines page is active.	
3.	In MANAGE Data: Job Name , Lines page highlight a line to be edited.	
4.	EDIT (F3) to access MANAGE Edit Line: Line ID .	
5.	MANAGE Edit Line: Line ID, General page The line ID and the type of points which are used to form the line during a survey can be edited. Other line related data is shown in output fields. <No. of Pts:> The number of points contained within the line. <Length:> The sum of the distances between the points in the sequential order in which they are stored for the line. This can be a horizontal grid distance or a geodetic distance on the WGS 1984 ellipsoid.	

Step	Description	Refer to chapter
	<Start Time:> and <Start Date:> The time/date when the line was created.  A line cannot be renamed to an already existing line ID.	
	MORE (F5) displays <End Time:> and <End Date:>. This is the time/date when the last point was added to the line. This can be different to the time the point was created. The values do not change after deleting the last added point or after editing unless an additional point is added to the line.	
6.	PAGE (F6) changes to the Points page.	
7.	MANAGE Edit Line: Line ID, Points page All points belonging to the line are listed. The point that was added last to the line is at the top of the list.	
	ADD (F2) Accesses MANAGE Select Point with the Points and Map page. To add an existing point from the active job to the line. A new point is added above the point which was highlighted when ADD (F2) was pressed.	6.2.
	EDIT (F3) edits the highlighted point.	6.3.3.
	REMOV (F4) removes the highlighted point from the line. The point itself is not deleted.	
	MORE (F5) displays information about the point codes if stored with the line, the time and the date of when the line was stored, the 3D coordinate quality, the class and the flag for Linework.	6.3.1

Step	Description	Refer to chapter
8.	PAGE (F6) changes to the Code page.	
9.	MANAGE Edit Line: Line ID, Code page The line code can be edited. All line codes can be selected. For <Line Code: <None>> , the line style can be changed. The description of the code is shown as an output field. The attributes are shown as output, input or choicelist fields depending on their definition.	8
	NEW-A (F2) allows additional attributes to be created for this line code.	
	NAME (F3) or VALUE (F3) Available for attributes for which an attribute name can be typed in. To highlight <Attribute n:> or the field for the attribute value. The name of <Attribute n:> can be edited and an attribute value can be typed in.	
	LAST (F4) recalls the last used attribute values which were stored with this line code.	
	DEFLT (F5) recalls the default attribute values for the selected code.	
10.	STORE (F1) stores the changes and returns to MANAGE Data: Job Name, Lines page.	
	An edited line retains the creation value for <Start Time:> . The value for <End Time:> changes when a point was added to the line.	

6.4.4

Working Example

Description

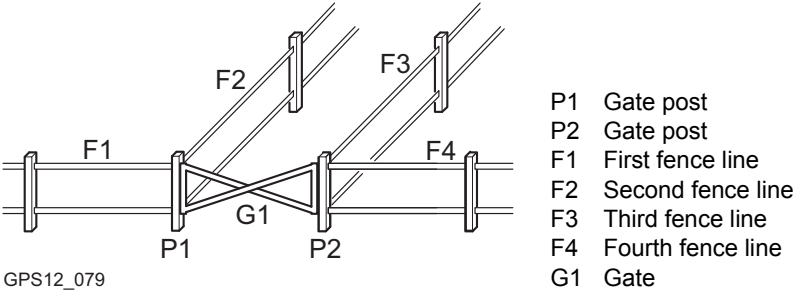
- Application:

Pick up points along fence lines with a gate. The gate can also be represented as a line.
Some points belong to more than one line.
- Setting:

F7 is configured to access the **MANAGE Data: Job Name** screen. Refer to "2.1 Hot Keys" on how to configure hot keys.
- Goal:

Each point is to be picked up once.

Diagram



Field procedure
step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Create the lines F1, F2 and G1.	6.4.2

Step	Description	Refer to chapter
2.	Start Survey application program.	48.1
3.	Press F7 .	
4.	MANAGE Data: Job Name, Lines (X) page The line F1 must be open, the lines F2 and G1 must be closed. To open/close a line, highlight the line and CLOSE (F4) and OPEN (F4) .	
5.	CONT (F1)	
6.	SURVEY Survey: Job Name Measure points along fence line F1 until the last point before P1. These points are automatically added to line F1.	
	Points can be coded separately.	
7.	Press F7 .	
8.	MANAGE Data: Job Name, Lines (X) page Highlight the line F2. OPEN (F4) to open the line.	
9.	Highlight the line G1. OPEN (F4) to open the line.	
	Line F1 stays open.	
10.	CONT (F1)	
11.	SURVEY Survey: Job Name	48.1

Step	Description	Refer to chapter
	Measure P1. This point is automatically added to all three lines open at that time.	
12.	Press F7 .	
13.	MANAGE Data: Job Name, Lines (X) page Highlight the line F1. CLOSE (F4) to close the line.	
14.	Highlight the line F2. CLOSE (F4) to close the line.	
	Line G1 stays open.	
15.	CONT (F1)	
16.	SURVEY Survey: Job Name Measure points along gate G1. These points are automatically added to line G1.	48.1
17.	After finishing the survey, import the data into a CAD package. If the line codes required by the CAD package were used, the lines are automatically connected and the point symbols are automatically set.	

6.5

Data Log

Description

A list of all objects and free codes in the active job is displayed in order of time.

Access step-by-step

Access within data management

Step	Description
1.	Refer to "6.2 Accessing Data Management" to access MANAGE Data: Job Name .
2.	In MANAGE Data: Job Name on the Points page, SHIFT LOG (F4) to access MANAGE Data Log: Job Name .

Access within job management

Step	Description
1.	Main Menu: Manage...\Jobs to access MANAGE Jobs (Device) . Refer to "5.2 Accessing Job Management" for further options to access this screen.
2.	In MANAGE Jobs (Device) highlight a job to be edited.
3.	EDIT (F3) to access MANAGE Edit Job: Job Name .
4.	SHIFT LOG (F5) to access MANAGE Data Log: Job Name .

Access by hot key

Press a hot key configured to access the screen **MANAGE Data Log: Job Name**. Refer to "2.1 Hot Keys" for information on hot keys.

Access by user defined menu

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

MANAGE

Data Log: Job Name

In the column **Data Record**, all points, lines and areas as well as free codes stored within the active job are displayed. They are always sorted by time with the most recent record at the top. For lines and areas, the value for **<Start Time:>** is relevant.

Data Record	Record Type
500	Point
500	Point
500	Point
1	Point
1ine003	Line
1ine002	Line
1ine001	Line

CONT (F1)

To close the screen and return to the screen from where this screen was accessed.

NEW (F2)

To insert a free code below, this means time-wise before, the currently highlighted object or record. The functionality of inserting a free code is identical to the functionality of entering a free code during a survey. Refer to "8.3 Free Coding".

EDIT (F3)

To edit the highlighted object or free code. Refer to "6.3.3 Editing a Point", "6.4.3 Editing a Line/Area". The functionality of editing a free code is identical to the functionality of entering a free code during a survey. Refer to "8.3 Free Coding".

DEL (F4)

To delete the highlighted object or free code.

MORE (F5)

To display information about the type of data recorded, the time and the date of when it was stored or for lines and areas when they were created and the codes if stored with any object.

Next step

CONT (F1) returns to the screen from where **MANAGE Data Log: Job Name** was accessed.

6.6

6.6.1

Point Sorting and Filters

Sorting and Filters for Points, Lines and Areas

Description

The sort settings define the order of the objects in the active job. The filter settings define the objects to be viewed.

Three types of filters are available:

- Point filter: An active point filter shows selected points in **MANAGE Data: Job Name, Points** page.
- Line filter: An active line filter shows selected lines in **MANAGE Data: Job Name, Lines (X)** page.
- Area filter: An active area filter shows selected areas in **MANAGE Data: Job Name, Areas (X)** page.

The sort and filter settings are stored in the job. They are remembered after turning off the instrument and are copied to a new job.

When a job becomes active, then the sort and filter settings of this job are saved in the SystemRAM. If the CompactFlash card is formatted then these last used sort and filter settings are used for the job **Default**.



Changing the active job does influence the sort settings for the objects. The filter settings are set to those of the selected job.



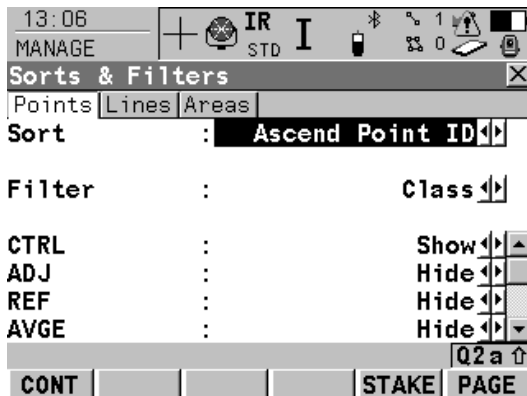
An active filter for an object is indicated in **MANAGE Data: Job Name** by **Y** located on the right hand side of the page name.

Access step-by-step

Step	Description
1.	Refer to "6.2 Accessing Data Management" to access MANAGE Data: Job Name .
2.	In MANAGE Data: Job Name on the Points , Lines or Areas page, SHIFT FILT (F5) to access MANAGE Sorts & Filters .
3.	MANAGE Sorts & Filters  This screen consists of three pages, one for each type of object. The page for an object is displayed when the equivalent page is displayed in MANAGE Data: Job Name .

MANAGE Sorts & Filters, Points page

The available fields on this screen depend on the selected setting for <Filter>.



13:08
MANAGE

Sorts & Filters

Points Lines Areas

Sort : Ascend Point ID

Filter : Class

CTRL : Show

ADJ : Hide

REF : Hide

AVGE : Hide

Q2a

CONT STAKE PAGE

CONT (F1)

To close the screen and return to the screen from where this screen was accessed. The selected sort and filter settings are applied.

STAKE (F5)

To filter points for the Stakeout application program. Refer to "6.6.3 Stakeout Filter".

PAGE (F6)

To change to another page on this screen.

Description of fields

Field	Option	Description
<Sort:>	Ascend Point ID, Descend Point ID, Forward Time or Backward Time	Always available. The method points are sorted by.
<Filter:>	No Filter Highest Class Range of Pt ID's Pt ID Wildcard Time Class Instrument Coordinate Type	Always available. The method the points are filtered by. Shows all points. Shows points of highest class. Shows points with point ID's between the entered start and end ID. The points are left aligned and sorted by the first digit. Shows points with point ID's matching the wild-card. Shows points which were recorded within a defined time window. Shows points of the selected class. Shows points originating from the selected instrument or software program type. Shows points of the selected type of coordinates.

Field	Option	Description
	Point Code	Shows points with selected codes attached. Refer to "6.6.2 Point, Line and Area Code Filter".
	Radius From Pt	Shows points within the defined radius from a particular point. The radius is the horizontal distance.
	Individual Line	Shows points forming a selected line. This may for example be useful during stakeout.
	Individual Area	Shows points forming a selected area. This may for example be useful during stakeout.
<Start ID:>	User input	Available for <Filter: Range of Pt ID's> . The first point to be displayed.
<End ID:>	User input	Available for <Filter: Range of Pt ID's> . The last point to be displayed.
<Wildcard:>	User input	Available for <Filter: Pt ID Wildcard> . * and ? are supported. * indicates an undefined number of unknown characters. ? indicates a single unknown character.
<Start Date:>	User input	Available for <Filter: Time> . The date of the first point to be displayed.
<Start Time:>	User input	Available for <Filter: Time> . The time of the first point to be displayed.

Field	Option	Description
<End Date:>	User input	Available for <Filter: Time>. The date of the last point to be displayed.
<End Time:>	User input	Available for <Filter: Time>. The time of the last point to be displayed.
<CTRL:>, <ADJ:>, <REF:>, <AVGE:>, <MEAS:>, <NAV:>, <EST:>, <NONE:>	Show or Hide	Available for <Filter: Class>. Defined classes are shown or hidden.
<View:>	Highest Triplet All Triplets	Available for <Filter: Class>. The coordinate triplets of the highest class are shown. All classes for one coordinate triplet are shown.
<Instrument:>	All, TPS, GPS, LEICA Geo Office, Level, Data Logger, Third Party SW or Unknown	Available for <Filter: Instrument>. Points originating from this instrument type are shown.
<Type:>	WGS84 Only or Local Only	Available for <Filter: Coordinate Type>. Points from the chosen coordinate type are shown.

Field	Option	Description
<Point ID:>	Choicelist	Available for <Filter: Radius From Pt>. The point to which the radius is applied. Opening the choicelist opens MANAGE Data: Job Name . Refer to "6.2 Accessing Data Management".
<Radius:>	User input	Available for <Filter: Radius From Pt>. The radius of the circle within which the points are shown.
<Line ID:>	Choicelist	Available for <Filter: Individual Line>. Opening the choicelist opens MANAGE Data: Job Name . Refer to "6.2 Accessing Data Management".
<Area ID:>	Choicelist	Available for <Filter: Individual Area>. Opening the choicelist opens MANAGE Data: Job Name . Refer to "6.2 Accessing Data Management".

Next step

PAGE (F6) changes to the **Lines** page. Refer to paragraph "MANAGE Sorts & Filters, Lines page".

MANAGE Sorts & Filters, Lines page

13:10
MANAGE

Sorts & Filters

Points Lines Areas

Sort : Ascend Line ID

Filter : Code/Code Group

CONT (F1)

To close the screen and return to the screen from where this screen was accessed. The selected sort and filter settings are applied and the lists in **MANAGE DATA: Job Name** are updated.

CODES (F4)

Available for **<Filter: Code/Code Group>**. To select the line codes to be used.

PAGE (F6)

To change to another page on this screen.

CONT CODES PAGE

Description of fields

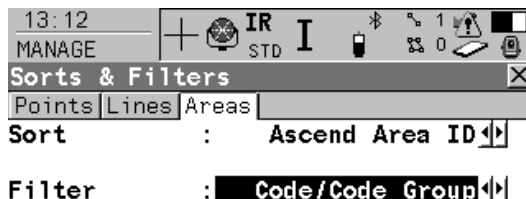
Field	Option	Description
<Sort:>	Ascend Line ID, Descend Line ID, Fwrđ Start Time, Bwrđ Start Time, Fwrđ End Time or Bwrđ End Time	Always available. The method the lines are sorted by.
<Filter:>	No Filter	Always available. The method by which the lines are filtered. Shows all lines.

Field	Option	Description
	Code/Code Group	Shows lines with selected codes attached. Refer to "6.6.2 Point, Line and Area Code Filter" since the functionality is identical to the point code filter.

Next step

PAGE (F6) changes to the **Areas** page. Refer to paragraph "MANAGE Sorts & Filters, Areas page".

MANAGE Sorts & Filters, Areas page



CONT (F1)

To close the screen and return to the screen from where this screen was accessed. The selected sort and filter settings are applied and the lists in **MANAGE DATA: Job Name** are updated.

CODES (F4)

Available for <Filter: Code/Code Group>. To select the area codes to be used.

PAGE (F6)

To change to another page on this screen.



Description of fields

The functionality of setting the filters is identical to those on the **Lines** page. Refer to paragraph "MANAGE Sorts & Filters, Lines page".

Next step

CONT (F1) returns to the screen from where **MANAGE Sorts & Filters** was accessed.

6.6.2

Point, Line and Area Code Filter



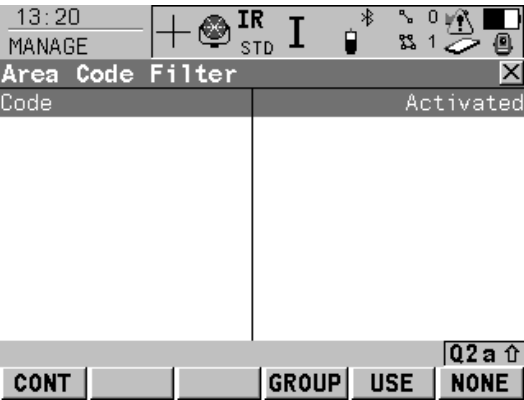
For each object, a code filter exists. The point, line and area code filters are independent from each other. The functionality is identical. For simplicity, the point code filter is explained.

Access step-by-step

Step	Description
1.	Refer to "6.6.1 Sorting and Filters for Points, Lines and Areas" to access MANAGE Sorts & Filters .
2.	Select <Filter: Point Code> .
3.	CODES (F4) to access MANAGE Point Code Filter .

MANAGE
Point Code Filter

This screen shows the point codes from the active job and codes currently used as filter. Point codes are sorted according to the settings in **MANAGE Sort Codes**.



- CONT (F1)**
To close the screen and return to the screen from where this screen was accessed.
- GROUP (F4)**
To activate and deactivate code groups. Accesses **MANAGE Code Groups**. Any code group that have been previously deactivated are displayed as deactivated here. Codes belonging to a deactivated code group are not displayed in **MANAGE Code Filter**. Refer to "7.6 Managing Code Groups".

USE (F5)

To activate and deactivate the filter for the highlighted code.

NONE (F6) or ALL (F6)

To deactivate or activate all point codes.

SHIFT SORT (F5)

To define the order of the codes. Accesses **MANAGE Sort Codes**.

6.6.3

Stakeout Filter

Description

The settings on this screen define a filter for the Stakeout application program, for example to show points which are already staked or points that are still to be staked.



The stakeout filter acts in addition to any other filter set in **MANAGE Sorts & Filters**. For example, points still to be staked out with a particular code can be filtered.

Access step-by-step

Step	Description
1.	Refer to "6.6.1 Sorting and Filters for Points, Lines and Areas" to access MANAGE Sorts & Filters .
2.	In MANAGE Sorts & Filters , PAGE (F6) until the Points page is active.
3.	STAKE (F5) to access MANAGE Stakeout Filter .

MANAGE Stakeout Filter



View : **All Points** [Left Arrow] [Right Arrow]



CONT (F1)

To close the screen and return to the screen from where this screen was accessed.

RESET (F4)

To reset the staked flag for all points of the currently active job.

Description of fields

Field	Option	Description
<View:>	All	Shows all points.
	Pts to Stakeout	Shows points not yet staked out.
	Staked Points	Shows points which are already staked out.

7.1

Terminology

Description

This chapter describes technical terms related to codes and codelists.



The values for code groups, codes and attributes are case sensitive. For example the code group Tree is not the same as the code group TREE.

Object

For coding, points, lines and areas have the same behaviour. In this chapter, object is used as generic term for points, lines and areas.

Code group

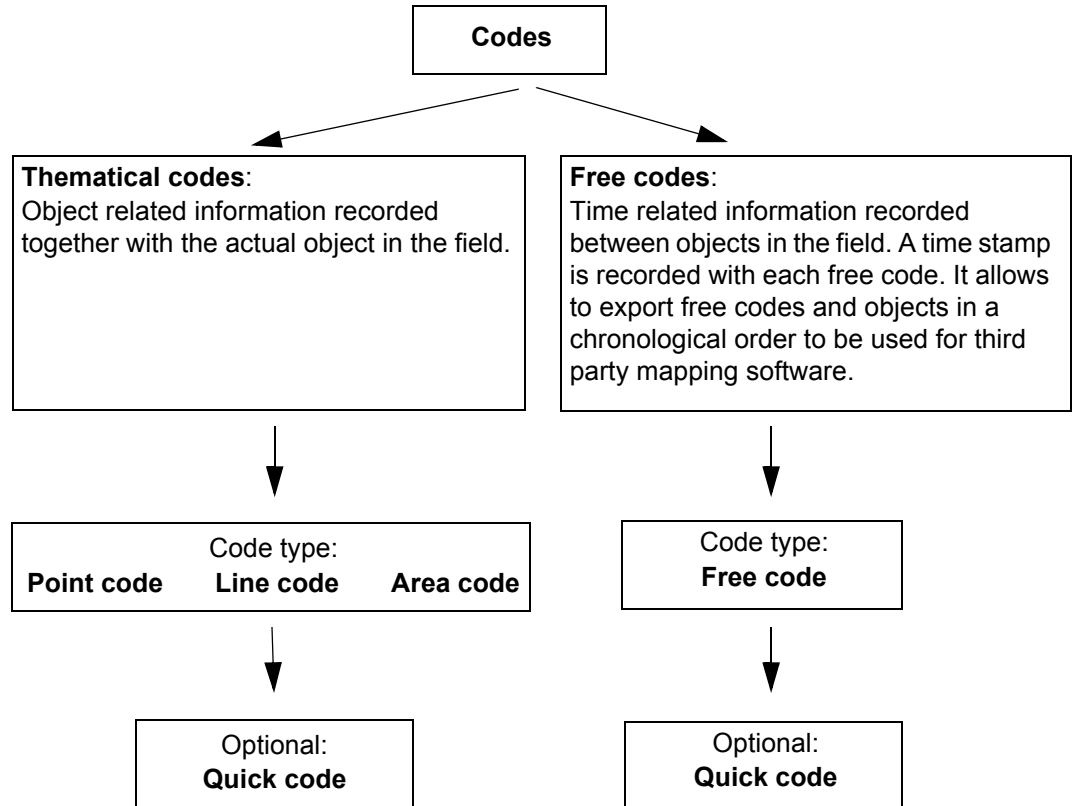
A code group allows codes belonging to the same theme to be grouped together. Individual groups can be activated or deactivated. The codes belonging to a deactivated code group cannot be selected from the choicelist for code selection.

Code

Description

A code is a description which can be stored with an object or alone.

Structure of codes



Code types

The code type defines how and for which objects a code can be used. It is possible to create a code of the same name but of different code types both on the instrument and in LGO.

Example: The code Oak can exist with code type point code and with code type line code.

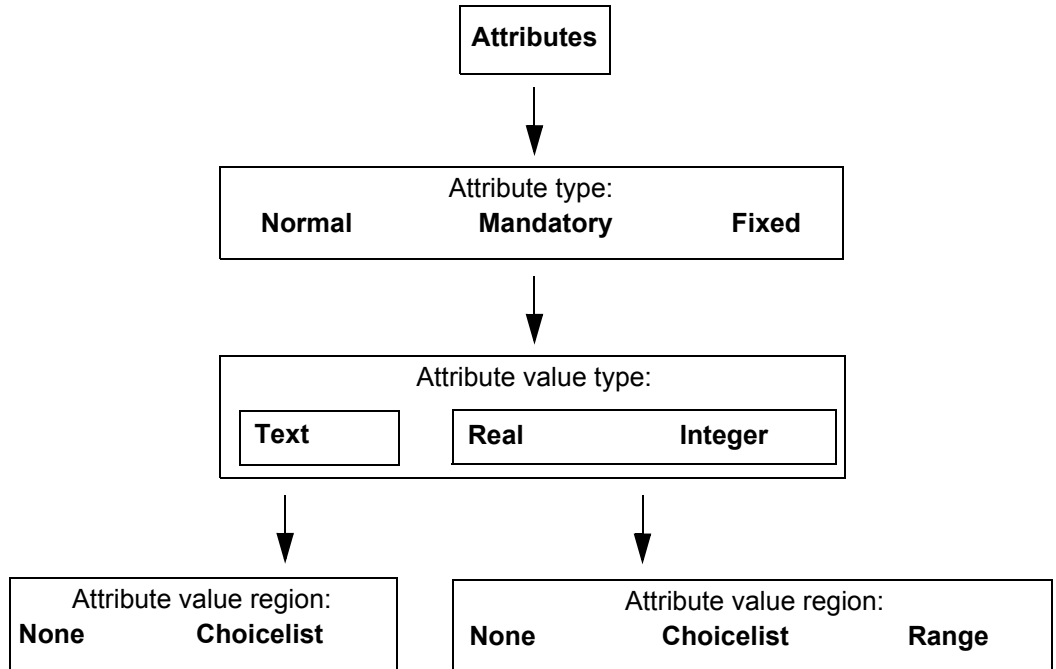
Point code:	To record a code directly with a point. This is thematical point coding.
Line code:	To record a code directly with a line. This is thematical line coding.
Area code:	To record a code directly with an area. This is thematical area coding.
Free code:	To record a code based on time in between objects.
Quick code:	To start a point measurement and store the code by typing in one, two or three predefined digits.

Attribute

Description

The use of attributes allows additional information to be stored with the code. Up to twenty attributes can be related to one code. Attributes are not compulsory.

Structure of attributes



Attribute types

The attribute type defines the input requirements for the attribute.

Normal:	An input for the attribute is optional. The attribute value can be typed in in the field. New attributes with this attribute type can be created in LGO or on the instrument.
Mandatory:	An input for the attribute is compulsory. The attribute value must be typed in the field. New attributes with this attribute type can be created in LGO.
Fixed:	The attribute value is a predefined default which is displayed but cannot be changed in the field. This attribute value is automatically attached to the code. New attributes with this attribute type can be created in LGO.

Attribute value types

The attribute value type defines which values are accepted as input.

Text:	Any input for the attribute is interpreted as text. New attributes with this attribute value type can be created in LGO or on the instrument.
Real:	An input for the attribute must be a real number, for example 1.23. New attributes with this attribute value type can be created in LGO.
Integer:	An input for the attribute must be an integer number, for example 5. New attributes with this attribute value type can be created in LGO.

Attribute value regions

The attribute value region defines if the attribute values must be selected from a predefined list.

None:	An input for the attribute must be typed in. New attributes with this attribute value region can be created in LGO or on the instrument.

- Range: An input for the attribute must fall within a predefined range. New attributes with this attribute value region can be created in LGO.
- Choicelist: An input for the attribute is selected from a predefined list. New attributes with this attribute value region can be created in LGO.

Example

Code	Attributes	Attribute value type	Attribute value region	Example for the attribute value region
Birch	Height	Real	Range	0.5-3.0
	Condition	Text	Choicelist	Good, Dead, Damaged
	Remark	Text	None	-

Codelist

Description

A codelist is a collection of codes that can be used to describe surveyed objects in the field.

Elements of a codelist

- Code group
- Code
- Attributes

Structure of a codelist

Structure	Example
Codelist — Code group 1 — Code 1.1 — Attribute 1.1.1 — Attribute ... — Attribute 1.1.20 — Code 1.2 — Attribute 1.2.1 — Attribute ... — Attribute 1.2.20 — Code ... — Code group 2 — Code 2.1 — Attribute 2.1.1 — ...	Codelist — Trees — Birch — Height — Condition — Remark — Oak — Circumference — Condition — ... — ... — Infrastructure — Road — Material — ...

Codelist types

System RAM codelist:

A codelist stored in the System RAM of the instrument.

Job codelist:

The collection of codes contained within the currently active job.

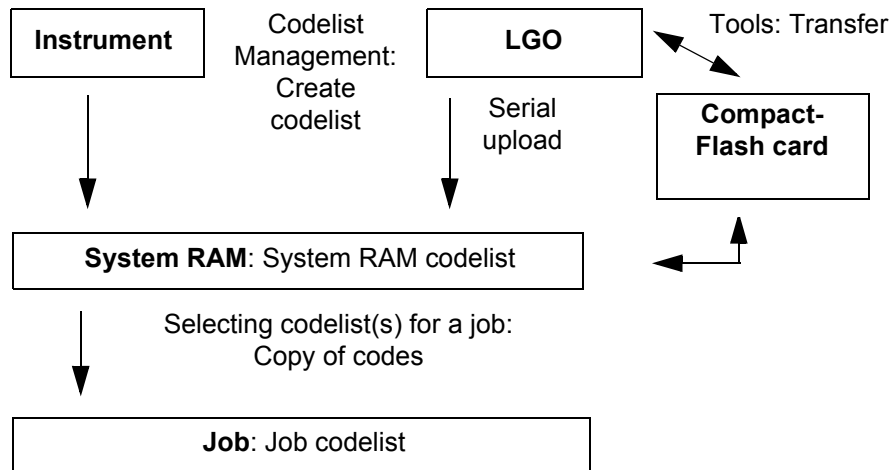
7.2



Steps from creating to using a codelist

Overview

It is recommended to create a codelist in LGO. A codelist can be transferred from LGO to the System RAM of the instrument using the CompactFlash card.



The creating, editing and managing of codelists is explained in this chapter. In order to use a codelist on the instrument, it must be transferred from the CompactFlash card to the System RAM. Refer to "24 Tools...\Transfer Objects...".

7.3

Accessing Codelist Management

Access

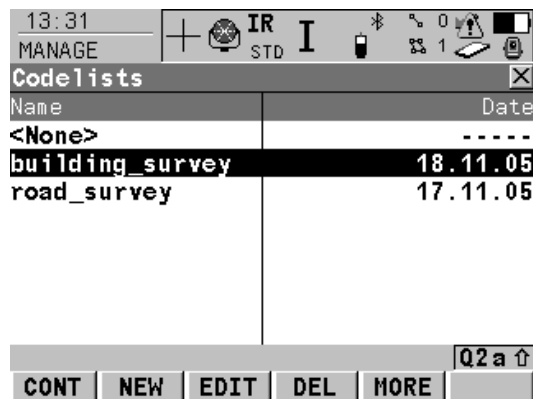
Select **Main Menu: Manage...Codelists**.

OR

From a choicelist in some screens, for example **MANAGE New Job, Codelist** page.

MANAGE Codelists

Listed are all codelists stored in the System RAM.



Name	Date
<None>	-----
building_survey	18.11.05
road_survey	17.11.05

CONT NEW EDIT DEL MORE Q2 a ↑

CONT (F1)

To return to the screen from where this screen was accessed. If this screen was accessed from a choicelist, the codes from the highlighted codelist are copied to the active job.

NEW (F2)

To create a codelist. Refer to "7.4 Creating/Editing a Codelist".

EDIT (F3)

To edit the highlighted codelist. Refer to "7.4 Creating/Editing a Codelist".

DEL (F4)

To delete the highlighted codelist.

MORE (F5)

To display information about the creator and the date of when the codelist was created.

Next step

IF a codelist	THEN
is to be selected	highlight the desired codelist. CONT (F1) copies the codes of the codelist to the active job, closes the screen and returns to the screen from where MANAGE Codelists was accessed.
is to be created	NEW (F2) . Refer to "7.4 Creating/Editing a Codelist".
is to be edited	highlight the codelist and EDIT (F3) . Refer to "7.4 Creating/Editing a Codelist".

7.4

Creating/Editing a Codelist

Access

Refer to "7.3 Accessing Codelist Management" to access **MANAGE Codelists**.

Create/edit a codelist step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	MANAGE Codelists NEW (F2) or EDIT (F3) to access MANAGE XX Codelist .	7.3
2.	MANAGE New Codelist or MANAGE Edit Codelist <Name:> A unique name for the codelist. The name may be up to 16 characters long and may include spaces. Input required. <Description:> A detailed description of the codelist. This can be for example, work to be performed. Input optional. <Creator:> The person's name who is creating the new codelist. Input optional.	
	CODES (F4) accesses MANAGE Codes where codes can be created, edited or deleted and code groups can be accessed.	7.5.2, 7.5.3 or 7.6
3.	STORE (F1) stores the codelist and returns to MANAGE Codelists .	

7.5

7.5.1

Managing Codes

Accessing **MANAGE** Codes

Description

Managing codes includes

- creating new codes
- viewing codes with their related information
- editing codes.
- deleting existing codes.

Access step-by-step

Step	Description
1.	Refer to "7.3 Accessing Codelist Management" to access MANAGE Codelists .
2.	In MANAGE Codelists highlight the codelist of which codes are to be managed.
3.	EDIT (F3) to access MANAGE Edit Codelist .
4.	CODES (F4) to access MANAGE Codes . This screen is described below.

MANAGE Codes

Codes from currently active code groups are shown.

The listed code groups belong to

the selected System RAM codelist when this screen was accessed through **Main Menu:
Manage...\Codelists**.

OR

to the job codelist when **MANAGE Codes** was accessed from an application program,
MANAGE New Job or **MANAGE Edit Job**.

The  indicates codes which have attributes attached.

17:54		  IR STD 		    	
MANAGE					
Codes					
Code				Code Description	
top				top of bank	
toe				toe of bank	
gum				gum tree	

CONT (F1)

To close the screen and return to the screen from where this screen was accessed.

NEW (F2)

To create a new code. Refer to "7.5.2 Creating a New Code".

EDIT (F3)

To edit the highlighted code. Refer to "7.5.3 Editing a Code".

DEL (F4)

To delete the highlighted code.

MORE (F5)

To display information about the code description, the quick codes if available, the code groups and the code type.

SHIFT GROUP (F4)

To view, create, delete, activate and deactivate code groups. Refer to "7.6 Managing Code Groups".

SHIFT SORT (F5)

To sort codes by code name, code description, quick code or the last use.

Next step

IF	THEN
a code is to be created	NEW (F2) . Refer to "7.5.2 Creating a New Code".
a code is to be edited	highlight the code and EDIT (F3) . Refer to "7.5.3 Editing a Code".
code groups are to be accessed	SHIFT GROUP (F4) . Refer to "7.6 Managing Code Groups".

7.5.2

Creating a New Code

Create a new code step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to "7.5.1 Accessing MANAGE Codes" to access MANAGE Codes .	
2.	NEW (F2) to access MANAGE New Code .	
3.	MANAGE New Code <Code:> A unique name for the new code. The name may be up to 16 characters long and may include spaces. Input required. <Code Desc:> A detailed description of the code. Input optional. <Group:> The code group to which the code is to be assigned. All code groups from MANAGE Code Groups can be selected. <Code Type:> This field contains a choicelist, where the code type (Thematical code - Point, Line, Area or Free code - Free) can be selected. The selected option will define how the code will be used. Selecting a code type allows a code to remain unique. <Code:> can have the same value but with a different <Code Type:> within the same codelist. <Linework:> Available for <Code Type: Point> only. This field contains a choicelist, to allow a new line or new area to be opened whenever the point code is newly selected. This functionality is also available when creating codelists with LGO Codelist Management.	

Step	Description	Refer to chapter
	- None: Select this option to disable the functionality. All other code settings on the instrument are not affected when this option is set. - Begin Line: When a point code is newly selected, a new line is opened and the point being stored is added to the line. When the same point code remains selected, a new line is not opened. The point being stored is simply added to the current line. - Begin Area: The behaviour for opening a new area is the same as the behaviour for opening a new line, as mentioned above.	
	<Line Style:> Not available for <Code Type: Free> . The style in which lines and areas are represented in MapView and LGO.	7.1
4.	NEW-A (F2) adds <Attribute 1:> as new input field for an attribute of attribute type normal and of value type text.	
	NAME (F3) or VALUE (F3) Available for attributes for which an attribute name can be typed in. To highlight <Attribute 1:> or the field for the attribute value. The name of <Attribute 1:> can be edited and the attribute value to be used as the default attribute value can be typed in.	
	Attributes of attribute type mandatory or fixed and of value type real or integer must be created in LGO.	
	Up to twenty attributes can be created.	
5.	Is another attribute to be created? - If yes, repeat step 4. - If no, continue with step 6.	

Step	Description	Refer to chapter
6.	STORE (F1) adds the new code and any associated attributes to the System RAM codelist and returns to the screen from where this screen was accessed.	
	A new code can also be created within an application program. In this case, the new code is added to the job codelist.	

7.5.3

Editing a Code

Access step-by-step

Step	Description
1.	Refer to "7.5.1 Accessing MANAGE Codes" to access MANAGE Codes .
2.	EDIT (F3) to access MANAGE Edit Code .
3.	All following steps are identical with the creation of a new code. Refer to "7.5.2 Creating a New Code". Follow the instructions in paragraph "Create a new code step-by-step" from step 3. onwards.
	Attribute names that have already been typed in cannot be edited in a job codelist.

7.6

Managing Code Groups

Access step-by-step

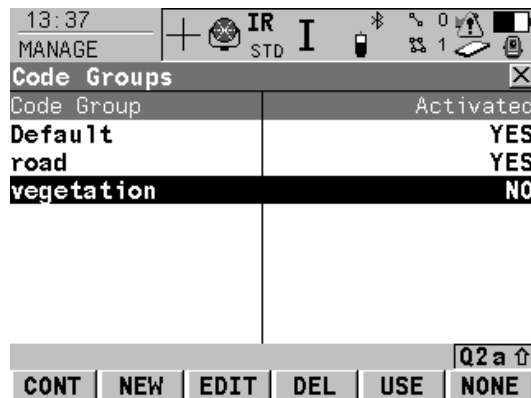
Step	Description
1.	Refer to "7.5.1 Accessing MANAGE Codes" to access MANAGE Codes .
2.	SHIFT GROUP (F4) to access MANAGE Code Groups .

MANAGE Code Groups

The listed code groups belong to
the selected System RAM codelist when this screen was accessed through **Main Menu:**
Manage...\Codelists.

OR

to the job codelist when **MANAGE Codes** was accessed from an application program,
MANAGE New Job or **MANAGE Edit Job**.



CONT (F1)

To close the screen and return to the screen from where this screen was accessed.

NEW (F2)

To create a new code group.

EDIT (F3)

Available for System RAM codelists. To edit the highlighted code group.

DEL (F4)

Available for System RAM codelists. To delete the highlighted code group.

USE (F5)

To activate and deactivate the highlighted code group. Codes belonging to a deactivated code group are not displayed in **MANAGE Codes**.

NONE (F6) or ALL (F6)

To deactivate or activate all code groups.

Description of columns

Column	Description
Code Group	The name of the code group.
Activated	Use code group or not. The options are Yes and No . The codes belonging to a deactivated code group cannot be selected from the choicelist for code selection. USE (F5) changes between the options.

Next step

IF a code group	THEN
is to be created	NEW (F2) . In MANAGE New Code Group type in a unique name for <Group:> . STORE (F1) stores the new code group typed in and returns to MANAGE Code Groups .
is to be edited	highlight the code group and EDIT (F3) . In MANAGE Edit Code Group type in the changes for <Group:> . STORE (F1) stores the changes and returns to MANAGE Code Groups .

8.1

Overview

Description

A code is a description which can be stored with a point, line, area or alone. Coding on TPS1200+/TS30/TM30 is very flexible with thematical, free and quick coding being available. Thematical and free coding is possible by selecting codes from a codelist or by directly typing in codes. SmartCodes are a quick way for a code to be stored with a point to be selected and to be measured.



For coding, points, lines and areas have the same behaviour. In this chapter, the word object is used as a generic term for points, lines and areas.

Coding methods

Coding method	Characteristic	Description
Thematical	Use Selection of the codes	To store a description together with an object inside an application program or in Main Menu: Manage...\Data. - For thematical coding with codelist: On a configured display mask, codes are selected from the job codelist in a choicelist. The job codelist must contain thematical codes. - For thematical coding without codelist: On a configured display mask, codes are typed in.

Coding method	Characteristic	Description
	Recording of the codes	Together with the objects.
Free	Use	To store a description independent of an object at any time. A free code can be used to store a description related to an object or to store additional descriptions such as the job name or the temperature.
	Selection of the codes	• For free coding using a codelist: Pressing the configured hot key opens a choicelist with the free codes of the job codelist. • For free coding with direct input: Pressing the configured hot key opens a screen for alphanumeric input.
	Recording of the codes	Stored as time related information. A time stamp is stored with each free code. According to the requirements of the CAD package used, free codes can be configured to be stored before or after the object.
Quick	Use	Quick coding is the storing of an object plus a thematical or free code using a minimum number of keystrokes.

Coding method	Characteristic	Description
	Selection of the codes	Shortcuts must be assigned to codes in the jobodelist. <Quick Code: On> must be set in CONFIGURE Coding & Linework . Typing the shortcut searches for the assigned code and initiates a measurement.
	Recording of the codes	- For thematical codes: Together with the objects. - For free codes: Stored as time related information before or after the points. A time stamp is stored with each free code.
		Quick codes must be created in LGO.
		Characters that can be assigned to quick codes are: 0 to 9 - A to Z, not case sensitive - a to z, not case sensitive

Configure Coding

Refer to "16.3 Coding & Linework Settings" for information on configuring coding.

8.2

8.2.1



Thematical Coding

Thematical Coding with Codelist

Thematical coding of points with a codelist is explained in this chapter. Refer to "6.4 Line/Area Management" for information on coding lines/areas.

Requirements

- The job codelist contains thematical codes.
 - **<Thematc Codes: With Codelist>** in **CONFIGURE Coding & Linework**.
 - A display mask with an input field for point codes must be configured.
-

Access

Open the choicelist for **<Code:>** in a display mask of an application program.

OR

Open the choicelist for **<Code:>/<Point Code:>** in **MANAGE New Point, Code** page in data management.

OR

Open the choicelist for **<Point Code:>** in **MANAGE Edit Point: Point ID, Code** page in data management.

OR

Open the choicelist for **<Auto Pt Code:>** in **SURVEY Survey: Job Name, Auto** page, if configured.

MANAGE Select Code

Code	Code Description
<None>	-----
top	top of bank
toe	toe of bank
gum	gum tree
c1	road centre line

CONT NEW MORE Q2 a ↑

CONT (F1)

To return to the screen from where this screen was accessed.

NEW (F2)

To create a new code. Refer to "7.5.2 Creating a New Code".

ATRIB (F3)

Available unless accessed from **MANAGE New Point/Line/Area** or **MANAGE Edit Point/Line/Area**. To type in attribute values for the selected code and/or add new attributes for the selected code.

LAST (F4)

Available if a code has been previously used in the active job. To select from a list of last used codes. The codes are sorted by time with the most recently used code at the top of the list.

MORE (F5)

To display information about the code description, the code group, the code type and the quick code if codes with quick codes exist in the job.

SHIFT GROUP (F4)

To view, create, delete, activate and deactivate code groups. Refer to "7.6 Managing Code Groups".

SHIFT SORT (F5)

To sort codes by code name, code description, quick code or the last used.

Thematical coding with codelist step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to paragraph "Access" to access XX Select Point Code .	
2.	MANAGE Select Point Code All point codes from the job codelist which belong to the active code groups are available for selection. Point codes marked with  have attributes attached.	7.6
3.	Highlight the desired code.	
4.	ATrib (F3) to access XX Enter Attributes .	
5.	XX Enter Attributes <Point Code:> The name of the selected code for which attribute values are to be typed in. <Code Desc:> The detailed description of the selected code. If configured for the selected code, input fields for attribute values are available. Type in the attribute values. Attribute values for attributes of type • normal can be typed in. • fixed cannot be edited.	
	NEW-A (F2) to add a new attribute of type normal and of value type text.	

Step	Description	Refer to chapter
	NAME (F3) or VALUE (F3) Available for attributes for which an attribute name can be typed in. To highlight <Attribute n:> or the field for the attribute value.	
	Attributes of type mandatory or fixed and of value type real or integer must be created in LGO.	online help in LGO.
	Up to twenty attributes can be added.	
	LAST (F4) recalls the last used attribute values for the selected code.	
	DEFLT (F5) recalls the default attribute values for the selected code.	
6.	CONT (F1) returns to the screen from where XX Select Point Code was accessed.	
	The point code and any associated attribute values are stored when the point is stored.	
	If a point with the same point ID exists in the job, the codes, the attribute names and the attribute values of the new and the existing point must be identical. Should they not be identical, a screen opens where the code or attribute mismatch can be corrected.	8.6

8.2.2

Thematical Coding without Codelist



Thematical coding without codelist for points is explained in this chapter. Refer to "6.4 Line/Area Management" for information on coding lines/areas.

Requirements

- **<Themadc Codes: Without Codelist>** in **CONFIGURE Coding & Linework**.
- A display mask with an input field for point codes must be configured.

Access

A thematical code is typed in the field

<Code:> in a display mask of an application program.

OR

<Code:>/<Point Code:> in **MANAGE New Point, Code** page in data management. The procedure is similar for lines and areas.

OR

<Point Code:> in **MANAGE Edit Point: Point ID, Code** page in data management. The procedure is similar for lines and areas.

OR

in the field **<Auto Pt Code:>** in **SURVEY Survey: Job Name, Auto** page, if configured.

Thematical coding without codelist step-by-step

Step	Description
	Thematical coding in the Survey application program is explained in this step-by-step instruction. A typical configuration set with a display mask for coding called Code is used.
1.	SURVEY Survey: Job Name, Code page

Step	Description
	<Point ID:> The identifier for the point for which codes and attribute values are to be typed in. <Point Code:> The name for the code. <Attribute n:> The attribute values for the code. Type in a code and attribute values.
	Up to eight attributes can be added. This is configured in the display mask.
2.	ALL (F1) to measure angles and distance. OR PAGE (F6) to change to another page on this screen.

8.3

8.3.1



Free Coding

Free Coding Using a Codelist

In this chapter, free coding using a codelist is explained for points. Refer to "6.4 Line/Area Management" for information on coding lines/areas.

Requirements

- The job codelist contains free codes.
 - A hot key is configured to access the screen **FREECODE Select Free Code** or the user defined menu is configured to display the option **Select Free Code**.
-

Access

Press a hot key configured to access the screen **FREECODE Select Free Code**. Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER** and select **Select Free Code** to access the screen **FREECODE Select Free Code**. Refer to "2.2 USER Key" for information on the **USER** key.

FREECODE

Select Free Code

Code	Code Description
SP0T	spot height

STORE NEW ATTRIB MORE Q2 a ↑

STORE (F1)

To store the free code and any associated attribute values and to return to the screen from where this screen was accessed.

NEW (F2)

To create a new code. Refer to "7.5.2 Creating a New Code".

ATTRIB (F3)

To type in attribute values and/or add new attributes for the selected free code.

LAST (F4)

Available if a free code has been previously used in the active job. To select from a list of last used free codes. The free codes are sorted by time with the most recently used code at the top of the list.

MORE (F5)

To display information about the code description, the code group and the quick code if codes with quick codes exist in the job.

SHIFT GROUP (F4)

To view, create, delete, activate and deactivate code groups. Refer to "7.6 Managing Code Groups".

SHIFT SORT (F5)

To sort codes by code name, code description, quick code or the last used.

Free coding using a codelist step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to paragraph "Access" to access FREECODE Select Free Code .	8.3
2.	FREECODE Select Free Code All free codes from the job codelist which belong to the active code groups are available for selection. Free codes marked with  have attributes attached.	7.6
3.	Highlight the desired code.	
4.	ATrib (F3) to access FREECODE Enter Attributes .	
5.	FREECODE Enter Attributes <Free Code:> The name of the selected code for which attribute values are to be typed in. <Code Desc:> The detailed description of the selected code. If configured for the selected code, input fields for attribute values are available. Type in the attribute values. Attribute values for attributes of type • normal can be typed in. • fixed cannot be edited.	
	NEW-A (F2) to add a new attribute of type normal and of value type text.	

Step	Description	Refer to chapter
	NAME (F3) or VALUE (F3) Available for attributes for which an attribute name can be typed in. To highlight <Attribute n:> or the field for the attribute value.	
	Attributes of type mandatory or fixed and of value type real or integer must be created in LGO.	online help in LGO.
	Up to twenty attributes can be added.	
	LAST (F4) recalls the last used attribute values for the selected code.	
	DEFLT (F5) recalls the default attribute values for the selected code.	
6.	FREECODE Enter Attributes STORE (F1) returns to the screen from where FREECODE Select Free Code was accessed and stores the free code, any associated attribute values and time related information.	

8.3.2

Free Coding with Direct Input



In this chapter, free coding with direct input is explained for points. Refer to "6.4 Line/Area Management" for information on coding lines/areas.

Requirements

A hot key is configured to access the screen **FREECODE Enter Free Code & Attributes** or the user defined menu is configured to display the option **Enter Free Code**.

Access

Press a hot key configured to access the screen **FREECODE Enter Free Code & Attributes**. Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER** and select **Enter Free Code** to access the screen **FREECODE Enter Free Code & Attributes**. Refer to "2.2 USER Key" for information on the **USER** key.

Free coding with direct input step-by-step

Step	Description
1.	Refer to paragraph "Access" to access FREECODE Enter Free Code & Attributes .
2.	FREECODE Enter Free Code & Attributes <Free Code:> The name for the free code. <Attribute n:> The attribute values for the free code. Type in a code and attribute values.
	As soon as a free code is typed in, a codelist is created within the job.
	Up to eight attributes can be added.

Step	Description
	LAST (F4) Available if a free code has been previously used in the active job. Accesses FREECODE Last Used Free Codes. To select from a list of last used free codes. The free codes are sorted by time with the most recently used code at the top of the list. In FREECODE Last Used Free Codes press ATRIB (F3) to type in attribute values.
3.	STORE (F1) stores the free code, any associated attribute values and time related information.

8.4

Quick Coding

Requirements

- The job codelist contains quick codes for points, lines and/or areas.
- According to the requirements of the used CAD package, set **<Rec Free Code: Before Point>** or **<Rec Free Code: After Point>** in **CONFIGURE Coding & Linework**.

Activate quick coding

The current setting for **<Quick Code:>** in **CONFIGURE Coding & Linework** determines how quick coding is activated. Quick coding can be activated at any time.

- For **<Quick Code: On>** in **CONFIGURE Coding & Linework**
Quick coding is active and can be used.
- For **<Quick Code: Off>** in **CONFIGURE Coding & Linework**
Press a hot key configured to switch between **<Quick Code: Off>** and **<Quick Code: On>** in **CONFIGURE Coding & Linework**. Refer to "2.1 Hot Keys" for information on hot keys.
OR
Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.
OR
Tap the quick coding icon visible during Survey and other application programs where it is possible to measure a point with quick codes.
OR
Access **CONFIGURE Coding & Linework** and change the setting. Refer to "16.3 Coding & Linework Settings".
- For **<Quick Code: Never>** in **CONFIGURE Coding & Linework**
Access **CONFIGURE Coding Settings** and change the setting. Refer to "16.3 Coding & Linework Settings".

Quick coding for points step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to paragraph "Activate quick coding" to activate quick coding.	
	A screen must be active where points can be measured. ALL (F1) must be visible. For example SURVEY Survey: Job Name .	
2.	Type in the one, two or three digits of the quick code. The current setting for <Digits:> in CONFIGURE Coding & Linework determines by how many keystrokes quick coding is executed.	16.3
	ENTER to execute quick coding already after one or two keystrokes. Available for <Digits: 2> and <Digits: 3> in CONFIGURE Coding & Linework .	
	ESC clears digits from the entry.	
3.	What is the code type of the quick codes? - For point codes continue with the next row. - For free codes continue with step 5.	
	The point code assigned to the quick code is searched for in the job codelist and initiates measurements.	
	Attribute values for attributes of type normal cannot be typed in. Depending on the setting for <Attributes:> in CONFIGURE Coding & Linework, the default or the last used attribute values are stored.	

Step	Description	Refer to chapter
	fixed cannot be edited.	
	The point code and any associated attribute values are stored with the point.	
	If a point with the same point ID exists in the job, the codes, the attribute names and the attribute values of the new and the existing point must be identical. Should they not be identical, a screen opens where the code or attribute mismatch can be corrected.	8.6
4.	Quick coding for a point code is finished.	
5.	Quick coding for free codes continues from here.	
	The free code assigned to the quick code is searched for in the job codelist and initiates measurements.	
	Attribute values for attributes of type - normal cannot be typed in. Depending on the setting for <Attributes:> in CONFIGURE Coding Settings, the default or the last used attribute values are stored. - fixed cannot be edited.	
	The free code, associated attribute values and time related information are stored. The setting for <Rec Free Code:> in CONFIGURE Coding & Linework determines if the free code is stored before or after the point.	
6.	Quick coding for a free code is finished.	

Quick coding for lines/areas step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to paragraph "Activate quick coding" to activate quick coding.	
2.	Type in the one, two or three digits of the quick code. The current setting for <Digits:> in CONFIGURE Coding & Linework determines by how many keystrokes quick coding is executed.	16.3
	ENTER to execute quick coding already after one or two keystrokes. Available for <Digits: 2> and <Digits: 3> in CONFIGURE Coding & Linework .	
	ESC clears digits from the entry.	
	The line/area code assigned to the quick code is searched for in the job codelist.	
	A new line/area is created and immediately stored with that line/area code and attributes. For the line/area ID, the line/area ID template as defined in CONFIGURE ID Templates is used.	
	The system asks for mandatory attribute values.	
3.	Quick coding for a line/area is finished.	

8.5

8.5.1

Description

SmartCodes

Overview

SmartCodes is basically a quick way for code to be selected and point to be measured. All existing coding, linework, and point measurement functionality is retained.

8.5.2

Configuring SmartCodes

Access

Select **Main Menu: Survey**. In **SURVEY Survey Begin** press **CONF (F2)** to access **SURVEY Configuration**.

OR

In **SURVEY Survey: Job Name** press **SHIFT CONF (F2)** to access **SURVEY Configuration**.

SURVEY Configuration, SCode page

The settings on this page activate the using of SmartCodes and define the method. All settings in this panel are stored within the currently active configuration set.

The screenshot shows the 'SURVEY Configuration' screen. At the top, there's a status bar with '18:37', 'SURVEY', and various icons. Below it is a 'Configuration' title bar with a close button. The main area has several settings: 'SCode' with tabs for 'Auto', 'Points', and 'Remote Pt'; 'Use SCodes' set to 'Yes'; 'Show Info' set to 'Not used'; 'Measure Point' set to 'No'; 'String Attrib' set to 'Not used'; 'Method' set to 'Zig-Zag'; 'Direction' set to 'Forward'; and 'No. Elements' set to '9'. At the bottom, there are navigation buttons: 'CONT', three empty buttons, and 'PAGE'.

CONT (F1)

To accept changes and return to the screen from where this screen was accessed.

PAGE (F6)

To change to another page on this screen.

Description of fields

Field	Option	Description
<Use SCodes:>	Yes	Activates using of SmartCodes.  All other fields on the screen are active and can be edited.
	No	Deactivates using of SmartCodes and all fields on this screen.
<Show Info:>		Information shown in line 8 of SURVEY Survey: Job name, SCode page.
	Not used	No display mask element is shown.
	Point ID	The identifier for the measured points. The configured point ID template is used.  Refer to "48.2 Surveying Points".
	3D CQ	The current 3D coordinate quality of the measured point.
	2D CQ	The current 2D coordinate quality of the measured point.
	1D CQ	The current height coordinate quality of the measured point.
	Reflector Ht	The height of the reflector that is being used. Changing the reflector height here does not update the default reflector height as defined in the active configuration set.
	Hz	The current horizontal angle of the measured point.

Field	Option	Description
	V Horiz Dist Slope Dist Ht Diff Linework	The current vertical angle of the measured point. The current horizontal distance of the measured point. The current slope distance of the measured point. The current height difference between the station and the measured point. The linework flag to be stored with the point. The options available depend on whether a line/area is currently open. Refer to "9.2 Performing Linework" for an explanation of the options that become available in SURVEY Survey: Job name, SCode page.
<Measure Point:>	Yes or No	If one of the code boxes is tapped in SURVEY Survey: Job name, SCode page then that code is selected and the point is measured for <Measure Point:Yes> .
<String Attrib:>	Choicelist	Available for <Show Codes: All Codes>. When this field is active, surveyed points that have the same code attached are strung to one line.  Refer to "16.3 Coding & Linework Settings".
<Method:>	Not used	Method by which subsequent code box is selected after a point is stored. <Direction:> and <No. Elements:> are invisible and the number of codes boxes shown in SURVEY Survey: Job name, SCode page is nine.

Field	Option	Description
	Zig-Zag Same direction 	Each new code block is started at the same end as where the previous code block finished. Each new code block is started at the same end as where the previous code block started. Refer to "51.1 Overview" for <Method: Zig-Zag> or <Method: Same direction>.
<Direction:>	Forward Backward	The way of using the code boxes. This influences in which order the code boxes will be applied. The code boxes are used in the same way as defined in SURVEY Survey: Job name, SCode page. The code boxes are used in the reverse way as defined in SURVEY Survey: Job name, SCode page.
<No. Elements:>	1, 2, 3, 4, 5, 6, 7, 8 or 9	Number of code boxes shown in SURVEY Survey: Job name, SCode page.

8.5.3

Code Block

Requirements

- **<Use SCodes: Yes>** in **SURVEY Configuration, SCode** page.

SURVEY

Survey: Job Name,
SCode page

The screenshot shows the SURVEY screen with a status bar at the top displaying '18:53' and 'SURVEY'. Below the status bar is a menu bar with icons for IR, STD, I, Bluetooth, and a printer. The main title bar reads 'Survey: survey job'. Below this is a tabbed interface with 'Survey', 'Offset', 'Code', 'SCode', 'Auto', and 'Map' tabs. The 'Code' tab is active, showing a 'Code Block' with a grid of nine buttons, all labeled '<None>'. To the right of the grid is a '1' button with a double arrow. At the bottom of the screen is a navigation bar with buttons for 'ALL', 'CODES', and 'PAGE'. The 'PAGE' button is highlighted, and a 'Q2 a ↑' button is visible to its right.

ALL (F1)

To measure and store distances and angles.

CODES (F3)

To select a code from **MANAGE Select Code** panel.

PAGE (F6)

To change to another page on this screen.

SHIFT CONF (F2)

To activate/deactivate/configure SmartCodes.

SHIFT 2FACE (F4)

To take a measurement in Face I and Face II.
The point stored is an average of the two measurements.

Creating a Code Block step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to paragraph "Accessing Survey" to access SURVEY Survey Begin .	48.1
2.	CONT (F1) to access SURVEY Survey: Job Name .	
3.	PAGE (F6) until the SCode page is visible.	

Step	Description	Refer to chapter
4.	With the focus on <Code Block: 1> press enter to access SURVEY Manage Code Blocks panel.	
5.	NEW (F2) to create a new code block.	
	Code blocks can only be created or deleted in SURVEY Manage Code Blocks panel.	
6.	CONT (F1) to return to SURVEY Survey: Job Name, SCode page.	

Assigning codes to a Code Block step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to paragraph "Creating a Code Block step-by-step" to access SURVEY Survey: Job Name, SCode page.	
2.	Move the focus on a code box.	
3.	CODES (F4) to select a code to be assigned to the highlighted code block.	
	To create a new code to be assigned refer to "Creating a New Code".	7.5.2

Copying a Code Block to a new job step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
	Code blocks are stored in the job.	
1.	Refer to paragraph "Accessing Job Management" to access MANAGE Edit Job: Job Name, Codelist page.	5.2
	<Codelist:> If codes had been copied from a System RAM codelist, the name of the codelist is displayed. If codes have been typed in, then the name of the active job is displayed.	
2.	SHIFT EXPRT (F2) copies codes and code blocks from the job to an existing or new codelist.	
	To create a new codelist refer to "Creating/Editing a Codelist".	7.4
	Copying code blocks to an existing codelist overwrites the code blocks of the existing codelist.	
3.	STORE (F1) to save the currently active job and return to MANAGE Job (Device) .	
4.	Create a new job and assign the related codelist to the job.	
	SmartCodes from the codelist are now available within the new job.	
	To create a new job refer to "Creating a New Job".	5.3

8.5.4

Measuring points using Code Blocks step-by-step

Using SmartCodes

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to paragraph "Creating a Code Block step-by-step" to access SURVEY Survey: Job Name, SCode page.	8.5.4
2.	Move the focus on a code box.	
	When <String Attrib:> is active, you can type in an attribute value below the code name of the highlighted code box.	
	+ (F4) or - (F5) to increase or decrease the value. Applies only if the value is numeric.	
3.	ALL (F1) to measure and store the point with the highlighted code.	
	When <Measure Point: Yes> is set in the configuration settings, tapping the code box with the supplied stylus automatically measures and stores the point with the highlighted code. Selecting the code box by using the arrow keys will not measure and store the point.	

Measuring lines/ares using Code Blocks step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Activate <Show Info: Linework> in SURVEY Configuration, SCode page.	8.5.2
2.	Refer to paragraph "Creating a Code Block step-by-step" to access SURVEY Survey: Job Name, SCode page.	8.5.4
3.	Create a line/area SmartCode and return to SURVEY Survey: Job Name, SCode page.	8.5.3
	The line/area is opened and closed using the SmartCode.	
4.	To start an arc/spline move the focus on <Linework:> , the last line of the page, and select the linework flag to be stored with the point.	
5.	Move the focus on the line/area code box.	
6.	ALL (F1) to measure and store the point with the highlighted line/area code.	

8.6

8.6.1

Code and Attribute Mismatch

Code Mismatch

Description

When storing a point with a code, it may happen that a point with the same point ID already exists in the job. If the codes of the new and the existing point do not match, a screen opens where the code can be corrected. One point cannot have different codes.

XX

Point Code Mismatch

14:18 SURVEY IR STD I 0 1

Point Code Mismatch

Point ID : 500

New Code : **toe**

Code Desc : toe of bank

Stored Code : top

Code Desc : top of bank

Q2 a ↑

STORE MORE

STORE (F1)

To store the highlighted code and any associated attributes with the point being stored and to continue with the application program or data management.

MORE (F5)

To display information about the code description, the code group and any attributes associated with the highlighted code.

Description of fields

Field	Option	Description
<New Code:>	Output	The code for the point.
<Stored Code:>	Output	The code as stored for the existing point in the job.

Match codes step-by-step

Step	Description
	XX Point Code Mismatch opens automatically if the codes of the new and the existing point do not match.
1.	Highlight the code to be stored with the new point.
2.	STORE (F1) stores the highlighted code and any associated attributes with the point being stored and continues with the application program or data management.

8.6.2

Attribute Mismatch

Description

If a point with the same point ID exists in the job, the codes, the attribute names and the attribute values of the new and the existing point must be identical. Should they not be identical, a screen opens where the attribute mismatch can be corrected. One point cannot have different attributes.



The name of the screen changes with pressing **CURNT (F5)** or **STORD (F5)**:

Pressing **CURNT (F5)**: **XX Attributes Being Stored**

Pressing **STORD (F5)**: **XX Attributes Already Stored**

For simplicity, the screen shown is **XX Attributes Already Stored**.

XX Attributes Already Stored

18:23		+ IR STD I		Bluetooth		Survey Point	
SURVEY		IR STD I		Bluetooth		Survey Point	
Attributes Already Stored [X]							
Point ID	:	500					
Point Code	:	tree					
Code Desc	:	gum tree					
trunk dia	:	1					
height	:	8					
spread	:	15					
							Q2a ↑
STORE				CURNT			

STORE (F1)

To store the selected attributes with the new/created point and to continue with the application program or data management.

CURNT (F5) or STORD (F5)

To change between viewing the attribute names and values of the new/created point and those stored for the existing point in the job.

Description of fields

Field	Option	Description
<Point Code:>	Output	- For XX Attributes Already Stored: The code of the existing point in the job. - For XX Attributes Being Stored: The code of the new point.
Attributes	Output	- For XX Attributes Already Stored: The attributes as stored for the existing point in the job. - For XX Attributes Being Stored: The attributes of the new point.

Match attributes step-by-step

Step	Description
	XX Attributes Already Stored opens automatically if the attribute names and/or values of the new and the existing point do not match.
1.	CURNT (F5) and STORD (F5) to display the attribute names and values to be stored with the point.
2.	STORE (F1) stores the displayed attribute names and values with the point being stored and continues with the application program or data management.

9.1

Overview

Description

Two methods are available for the surveying of lines and areas. These two methods can be combined and are described in the following table.

Linework by	Description
Linework	• In all application programs, a display mask can be configured to show the field <Linework:>. This field contains a choicelist, where the Linework flags can be selected. • The selection of a linework flag determines: • the action taken for a line/area, for example beginning a line. • the linework flag to be stored with the point. • The Linework flags: • are configured in CONFIGURE Coding & Linework, Linework. • can be exported with a format file.
Coding	• Line/area codes can be selected in many application programs. • Refer to "7.5.2 Creating a New Code" and "8 Coding" for more information.



- The Linework flag and coding are not linked.
- Additionally to Linework, thematical point, line and area codes can be used.
- Quick coding can be used as per normal.

9.2

Performing Linework



Requirements

- A display mask with a choicelist for Linework must be configured.
- The Linework flags are defined in **CONFIGURE Coding & Linework Settings, Linework**

Preparing Linework

Step1: Placing Linework in a display mask **Step2: Defining the Linework flags**

18:41		15:20	
CONFIGURE		CONFIGURE	
Define Display Mask 3		Coding & Linework	
Name :	Code	Coding Linework	
Visible :	Yes	Begin Line :	BEG
Fixed Lines :	1	3pt Curve :	PC
1st Line :	Point ID	ReOpen Last Line:	JPND
2nd Line :	Code	End Line :	END
3rd Line :	Code Desc	Cont Line/Area :	CONT
4th Line :	Linework	Start Spline :	SPL
5th Line :	Line Space Full	End Spline :	ENDSPLN
6th Line :	Line Space Full	Cont Spline :	CONT SPL
Q2 a ↑		Q2 a ↑	
CONT	CLEAR DEFLT	CONT	PAGE

Performing Linework

The most important keys are explained.



ALL (F1)

To measure and store distances and angles.

STOP (F1)

Available if **<EDM Mode: Tracking>** and **DIST (F2)** was pressed. Stops the distance measurements. **(F1)** changes back to **ALL**.

DIST (F2)

To measure and display distances. Available unless **<EDM Mode: Tracking>** and/or **<Log Auto Pts: Yes>**, after the tracking or logging is started.

REC (F3)

To record data. If **<EDM Mode: Tracking>** and/or **<Log Auto Pts: Yes>**, records measured point and continues tracking.

Description of fields

Field	Option	Description
<Point ID:>	User input	The identifier for manually occupied points. The configured point ID template is used. The ID can be changed in the following ways: To start a new sequence of point ID's type over the point ID.

Field	Option	Description
		For an individual point ID independent of the ID template SHIFT INDIV (F5). SHIFT RUN (F5) changes back to the next ID from the configured ID template. Refer to "16.1 ID Templates".
<Linework:>	----- Begin Line 3pt Curve ReOpen Any Line	The linework flag to be stored with the point. The options available depend on whether a line/area is currently open. No linework flag is stored. Opens a new line when the next point is stored. Any line/area which is currently open is closed and the last point belonging to that line/area is given the End Line/Close Area linework flag. The point may or may not be stored with a point code. Stores the linework flag for a curve through the next three measured points and continues a line/area. Opens a line from a list of all lines which are currently stored in the job when the next point is stored. The last code used with the reopened line is automatically selected when the point is stored. Any line/area which is currently open is closed and the last point belonging to that line/area is given the End Line/Close Area linework flag.

Field	Option	Description
	ReOpen Last Line	Opens the last used line again. The last code used with the reopened line is automatically selected when the point is stored.
	End Line	Closes all open lines.
	Cont Line/Area	Indicates a line/area is open.
	Start Spline	Stores the linework flag for beginning a spline and continues any open line/area.
	End Spline	Closes a spline and continues any open line/area.
	Cont Spline	Indicates a line/area is open with spline line type.
	Begin Area	Opens a new area when the next point is stored. Any line/area which is currently open is closed and the last point belonging to that line/area is given the End Line/Close Area linework flag. The point may or may not be stored with a point code.
	ReOpen Any Area	Opens an area from a list of all lines which are currently stored in the job when the next point is stored. The last code used with the reopened area is automatically selected when the point is stored. Any line/area which is currently open is closed and the last point belonging to that line/area is given the End Line/Close Area linework flag.
	ReOpen Last Area	Opens the last used area again. The last code used with the reopened area is automatically selected when the point is stored.

Field	Option	Description
	Close Area	Closes all open areas.

Next step

Step	Description
1.	Go to the point to be measured.
2.	Select the appropriate Linework flag to be stored with the next point.
3.	ALL (F1)
4.	Repeat steps 1. to 3. until all points are measured and stored.
5.	SHIFT QUIT (F6) to exit the Survey application program.
6.	Use a format file to export the points including the linework flags.

Selecting a line with MapView

- Selecting a line in MapView is possible with either the softkeys or the touch screen.
- Refer to "35 MapView Interactive Display Feature" for further information.

Description

- Linework and coding can be combined.
- This combination can be useful, because coding, assigning linework flags and opening/closing lines/areas can all be done with one point observation.
- Combining Linework and coding can only be configured if thematical point codes or if thematical point, line and area codes are available for selection. Thematical coding can be done with or without codelists.



Linework and coding can also be combined using SmartCodes. Refer to "8.5.4 Using Smart-Codes".

Configuration options

- The configuration for the types of codes available and the configuration for coding with/without a codelist both have an influence on the following:
 - The required configuration of a display mask.
 - The behaviour of the fields configured for the display mask.
 - The behaviour of the software.
- The possible configurations and their influence are shown in this table:

Configuration in CONFIGURE Coding & Linework				
Show Codes	Only Pt Codes		All Codes	
Thematc Codes	With Codelist	Without Codelist	With Codelist	Without Codelist
Required fields and their appearance in display mask				
Code				
Required	✓	✓	✓	✓

Optional Appearance	- Choicelist	- User input	- Choicelist	- User input
Code Type				
Required	-	-	-	✓
Optional	✓	✓	✓	-
Appearance	Output	Output	Output	Choicelist
Linework				
Required	✓	✓	✓	✓
Optional	-	-	-	-
Appearance	Choicelist	Choicelist	Choicelist	Choicelist

Requirements

- A display mask must be configured with:
 - a field for codes.
 - a choicelist for Linework.
- The configuration of a field for code types in a display mask is required for working with point, line and area codes without choicelist. Else the configuration of a field for code types is optional.
- Configure in **CONFIGURE Coding & Linework, Coding**:
 - **<Show Codes: Only Pt Codes>** or **<Show Codes: All Codes>**.
 - **<Thematc Codes: With Codelist>** or **<Thematc Codes: Without Codelist>**.
- In **CONFIGURE Coding & Linework Settings, Linework** defines the flags for Linework.



Access step-by-step

The Survey application program is used here to explain the combination of Linework/Coding.

Step	Description
1.	Select Main Menu: Survey to access SURVEY Survey Begin .
2.	In SURVEY Survey Begin select a job.
3.	Select a configuration set.
4.	Select a reflector.
5.	CONT (F1) to access SURVEY Survey: Job Name .

Using Linework/Coding

This is what a display mask configured for Linework and coding looks like. The most important keys are explained. For the explanation of the other keys refer to "48.2 Surveying Points".

The screenshot shows the Survey application interface. At the top, there's a status bar with the time 13:27 and the word SURVEY. Below that is a toolbar with icons for IR, STD, and other functions. The main display area is titled "Survey: active job" and contains a table with columns for Survey, Offset, Code, Auto, and Map. The table has several rows of data: Point ID (0001), Code (c1), Code Type (Point), Linework (Begin Line), Horiz Dist (54.905 m), V (37.0007 g), and Reflector (Leica Circ Prism). At the bottom, there are several buttons: ALL, DIST, REC, SETAZ, and PAGE.

ALL (F1)

To measure and store distances and angles.

STOP (F1)

Available if **<EDM Mode: Tracking>** and **DIST (F2)** was pressed. Stops the distance measurements. **(F1)** changes back to **ALL**.

DIST (F2)

To measure and display distances. Available unless **<EDM Mode: Tracking>** and/or **<Log Auto Pts: Yes>**, after the tracking or logging is started.

REC (F3)

To record data. If **<EDM Mode: Tracking>** and/or **<Log Auto Pts: Yes>**, records measured point and continues tracking.

Using Linework/Coding for point codes step-by-step

For <Show Codes: Only Pt Codes>

Step	Field	Description for thematic coding	
		With codelist	Without codelist
1. 	<Code:>	Select a code from the choicelist. Only point codes are available for selection. <None> to store a point without code or to perform Linework without coding.	Type in a code. ----- to store a point without code or to perform Linework without coding.
2.	<Code Type:>	Point is displayed. This field is an output field only.	
3. 	<Linework:>	- Select a Linework flag to be stored with the point. - Select ----- to store a point without a Linework flag or to perform coding without Linework.	
4.	-	ALL (F1)	
	- - -	- The point is stored with the selected code. - The point is stored with the selected Linework flag. - The choice of flags available for <Linework:> is updated.	

Using Linework/Coding
for all codes
step-by-step

For <Show Codes: All Codes>

Step	Field	Description for thematic coding	
		With codelist	Without codelist
1. 	<Code:>	Select a code from the choicelist. Point, line and area codes are available for selection. <None> to store a point without code or to perform Linework without coding.	Type in a code. ----- to store a point without code or to perform Linework without coding.
2.	<Code Type:>	The type of the selected code. This field is an output field only.	Select the type of the entered code.
3. 	<Linework:>	- Select a Linework flag to be stored with the point. - Select ----- to store a point without a Linework flag or to perform coding without Linework.	
4. 	-	ALL (F1)	
	- - -	- For a point code being selected: - The point is stored with the selected code. - The point is stored with the selected Linework flag. - The choice of flags available for <Linework:> is updated.	

10.1

Overview

Using coordinate systems on TPS

Coordinate systems are used on TPS1200+/TS30/TM30 instruments to combine GPS1200+ data with TPS1200+/TS30/TM30 data.

Description

A coordinate system

- consists of up to five elements.
- allows the conversion from WGS 1984 geodetic or cartesian coordinates to local cartesian, geodetic or grid coordinates and back.
- can be attached to jobs.
- can be defined.
- can be computed in the field.
- can be downloaded to LGO.
- can be uploaded from LGO.



The geometric ppm and atmospheric ppm to reduce the raw distances measured with an EDM are completely independent from any coordinate system. An attached coordinate system is not used to reduce any measured distance on a TPS1200+/TS30/TM30 instrument.



Points surveyed with a TPS1200+/TS30/TM30 instrument are always stored in local GRID coordinates regardless of the coordinate system being used.

GPS surveyed points are always stored as WGS 1984 geodetic coordinates regardless of the coordinate system being used.

Using a different coordinate system converts the coordinates displayed on the screen, but does not convert and restore the coordinate values in the database DB-X.

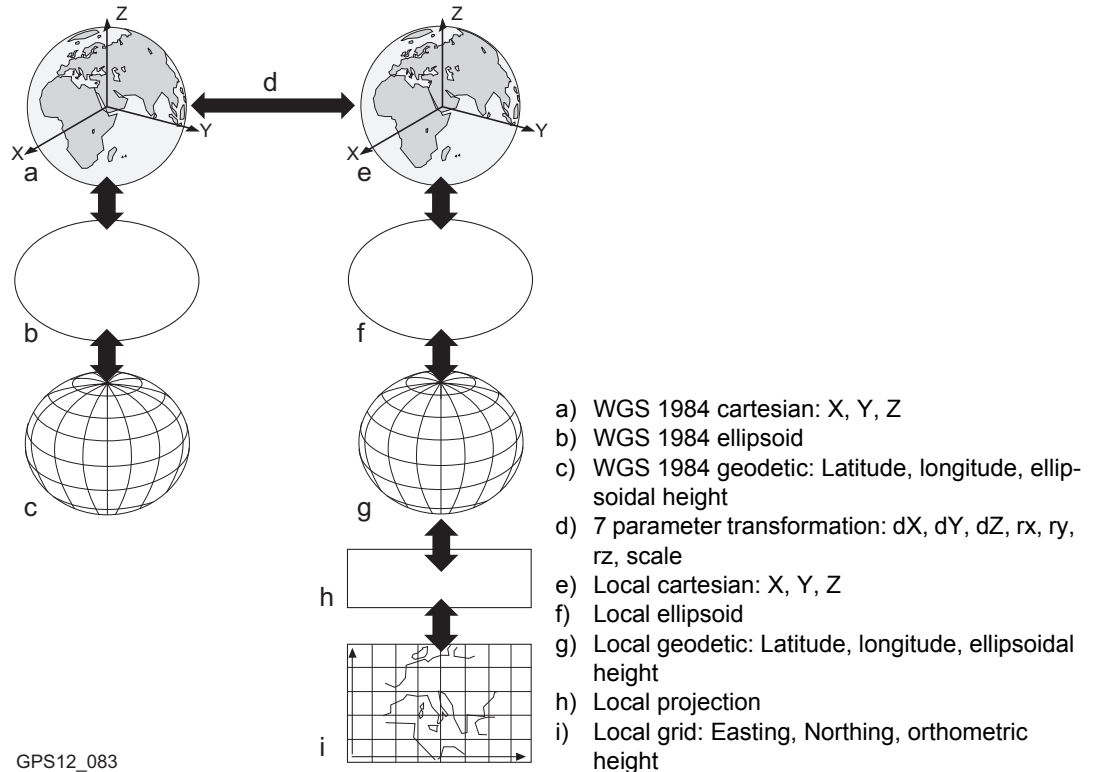


One coordinate system can be attached to a job at one time. This coordinate system remains attached to the job unless it is changed.

Elements of coordinate system

The five elements which define a coordinate system are:

- a transformation
- a projection
- an ellipsoid
- a geoid model
- a **C**ountry **S**pecific **C**oordinate **S**ystem model



GPS12_083

All these elements can be specified when creating a coordinate system.

Default coordinate systems	TPS1200+/TS30/TM30 and GPS1200+ have different default coordinate systems. They cannot be deleted. Additional default coordinate systems may be available for certain countries.
Coordinate system <None>	<None> is the default coordinate system on a TPS1200+/TS30/TM30 instrument. It is not possible to create a coordinate system called <None> .
Coordinate system WGS 1984	WGS 1984 is the global geocentric datum to which all GPS positioning information is referred to. WGS 1984 is the default coordinate system on a GPS1200+ receiver. It is not possible to create a coordinate system called WGS 1984 .
Active coordinate system	The active coordinate system is the one attached to the job currently being used. One coordinate system is always considered as the active coordinate system.
RTCM coordinate system	For <Use Auto CrdSys: Yes> configured in CONFIGURE Additional Rover Settings the coordinate system is directly received from the reference network. Refer to "22.1.2 Configuration of GGA Message Sending for Ref Network Applications". It is not possible to delete this coordinate system when it is active. Refer to "Active coordinate system".
Coordinate systems when transferring jobs between GPS and TPS	When transferring a job from TPS1200+/TS30/TM30 to GPS1200+, or vice-versa, the coordinate system stays attached to the job and appears like any other coordinate system on the instrument.

10.2

Terminology

Description

This chapter describes technical terms related to coordinate system management.

Transformation

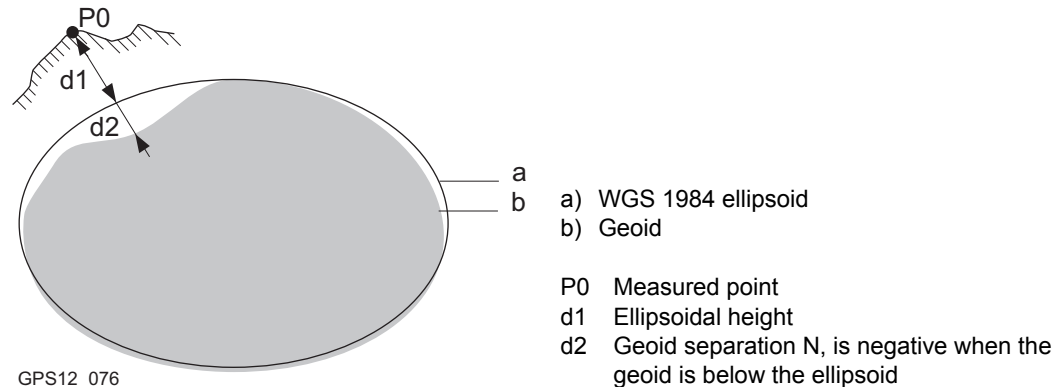
Refer to "38.1 Overview" for information on transformations.

Geoid model

Description

GPS operates on the WGS 1984 ellipsoid and all heights obtained by measuring baselines are ellipsoidal heights. Existing heights are usually orthometric heights, also called height above the geoid, height above mean sea level or leveled height. The mean sea level corresponds to a surface known as the geoid. The relation between ellipsoidal height and orthometric height is

$$\text{Orthometric Height} = \text{Ellipsoidal Height} - \text{Geoid Separation } N$$



N value and geoid model

The geoid separation (N value) is the distance between the geoid and the reference ellipsoid. It may refer to the WGS 1984 or to the local ellipsoid. It is not a constant except over maybe small flat areas such as 5 km x 5 km. Therefore it is necessary to model the N value in order to obtain accurate orthometric heights. The modelled N values form a geoid model for an area. With a geoid model attached to a coordinate system, N values for the measured points can be determined. Ellipsoidal heights can be converted to orthometric heights and back.

Refer to the online help of LGO for more information on geoid models.



Geoid models are an approximation of the N value. In terms of accuracy, they may vary considerably and global models in particular should be used with caution. If the accuracy of the geoid model is not known it might be safer to use local control points with orthometric heights and apply a transformation to approximate the local geoid.

Geoid field file

Geoid field files may be used in the field to calculate orthometric heights out of ellipsoidal heights and vice versa.

CSCS model

Description

Country Specific Coordinate System models

- are tables of correction values to directly convert coordinates from WGS 1984 to local grid without the need of transformation parameters.
- take the distortions of the mapping system into account.
- are an addition to an already defined coordinate system.

Types of CSCS models

The correction values of a CSCS model can be applied at different stages in the coordinate conversion process. Depending on this stage, a CSCS model works differently. Three types

of CSCS models are supported by TPS1200+/TS30/TM30. Their conversion process is as explained in the following table. Any suitable geoid model can be combined with a geodetic CSCS model. Refer to the online help of LGO for more information on CSCS models.

Type	Description
Grid	1. Determination of preliminary grid coordinates by applying the specified transformation, ellipsoid and map projection. 2. Determination of the final local grid coordinates by applying a shift in Easting and Northing interpolated in the grid file of the CSCS model.
Cartesian	1. Performing the specified transformation. 2. Determination of local cartesian coordinates by applying a 3D shift interpolated in the grid file of the CSCS model. 3. Determination of the final local grid coordinates by applying the specified local ellipsoid and map projection.
Geodetic	1. Determination of local geodetic coordinates by applying a correction in latitude and longitude interpolated from the file of the CSCS model. 2. Determination of the final local grid coordinates by applying the local map projection.  Using a geodetic CSCS model excludes the use of a transformation in a coordinate system.

CSCS field file

CSCS field files may be used in the field. They are extracted from the main CSCS model, which may be too big to fit on the instrument.

Access

Select **Main Menu: Manage...\Coordinate Systems**.

OR

Press a hot key configured to access the screen **MANAGE Coordinate Systems**. Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

OR

From a choicelist in some screens for example in **MANAGE New Job, Coord System** page.

OR

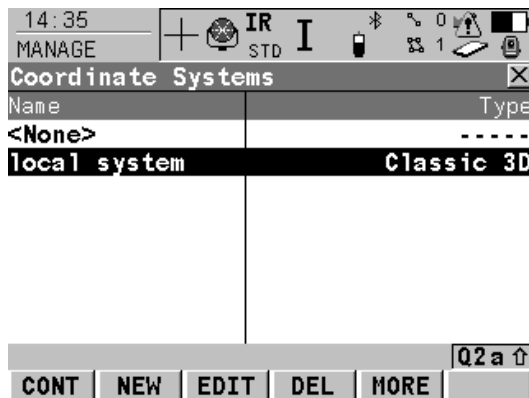
Press **CSYS (F6)** in some screens for example in **SURVEY Survey Begin**.



For **<Use Auto CrdSys: Yes>** configured in **CONFIGURE Additional Rover Settings** the coordinate system management can only be accessed by selecting **Main Menu: Manage...\Coordinate Systems**. Refer to "22.1.1 Configuration of Real-Time".

**MANAGE
Coordinate Systems**

Listed are all coordinate systems stored in the database DB-X. Any unavailable information is shown as -----.



CONT (F1)

To select the highlighted coordinate system and to return to the previous screen. With a CompactFlash card inserted, the selected coordinate system will be attached to the active job.

NEW (F2)

To create a coordinate system. Refer to "10.4.1 Creating a New Coordinate System".

EDIT (F3)

To edit the highlighted coordinate system. Refer to "10.4.2 Editing a Coordinate System".

DEL (F4)

To delete the highlighted coordinate system.

MORE (F5)

To display information about the type of transformation used, the type of heights computed, the number of control points used for the determination and the date of when the coordinate system was created.

SHIFT SET-D (F4)

Available unless a default coordinate system is highlighted. To turn the highlighted coordinate system into a user defined default coordinate system stored in the instrument.

SHIFT DEFLT (F5)

To recall the deleted default coordinate systems.

Next step

IF a coordinate system	THEN
is to be selected	highlight the desired coordinate system. CONT (F1) closes the screen and returns to the screen from where MANAGE Coordinate Systems was accessed.
is to be created	highlight any coordinate system and NEW (F2) . Refer to "10.4.1 Creating a New Coordinate System".
is to be edited	highlight the coordinate system and EDIT (F3) . Refer to "10.4.2 Editing a Coordinate System".

10.4

10.4.1



Access

Create a coordinate system step-by-step

Coordinate Systems
Creating a New Coordinate System

Coordinate systems can be defined by manual creation or determined by calculation. In this chapter, the manual creation of coordinate systems is explained. Refer to "38 Determine Coordinate System - General" for information on the determination by calculation.

Coordinate systems with a Classic 3D transformation can be defined by manual creation.

Refer to "10.3 Accessing Coordinate System Management" to access **MANAGE Coordinate Systems**.

The following table explains the most common settings.
Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	In MANAGE Coordinate Systems highlight a coordinate system. A copy of this coordinate system is taken for further configurations.	
2.	NEW (F2) to access MANAGE New Coordinate System .	
3.	MANAGE New Coordinate System <Name:> A unique name for the new coordinate system. The name may be up to 16 characters long and may include spaces.	

Step	Description	Refer to chapter
	<Residuals:> Available for transformations with control points. Entered transformations do not have control points. The method by which residuals are distributed throughout the transformation area. The transformation results become more realistic and any strain is dispersed in the transformation. <Residuals: 1/Dist>, <Residuals: 1/Dist^{2 and <Residuals: 1/Dist^{3/2 distribute the residuals of the control points according to the distance between each control point and the newly transformed point. <Residuals: Multiquadratic> distributes the residuals using a multiquadratic interpolation approach.}} <Transform:> The type of transformation. <Ellipsoid:> Available unless projection <Type: Customised>. The local coordinates are based on this ellipsoid. <Projection:> The map projection. <Geoid Model:> The geoid model. <CSCS Model:> The Country Specific Coordinate System model. Enter a name.	10.5 10.6 10.7 10.8 10.9
4.	STORE (F1) stores the new coordinate system and returns to MANAGE Coordinate Systems .	



The type of transformation of the selected coordinate system determines which elements of a coordinate system can be edited. The name of the coordinate system, the method of residual distribution and the geoid model in use are always editable.



For coordinate systems with source RTCM only the geoid model in use can be changed. Refer to "RTCM coordinate system".

Access

Refer to "10.3 Accessing Coordinate System Management" to access **MANAGE Coordinate Systems**.

Edit a coordinate system step-by-step

The following table explains the most common settings.
Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	In MANAGE Coordinate Systems highlight a coordinate system to be edited.	
2.	EDIT (F3) to access MANAGE Edit Coordinate System .	
3.	MANAGE Edit Coordinate System The transformation type of the selected coordinate system determines the availability and the options of the subsequent fields. Most fields are identical with those for the creation of a new coordinate system. An additional field is:	10.4.1

Step	Description	Refer to chapter
	<Pre Transform:> Available for Twostep transformations. The name of a preliminary 3D transformation which is used together with the selected projection to obtain preliminary grid coordinates to be used for a final 2D transformation. Make the required changes.	
4.	STORE (F1) stores the changes and returns to MANAGE Coordinate Systems.	

10.5

10.5.1



Access step-by-step

Transformations

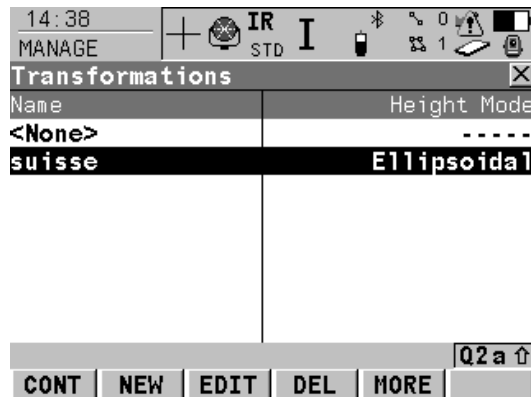
Accessing Transformation Management

MANAGE Transformations cannot be accessed for coordinate systems with source RTCM. Refer to "RTCM coordinate system".

Step	Description
1.	Refer to "10.3 Accessing Coordinate System Management" to access MANAGE Coordinate Systems .
2.	In MANAGE Coordinate Systems highlight a coordinate system to be edited.
3.	EDIT (F3) to access MANAGE Edit Coordinate System .
4.	In MANAGE Edit Coordinate System highlight <Transform:> .
5.	ENTER to access MANAGE Transformations .

MANAGE Transformations

Listed are all Classic 3D transformations stored in the database DB-X. Any unavailable information is shown as -----.



CONT (F1)

To select the highlighted transformation and to return to the previous screen.

NEW (F2)

To create a new transformation. Refer to "10.5.2 Creating a New Transformation".

EDIT (F3)

To edit the highlighted transformation. Refer to "10.5.3 Editing a Transformation".

DEL (F4)

To delete the highlighted transformation.

MORE (F5)

To display information about the type of heights computed and the number of control points used for the determination of the transformation.

SHIFT SET-D (F4)

To turn the highlighted transformation into a user defined default transformation stored in the instrument.

SHIFT DEFLT (F5)

To recall the deleted default transformations.

Next step

IF a transformation	THEN
is to be selected	highlight the desired transformation. CONT (F1) closes the screen and returns to the screen from where MANAGE Transformations was accessed.
is to be created	highlight any transformation and NEW (F2) . Refer to "10.5.2 Creating a New Transformation".
is to be edited	highlight the transformation and EDIT (F3) . Refer to "10.5.3 Editing a Transformation".

10.5.2

Creating a New Transformation



Access

Refer to "10.5.1 Accessing Transformation Management" to access **MANAGE Transformations**.

Create a transformation step-by-step

The following table explains the most common settings.

Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	In MANAGE Transformations highlight a transformation. A copy of this transformation is taken for further configurations.	
2.	NEW (F2) to access MANAGE New Transformation .	
3.	MANAGE New Transformation, General page <Name:> A unique name for the new transformation. The name may be up to 16 characters long and may include spaces. <Type:> Output field. No other transformations than Classic 3D can be created. Enter a name.	38.1
4.	PAGE (F6) changes to the Parameters page.	
5.	MANAGE New Transformation, Parameters page Enter the known values of the transformation parameters.	
6.	PAGE (F6) changes to the More page.	

Step	Description	Refer to chapter
7.	MANAGE New Transformation, More page <Height Mode:> The type of heights to be computed. <Transf Model:> The transformation model to be used. For <Transf Model: Molodensky-Bad> , additional input fields are available. Select at least a height mode and a transformation model.	
	CLEAR (F5) Available for <Transf Model: Molodensky-Bad> . To set the additional input fields to 0.	
8.	STORE (F1) stores the new transformation and returns to MANAGE Transformations .	

10.5.3

Editing a Transformation

Access step-by-step

Step	Description
	Transformations with source RTCM cannot be edited. Refer to "RTCM coordinate system".
1.	Refer to "10.5.1 Accessing Transformation Management" to access MANAGE Transformations .
2.	In MANAGE Transformations highlight a transformation to be edited.
3.	EDIT (F3) to access MANAGE Edit Transformation .
4.	All following steps are identical with the creation of a new transformation. <Height Mode:> in MANAGE Edit Transformation, More page cannot be changed. Refer to "10.5.2 Creating a New Transformation". Follow the instructions in paragraph "Create a transformation step-by-step" from step 3. onwards.

10.6

10.6.1



Access step-by-step

Ellipsoids

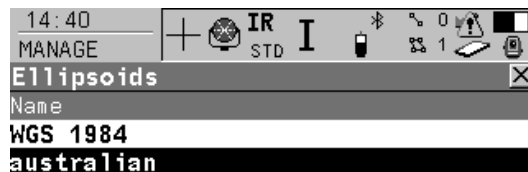
Accessing Ellipsoid Management

MANAGE Ellipsoids cannot be accessed for coordinate systems with source RTCM. Refer to "RTCM coordinate system".

Step	Description
1.	Refer to "10.3 Accessing Coordinate System Management" to access MANAGE Coordinate Systems .
2.	In MANAGE Coordinate Systems highlight a coordinate system to be edited.
3.	EDIT (F3) to access MANAGE Edit Coordinate System .
4.	In MANAGE Edit Coordinate System highlight <Ellipsoid:> .
5.	ENTER to access MANAGE Ellipsoids .

MANAGE Ellipsoids

Listed are all ellipsoids stored in the database DB-X.



CONT (F1)

To select the highlighted ellipsoid and to return to the previous screen.

NEW (F2)

To create a new ellipsoid. Refer to "10.6.2 Creating a New Ellipsoid".

EDIT (F3)

To edit the highlighted ellipsoid. Refer to "10.6.3 Editing an Ellipsoid".

DEL (F4)

To delete the highlighted ellipsoid.

SHIFT SET-D (F4)

To turn the highlighted ellipsoid into a user defined default ellipsoid stored in the instrument.

SHIFT DEFLT (F5)

To recall the deleted default ellipsoids.

Next step

IF an ellipsoid	THEN
is to be selected	highlight the desired ellipsoid. CONT (F1) closes the screen and returns to the screen from where MANAGE Ellipsoids was accessed.
is to be created	highlight any ellipsoid and NEW (F2) . Refer to "10.6.2 Creating a New Ellipsoid".
is to be edited	highlight the ellipsoid and EDIT (F3) . Refer to "10.6.3 Editing an Ellipsoid".

10.6.2

Creating a New Ellipsoid

Access

Refer to "10.6.1 Accessing Ellipsoid Management" to access **MANAGE Ellipsoids**.

Create an ellipsoid
step-by-step

The following table explains the most common settings.
Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	In MANAGE Ellipsoids highlight an ellipsoid. A copy of this ellipsoid is taken for further configurations.	
2.	NEW (F2) to access MANAGE New Ellipsoid .	
3.	MANAGE New Ellipsoid <Name:> A unique name for the new ellipsoid. A name is mandatory and may be up to 16 characters long and may include spaces. <Axis a:> The semi-major axis a. <1/f:> The reciprocal value of flattening f. Enter a name.	
4.	STORE (F1) stores the new ellipsoid and returns to MANAGE Ellipsoids .	

10.6.3

Editing an Ellipsoid

Access step-by-step

Step	Description
1.	Refer to "10.6.1 Accessing Ellipsoid Management" to access MANAGE Ellipsoids .
2.	In MANAGE Ellipsoids highlight an ellipsoid to be edited.
3.	EDIT (F3) to access MANAGE Edit Ellipsoid .
4.	All following steps are identical with the creation of a new ellipsoid. Refer to "10.6.2 Creating a New Ellipsoid". Follow the instructions in paragraph "Create an ellipsoid step-by-step" from step 3. onwards.

10.7

10.7.1



Access step-by-step

Projections

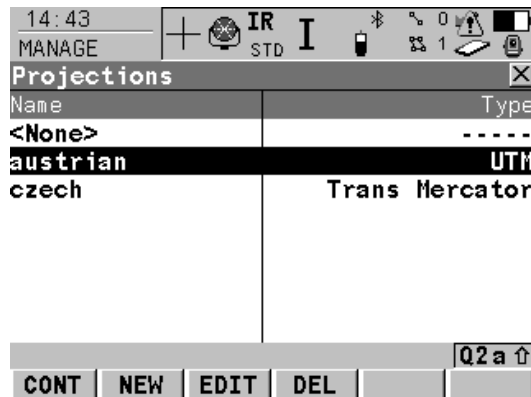
Accessing Projection Management

MANAGE Projections cannot be accessed for coordinate systems with source RTCM. Refer to "RTCM coordinate system".

Step	Description
1.	Refer to "10.3 Accessing Coordinate System Management" to access MANAGE Coordinate Systems .
2.	In MANAGE Coordinate Systems highlight a coordinate system to be edited.
3.	EDIT (F3) to access MANAGE Edit Coordinate System .
4.	In MANAGE Edit Coordinate System highlight <Projection:> .
5.	ENTER to access MANAGE Projections .

MANAGE Projections

Listed are all projections stored in the database DB-X. Any unavailable information is shown as -----.



CONT (F1)

To select the highlighted projection and to return to the previous screen.

NEW (F2)

To create a new projection. Refer to "10.7.2 Creating a New Projection".

EDIT (F3)

To edit the highlighted projection. Refer to "10.7.3 Editing a Projection".

DEL (F4)

To delete the highlighted projection.

SHIFT SET-D (F4)

Available unless a default projection is highlighted. To turn the highlighted projection into a user defined default projection stored in the instrument.

SHIFT DEFLT (F5)

To recall the deleted default projections.

Description of columns

Column	Option	Description
Type		The projection type. Refer to standard surveying literature for details on projections.

Column	Option	Description
	Customised	Customised projection. Certain hard wired projections which cannot be defined by any of the following options.
	Trans Mercator	Transverse Mercator. Conformal projection onto a cylinder with its axis lying on the equatorial plane. The cylinder is tangential to a meridian.
	UTM	Universal Transverse Mercator. Transverse Mercator projection with fixed zone-defining constants. The central meridian is selected automatically according to the selected zone number.
	Oblq Mercator	Oblique Mercator. Oblique Mercator Conformal projection onto a cylinder. The cylinder is tangent to any circle other than the equator or a meridian.
	Mercator	Mercator. Conformal projection onto a cylinder with its axis lying on a meridian plane. The cylinder is tangent to the sphere along the equator.
	Lambert 1 Para	Lambert 1 Parallel. Conformal projection onto a cone, with its axis coinciding with the z-axis of the ellipsoid.
	Lambert 2 Para	Lambert 2 Parallel. Conformal projection onto a cone, with its axis coinciding with the z-axis of the ellipsoid. The cone is secant to the sphere.

Column	Option	Description
	Cassini-Soldn	Soldner Cassini. Projection onto a cylinder. It is neither equal area nor conformal. The scale is true along the central meridian and along lines perpendicular to central meridian.
	Polar Stereo	Polar Stereographic. Conformal azimuthal projection onto a plane. The point of projection is on the surface of the ellipsoid diametrically opposite of the origin which is the centre of the projection.
	Double Stereo	Double Stereographic. Conformal azimuthal projection onto a plane. The point of projection is on the surface of the sphere diametrically opposite of the centre of the projection.
	RSO	Rectified Skewed Orthomorphic. This is a special type of Oblique Mercator projection.

Next step

IF a projection	THEN
is to be selected	highlight the desired projection. CONT (F1) closes the screen and returns to the screen from where MANAGE Projections was accessed.
is to be created	highlight any projection and NEW (F2) . Refer to "10.7.2 Creating a New Projection".

IF a projection	THEN
is to be edited	highlight the projection and EDIT (F3) . Refer to "10.7.3 Editing a Projection".

10.7.2

Creating a New Projection

Access

Refer to "10.7.1 Accessing Projection Management" to access **MANAGE Projections**.

Create a projection
step-by-step

The following table explains the most common settings.
Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	In MANAGE Projections highlight a projection. A copy of this projection is taken for further configurations.	
2.	NEW (F2) to access MANAGE New Projection .	
3.	MANAGE New Projection <Name:> A unique name for the new projection. A name is mandatory and may be up to 16 characters long and may include spaces. <Type:> The projection type. The setting for <Type:> determines the availability of the subsequent fields for the parameters of the projection. Enter a name.	10.7.1
4.	STORE (F1) stores the new projection and returns to MANAGE Projections .	

10.7.3

Editing a Projection

Access step-by-step

Step	Description
	Projections with source RTCM cannot be edited. Refer to "RTCM coordinate system".
1.	Refer to "10.7.1 Accessing Projection Management" to access MANAGE Projections .
2.	In MANAGE Projections highlight a projection to be edited.
3.	EDIT (F3) to access MANAGE Edit Projection .
4.	All following steps are identical with the creation of a new projection. <Type> in MANAGE Edit Projection cannot be changed. Refer to "10.7.2 Creating a New Projection". Follow the instructions in paragraph "Create a projection step-by-step" from step 3. onwards.

10.8

10.8.1

Geoid Models

Overview

Use in the field

For use on the instrument in the field, geoid field files are created from the geoid model.

Geoid field file

The geoid separations in a geoid field file may be used in the field to change between ellipsoidal and orthometric heights.

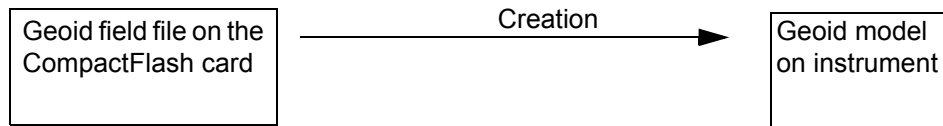
Creation: In LGO with export onto a CompactFlash card or the internal memory of the instrument.

Extension: *.gem

Create geoid models on the instrument

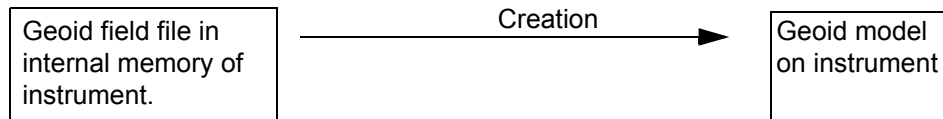
Geoid models can be created on the instrument in one of three ways:

1.



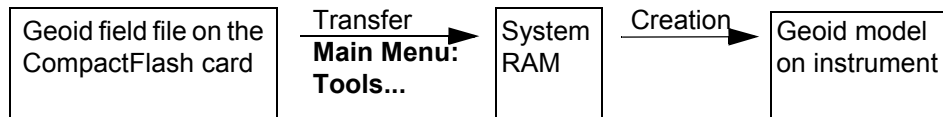
Here the geoid field file is stored on a CompactFlash card and can be used when the CompactFlash card is inserted in the instrument. It is recommended for large geoid field files. This method is explained in this chapter.

2.



Here the geoid field file is stored in the internal memory of the instrument. It is recommended for large geoid field files. This method is also explained in this chapter.

3.



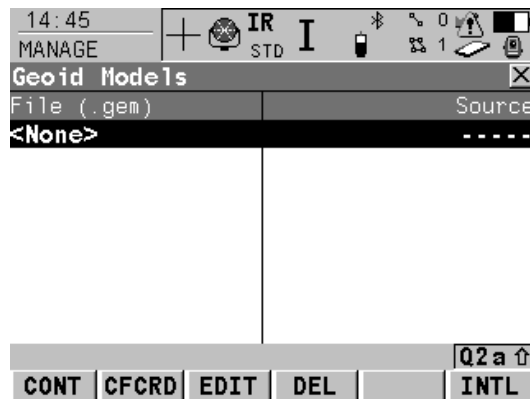
Here the geoid field file is transferred to the System RAM and can be used at any time. The total size of all files is restricted to 1 MB. Refer to "24 Tools...\Transfer Objects..." for information on how to transfer geoid field files to the System RAM on the instrument.

Access step-by-step

Step	Description
1.	Refer to "10.3 Accessing Coordinate System Management" to access MANAGE Coordinate Systems .
2.	In MANAGE Coordinate Systems highlight a coordinate system to be edited.
3.	EDIT (F3) to access MANAGE Edit Coordinate System .
4.	In MANAGE Edit Coordinate System highlight <Geoid Model:> .
5.	ENTER to access MANAGE Geoid Models .

**MANAGE
Geoid Models**

Listed are all geoid models stored in the database DB-X. Any unavailable information is shown as -----, for example if the geoid field file which was associated to the geoid model is not available on the CompactFlash card / internal memory.

**CONT (F1)**

To select the highlighted geoid model and to return to the previous screen.

CFCRD (F2)

To create a new geoid model. The \DATA\GPS\GEOID directory on the CompactFlash card is automatically scanned for geoid field files. Refer to "10.8.3 Creating a New Geoid Model from the CompactFlash Card / Internal Memory".

EDIT (F3)

To view the highlighted geoid model. None of the fields can be edited. The geoid field file from which the geoid model was created must be stored in the System RAM or in the \DATA\GPS\GEOID directory on the Compact-Flash card / internal memory.

DEL (F4)

To delete the highlighted geoid model. The geoid field file which was associated with this geoid model is then also deleted.

INTL (F6)

To create a new geoid model. The \DATA\GPS\GEOID directory of the internal memory is automatically scanned for geoid field files. Refer to "10.8.3 Creating a New Geoid Model from the CompactFlash Card / Internal Memory".

Next step

IF a geoid model	THEN
is to be selected	highlight the desired geoid model. CONT (F1) closes the screen and returns to the screen from where MANAGE Geoid Models was accessed.
is to be created	CFCRD (F2) . Refer to "10.8.3 Creating a New Geoid Model from the CompactFlash Card / Internal Memory".

10.8.3

Creating a New Geoid Model from the CompactFlash Card / Internal Memory



Refer to "24 Tools...\Transfer Objects..." for information on how to transfer geoid field files to the System RAM on the instrument.

Requirement

At least one geoid field file with the extension *.gem is in the \DATA\GPS\GEOID directory on the CompactFlash card / internal memory. Refer to "10.2 Terminology" for information on geoid field files.

Create geoid model step-by-step

Step	Description
1.	Refer to "10.8.2 Accessing Geoid Model Management" to access MANAGE Geoid Models .
2.	CFCRD (F2) to scan the \DATA\GPS\GEOID directory on the CompactFlash card. OR INTL (F6) to scan the \DATA\GPS\GEOID directory of the internal memory.
3.	For each geoid field file on the CompactFlash card or in the internal memory, one geoid model is automatically created. The names given to the geoid models are those which were entered in LGO.  Existing geoid models are automatically overwritten by new models with the same name.
4.	The creation of a geoid model is finished.

10.9

CSCS Models

Use in the field

For use on the instrument in the field, CSCS field files are created from the CSCS model.

CSCS field file

CSCS field files may be used in the field to directly convert coordinates from WGS 1984 to local grid without the need of transformation parameters.

Creation: In LGO with export onto a CompactFlash card or the internal memory of the instrument.

Extension: *.csc



The creation of CSCS models on the instrument and the functionality of all screens and fields are similar to those for geoid models. Refer to "10.8 Geoid Models".

The directory on the CompactFlash card / internal memory for CSCS field files with the extension *.csc is \DATA\GPS\CSCS.

11.1

Overview

Description

The instrument has numerous user configurable parameters and functions. This allows a variety of preferences to be addressed. The configuration of the parameters and functions for an individual measuring technique are combined in a configuration set.

Default configuration sets

Default configuration sets exist on the instrument. They use standard settings for the majority of application programs. Default configuration sets can be edited and deleted. It is always possible to restore the default configuration sets.

User defined configuration sets

New configuration sets can be created. The configuration set wizard assists in editing configuration sets.

Edit outside the configuration set wizard

Parameters and functions can be edited without going through the configuration set wizard. Refer to "11.4 Editing a Configuration Set" for more information.



Each application program can be configured separately. Application program settings are configured in the application program but are stored as part of the configuration set. Refer to "36 Application Programs - General".

11.2

Accessing Configuration Set Management

Access

Select **Main Menu: Manage...Configuration Sets**.

OR

Press a hot key configured to access the screen **MANAGE Configuration Sets**. Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

OR

From a choicelist in some screens for example the begin screen of application programs.

MANAGE Configuration Sets

17:12
MANAGE



IR
STD






Configuration Sets

Name	Description
TCRP	Default
TCRP RCS RH1200	Default
TCRP RCS TCPS27	Default
TCRP SmrtStn	Default
TPS RX1250 Cable	Default
TPS RX1250 Robot	Default

CONT

NEW

EDIT

DEL

MORE

a ↑

CONT (F1)

To select the highlighted configuration set and to return to **TPS1200+/TS30/TM30 Main Menu**.

NEW (F2)

To create a new configuration set. Refer to "11.3 Creating a New Configuration Set".

EDIT (F3)

To edit a configuration set. Accesses the first screen of the sequential configuration set wizard for the highlighted configuration set. Default configuration sets can be edited. Refer to "11.4 Editing a Configuration Set".

DEL (F4)

To delete the highlighted configuration set.

MORE (F5)

To display information about the description, the creator and the creation date of the configuration set.

SHIFT SET-D (F4)

Available unless a default configuration set is highlighted. To turn the highlighted configuration sets into a user defined default configuration set stored in the instrument.

SHIFT DEFLT (F5)

To recall previously deleted default configuration sets and to reset default configuration sets to the default settings. User defined configuration sets are not affected.

Next step

IF a configuration set	THEN
is to be selected	select the desired configuration set. CONT (F1) to close the screen and to return to the screen from where MANAGE Configuration Sets was accessed.
is to be created	highlight any configuration set and NEW (F2) . Refer to "11.3 Creating a New Configuration Set".
is to be edited	highlight the configuration set and EDIT (F3) . Refer to "11.4 Editing a Configuration Set".

Access

Refer to "11.2 Accessing Configuration Set Management" to access **MANAGE Configuration Sets**.

Configuration step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	In MANAGE Configuration Sets highlight a configuration set. A copy of this configuration set is taken for further configurations. Example: Select DEFAULT for the creation of a new configuration set.	11.2
2.	NEW (F2) to access MANAGE New Configuration Set . A copy of the highlighted configuration set is created.	
3.	MANAGE New Configuration Set <Name:> A unique name for the new configuration set. <Description:> A detailed description of the configuration set, since the name of a configuration set is usually an abbreviation. Input optional. <Creator:> The person's name who creates the new configuration set. Input optional. Enter a name.	
4.	STORE (F1) stores the new configuration set with the entered name. Starts the sequential configuration set wizard.	

Step	Description	Refer to chapter
5.	CONFIGURE Wizard Mode <Wizard Mode: Reduced>	18.1
	LIST (F6) accesses CONFIGURE Quick Access . Lists all screens within the configuration set. Allows to access these individual screens and to change settings.	
6.	CONT (F1) to access CONFIGURE Coding Settings .	
7.	CONFIGURE Coding Settings	16.3
8.	CONT (F1) to access CONFIGURE TPS Correction .	
9.	CONFIGURE TPS Corrections Configure atmospheric ppm, geometric ppm and refraction.	17.4
10.	CONT (F1) to access CONFIGURE EDM & ATR Settings .	
11.	CONFIGURE EDM & ATR Settings	17.1
12.	CONT (F1) to access CONFIGURE Offsets .	
13.	CONFIGURE Offsets	16.4
14.	CONT (F1) to access MANAGE Configuration Sets .	
15.	MANAGE Configuration Sets The adapted configuration set is highlighted.	
16.	CONT (F1) closes the screen and returns to TPS1200+/TS30/TM30 Main Menu . The highlighted configuration set is then the active configuration set.	

Description

There are two possibilities to edit a configuration set.

Using the **configuration set wizard** to be lead through the steps.

OR

Outside of the **configuration set wizard**. Each screen can be accessed separately without being guided through the steps.

Access step-by-step with using configuration set wizard

Step	Description
1.	Refer to "11.2 Accessing Configuration Set Management" to access MANAGE Configuration Sets .
2.	In MANAGE Configuration Sets highlight a configuration set to be edited.
3.	EDIT (F3) to access CONFIGURE Wizard Mode . This starts the sequential configuration set wizard.
4.	All following steps are identical with the creation of a new configuration set. Refer to "11.3 Creating a New Configuration Set". Follow the instructions in paragraph "Configuration step-by-step" from step 5. onwards.

Access without using the configuration set wizard

The currently active configuration set can be edited. Choose one of the following options and access the required screens to edit the configuration set.

Select **Main Menu: Config....** Refer to "4 Main Menu".

OR

From inside an application program press **USER** and then **CONF (F2)**.

OR

In **CONFIGURE Wizard Mode**, press **LIST (F6)**. Refer to "11.3 Creating a New Configuration Set".

12.1

Overview

Description

- Each reflector type has an additive constant.
- Leica Geosystems reflectors are predefined as default and can be selected.
- Additional reflectors can be defined.

Default reflectors

Following default reflectors are always available on the instrument:

Product Name	Name in list	Type	Additive Constant
GRZ4, GRZ122	Leica 360° Prism	Prism	+23.1 mm
GPR1, GPR111, GPR113, GPR121, GPH1P	Leica Circ Prism	Prism	0.0 mm
GMP111-0	Leica Mini 0	Prism	0.0 mm
GRZ101	Leica Mini 360°	Prism	+30.0 mm
GMP101, GMP111	Leica Mini Prism	Prism	+17.5 mm
GZM29, GZM30, GZM31, CPR105	Leica RefiTape	Tape	+34.4 mm
-	Reflectorless	RL	+34.4 mm
MPR122  For Machine Control purposes only!	MA Power Prism	Prism	+28.1 mm

Active reflector

One reflector is always the active reflector.

12.2

Accessing Reflector Management

Access

Select **Main Menu: Manage... \ Reflectors**.

OR

Press a hot key configured to access the screen **MANAGE Reflectors**. Refer to "2.1 Hot Keys" for information on hot keys.

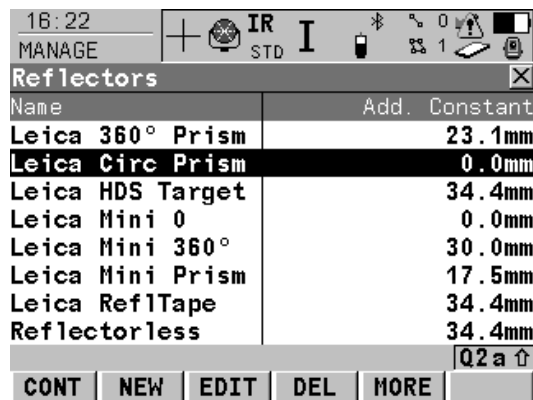
OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

OR

From a choicelist in some screens for example the **SURVEY Survey Begin** screen.

MANAGE Reflectors



Name	Add.	Constant
Leica 360° Prism		23.1mm
Leica Circ Prism		0.0mm
Leica HDS Target		34.4mm
Leica Mini 0		0.0mm
Leica Mini 360°		30.0mm
Leica Mini Prism		17.5mm
Leica ReflTape		34.4mm
Reflectorless		34.4mm

Q2 a ↑

CONT NEW EDIT DEL MORE

CONT (F1)

To select the highlighted reflector and to return to the previous screen.

NEW (F2)

To define a new reflector. Refer to "12.3 Creating a New Reflector".

EDIT (F3)

To edit the highlighted reflector, except for default reflectors. Refer to "12.4 Editing a Reflector".

DEL (F4)

To delete the highlighted reflector, except for default reflectors.

MORE (F5)

To display information about the additive constant, the reflector type and the creator of the reflector.

Next step

IF a reflector	THEN
is to be selected	highlight the desired reflector. CONT (F1) closes the screen and returns to the screen from where MANAGE Reflectors was accessed.
is to be created	highlight any reflector and NEW (F2) creates a new reflector. Refer to "12.3 Creating a New Reflector".
is to be edited	highlight the desired reflector. EDIT (F3) Refer to "12.4 Editing a Reflector".

12.3

Creating a New Reflector

Access

Refer to "12.2 Accessing Reflector Management" to access **MANAGE Reflectors**.

Create new reflector step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description
1.	In MANAGE Reflectors press
2.	NEW (F2) The <Type:> of the new reflector is taken from the previously high-lighted reflector except for RL reflectors.
3.	MANAGE New Reflector <Name:> A significant name for the new reflector. <Type:> The type of reflector to be defined can be <Type: Prism> , <Type: Tape> or <Type: Undefined> . <Add. Constant:> The additive constant is always in [mm].  An additive constant of 0.0 mm has been defined for the Leica Geosystems standard reflectors GPR1, GPR111, etc. All entered or selected additive constant values are differences to this 0.0 mm based Leica Geosystems TPS prism system.

Step	Description
	 The additive constants of non Leica Geosystems prisms are often given in the true zero prism system. Use the following formula to convert the additive constant to the Leica Geosystems TPS prism system. This Leica constant needs to be entered into the Leica instrument. Formula: True zero constant - 34.4 mm = Leica constant. It is highly recommended to check the additive constant for non Leica Geosystems prisms on a baseline by means of an appropriate procedure. <Creator:> A name of the creator or other comments can be entered.
4.	STORE (F1) stores the new reflector and returns to MANAGE Reflectors .

12.4

Editing a Reflector

Access

Refer to "12.2 Accessing Reflector Management" to access **MANAGE Reflectors**.

Edit reflector step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	In MANAGE Reflectors highlight a reflector to be edited.	
2.	EDIT (F3) to access MANAGE Edit Reflector .	
3.	MANAGE Edit Reflector The fields are identical with those for the creation of a new reflector. All fields can be edited except fields of Leica default reflectors. Make the required changes.	12.3
4.	STORE (F1) stores the changes and returns to MANAGE Reflectors .	

13.1

Overview

Description

This screen lists all the exporters loaded.

Data can be exported

- to a file on the CompactFlash card.
- to a file on the internal memory if fitted.
- via RS232 to an external device. Refer to "20 Config...\Interfaces... - Editing The Interface" for information on how to configure the interface.

Export format

Format	Characteristic	Description
Custom ASCII	Export variables	Refer to the online help of LGO.
	Format definition	Composed individually as format file using LGO. Refer to the online help of LGO for information on creating format files.
	Units	Defined within the format file.
	Coordinate conversion	All coordinate types are supported.
	Height	All height types are supported. If the desired height cannot be computed, the default value for the missing variable is output.

Format	Characteristic	Description
	Specialities: Points in file outside of CSCS model Points in file outside of geoid model	The default value for missing variable is output. The default value for missing variable is output, also if a geoid separation is available.
DXF	Coordinate conversion Height Specialities: Points in file outside of CSCS model Points in file outside of geoid model	All points are converted to local grid position using the coordinate system. Orthometric height and ellipsoidal height are supported. Points outside of CSCS model are not exported. The ellipsoidal height is exported.
LandXML	Coordinate conversion Height Specialities: Points in file outside of CSCS model	All points are converted to local grid position using the coordinate system. Orthometric height and ellipsoidal height are supported. Local grid position of the points outside of CSCS model is not exported.

Format	Characteristic	Description
	Points in file outside of geoid model	The ellipsoidal height is exported.

13.2

Accessing the Data Export Functionality

Access

Select **Main Menu: Convert...\Export Data from Job.**

OR

Press a hot key configured to access the screen **EXPORT Export Data from Job.**

Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

Next step

IF exporting to	THEN
custom ASCII format	Refer to "13.3 Exporting Data from a Job to a Custom ASCII Format".
another device	Refer to "13.4 Exporting Data from a Job to another Device".
DXF format	Refer to "13.5 Exporting Data in DXF Format".
LandXML format	Refer to "13.6 Exporting Data in LandXML Format".

13.3

Exporting Data from a Job to a Custom ASCII Format

Description

The settings on this screen define the data that is converted and exported and what format is used.

Data is exported from the selected job. Currently active view, filter and sort settings are applied. The points that are exported are those that are visible in **MANAGE Data: Job Name**.

Requirement

At least one format file was created using LGO and has been transferred to the System RAM.

Access

Refer to "13.2 Accessing the Data Export Functionality" to access **EXPORT Export ASCII from Job**.

Export data step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	EXPORT Export ASCII from Job <Export To: CF Card> or <Export To: Internal Memory> <Directory:> Available for <Export To: CF Card> . The data can be exported to the \Data, the \GSI or the root directory. Data must be stored to the \GSI directory in order to read it in a TPS1100. For <Export To: Internal Memory> , the data is always exported to the \Data directory. <Job:> All jobs from Main Menu: Manage...\Jobs can be selected. When in this choicelist press CFCRD (F6) or INTL (F6) to select a job from a different memory device.	5

Step	Description	Refer to chapter
	<Coord System:> The coordinate system currently attached to the selected <Job:>. <Format File:> The format files currently available in the System RAM. <File Name:> The name of the file to which the data should be exported. The name is automatically suggested based on the job name to be exported and an extension. The default extension to be used can be configured in the EXPORT Define ASCII Export panel using CONF (F2). Select the job to be exported and enter an individual file name or accept the suggested name.	
2.	Highlight <Format File:> and ENTER .	
3.	EXPORT Format Files All format files available in the System RAM are listed. Select the format file to be used.	
 4.	DEL (F4) deletes the highlighted format file from the System RAM.	
4.	CONT (F1) selects the highlighted format file and leads back to EXPORT Export ASCII from Job .	
5.	FILT (F4) to set the sort and filter settings for export. Accesses EXPORT Sorts & Filters .	
6.	EXPORT Sorts & Filters, Points page <Sort:> The order in which points, lines and areas are exported.	6.6

Step	Description	Refer to chapter
	<Filter:> Defines which points are exported.	
	PAGE (F6) changes to the Lines or Areas page. The setting for <Filter:> on these pages defines which lines or areas are exported.	
7.	CONT (F1) accepts the changes and returns to EXPORT Export ASCII from Job .	
	CSYS (F6) accesses EXPORT Coordinate Systems . To update the coordinate system in which the coordinates are exported.	10.3
8.	CONT (F1) exports the data.	
9.	Information message: Are more data to be exported? • If yes, continue with step 10. • If no, continue with step 11.	
10.	YES (F4) . Repeat steps 1. to 9.	
11.	NO (F6) returns to the TPS1200+/TS30/TM30 Main Menu .	

13.4

Exporting Data from a Job to another Device

General

Data can be transferred to an external device via RS232.

Access

Refer to "13.2 Accessing the Data Export Functionality" to access **EXPORT Export ASCII from Job**.

Export data step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	EXPORT Export ASCII from Job <Export To: RS232>	13.1
	IFACE (F5) accesses CONFIGURE Export Job Interface . Choose the port and device to which the data should be exported.	
2.	FILT (F4) to set the sort and filter settings for the export. Accesses EXPORT Sorts & Filters .	
3.	EXPORT Sorts & Filters, Points page <Sort:> The order in which points, lines and areas are exported. <Filter:> Defines which points are exported.	6.6
	PAGE (F6) changes to the Lines and Areas page. The setting for <Filter:> on these pages defines which lines or areas are exported.	
4.	CONT (F1) accepts the changes and returns to EXPORT Export ASCII from Job .	

Step	Description	Refer to chapter
	CSYS (F6) accesses EXPORT Coordinate Systems . To update the coordinate system in which the coordinates are exported.	10.3
5.	CONT (F1) exports the data.	
6.	Information message: Are more data to be exported? • If yes, continue with step 7. • If no, continue with step 8.	
7.	YES (F4) . Repeat the steps 1. to 6.	
8.	NO (F6) returns to the TPS1200+/TS30/TM30 Main Menu .	

13.5

Exporting Data in DXF Format

General

Data can be exported to a DXF file in the \DATA directory of the CompactFlash card or the internal memory, if fitted.

Access

Refer to "13.2 Accessing the Data Export Functionality" to access **EXPORT Export DXF from Job**.

Export data step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description
1.	EXPORT Export DXF from Job <Job:> All jobs from Main Menu: Manage...\Jobs can be selected. When in this choicelist press CFCRD (F6) or INTL (F6) to select a job from a different memory device. <Coord System:> The coordinate system currently attached to the selected <Job:>. <File name:> The name of the file to which the data should be exported. The name is automatically suggested based on the job name to be exported and the extension dxf. Select the job to be exported and enter an individual file name or accept the suggested name.
	CONF (F2) accesses Configuration, Export page. <Points:> Defines if points are exported. <Lines:> Defines if lines are exported.

Step	Description
	<Areas:> Defines if areas are exported. <Filter:> Defines which points are exported. PAGE (F6) changes to the DXF page. <Lines & Areas:> Defines if lines and areas are exported as Line or Polyline entities. <LGO Symbols:> Defines if a block is created for each point with the same icons used in LGO. <Symbol Size:> Defines the size used for creation of the LGO symbols. <Dimensions:> Defines the dimension of the DXF file. <DXF Layer:> Defines the DXF Layer as <Default>, <Code Group>, <Code>, <Code+Attri> or <Code+Descr+Attri>.
	PAGE (F6) changes to the Labels page. The settings on this page define which labels with information (Point ID, Coords, Height and Pt Code) for each point are exported. Each label can be exported as separate layer or in the same layer as the point is exported. For each label the color can be defined and for user defined labels the DXF layer name can also be defined. Additionally the decimals can be defined for the Coords and Height label.
2.	CONT (F1) accepts the changes and returns to EXPORT Export DXF from Job .
3.	CONT (F1) exports the data.
	Message: Do not remove CF Card!
4.	Information message: Are more data to be exported? If yes , continue with step 5.

Step	Description
	If no , continue with step 6.
5.	YES (F6) . Repeat steps 1. to 4.
6.	NO (F4) returns to the TPS1200+/TS30/TM30 Main Menu .

13.6

Exporting Data in LandXML Format

General

Data can be exported to a LandXML file in the \DATA directory of the CompactFlash card or the internal memory, if fitted.

Access

Refer to "13.2 Accessing the Data Export Functionality" to access **EXPORT Export LandXML from Job**.

Export data step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description
1.	EXPORT Export LandXML from Job <Job:> All jobs from Main Menu: Manage...\Jobs can be selected. When in this choicelist press CFCRD (F6) or INTL (F6) to select a job from a different memory device. <Coord System:> The coordinate system currently attached to the selected <Job:>. <File name:> The name of the file to which the data should be exported. The name is automatically suggested based on the job name to be exported and the extension xml. Select the job to be exported and enter an individual file name or accept the suggested name.
	CONF (F2) accesses Configuration, Export page. <Points:> Defines if points are exported. <Lines:> Defines if lines are exported.

Step	Description
	<Areas:> Defines if areas are exported. <TPS Measurements:> Defines if TPS observations are exported. <GPS Measurements:> Defines if GPS observations are exported. <Codes:> Defines if point codes, line codes and area codes are exported. <Free Codes:> Defines if the free code, the free code description, the free code group and the free code attributes are exported to the LandXML file associated to each exported point.
2.	FILT (F4) to set the sort and filter settings for export. Accesses EXPORT Sorts & Filters .
3.	EXPORT Sorts & Filters, Points page <Sort:> The order in which points, lines and areas are exported. <Filter:> Defines which points are exported.
	PAGE (F6) changes to the Lines or Areas page. The setting for <Filter:> on these pages defines which lines or areas are exported.
4.	CONT (F1) accepts the changes and returns to EXPORT Configuration, Export page.
	PAGE (F6) changes to the LandXML page. <Dimensions:> Defines the dimension (2D, 3D) of the exported entities. <LandXML version:> Defines the LandXML version of the file exported file. Supported LandXML versions: 1.0/1.1
5.	CONT (F1) accepts the changes and returns to EXPORT Export LandXML from Job .

Step	Description
6.	CONT (F1) exports the data.
	Message: Do not remove CF Card!
7.	Information message: Are more data to be exported? If yes , continue with step 8. If no , continue with step 9.
8.	YES (F6) . Repeat steps 1. to 6.
9.	NO (F4) returns to the TPS1200+/TS30/TM30 Main Menu .

14.1

Overview

Description

This screen lists all the importers loaded. The data to import must either be stored on the CompactFlash card or in the internal memory, if fitted.

Data can be imported to a job

- on the CompactFlash card.
- on the internal memory, if fitted.

Import formats

Format	Characteristic	Description
ASCII	Import variables	Point ID, grid coordinates, thematical codes. No free codes, no attributes.
	Format definition	Free format. Use and order of variables and delimiter can be defined during import.
	Units	As currently configured on the instrument.
	Height	Orthometric or ellipsoidal.
	Specialities	
	Local heights but no coordinates in file	Points are imported without coordinates but with local height and code if available.
	Coordinates but no heights in file	Points are imported without height but with coordinates and code if available.

Format	Characteristic	Description
	Neither coordinates nor heights in file	No import.
	No point ID's in file	No import.
GSI8 GSI16	Import variables	Point ID WI 11, local coordinates WI 81, WI 82, WI 83, thematic codes WI 71. No free codes, no attributes. Refer to "20.1 GSI Output" for information on GSI Format.
	Format definition	Fixed format. Easting and Northing can be switched during import.
	Units	As defined in the GSI file.
	Heights	Orthometric or ellipsoidal.
	Specialities	
	Local heights but no coordinates in file	Points are imported without coordinates but with local height and code if available.
	Coordinates but no heights in file	Points are imported without height but with coordinates and code if available.
	Neither coordinates nor heights in file	No import.
	No point ID's in file	No import.
DXF	Import variables	Block, point, line, arc, polyline. Local coordinates. No free codes, no attributes.
	Format definition	Fixed format (X/Y/Z).

Format	Characteristic	Description
	Units	Not predefined.
	Heights	Z value imported as orthometric.
	Specialities	
	Neither coordinates nor heights in file	No import

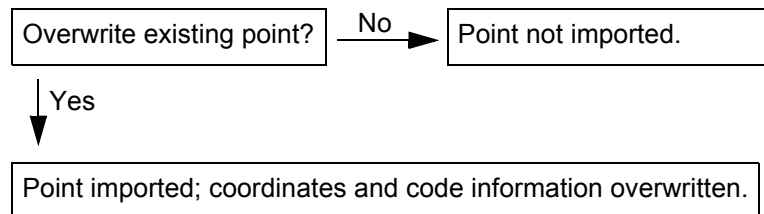
Checks

Points are always imported with the class **CTRL** and a coordinate quality of ----.

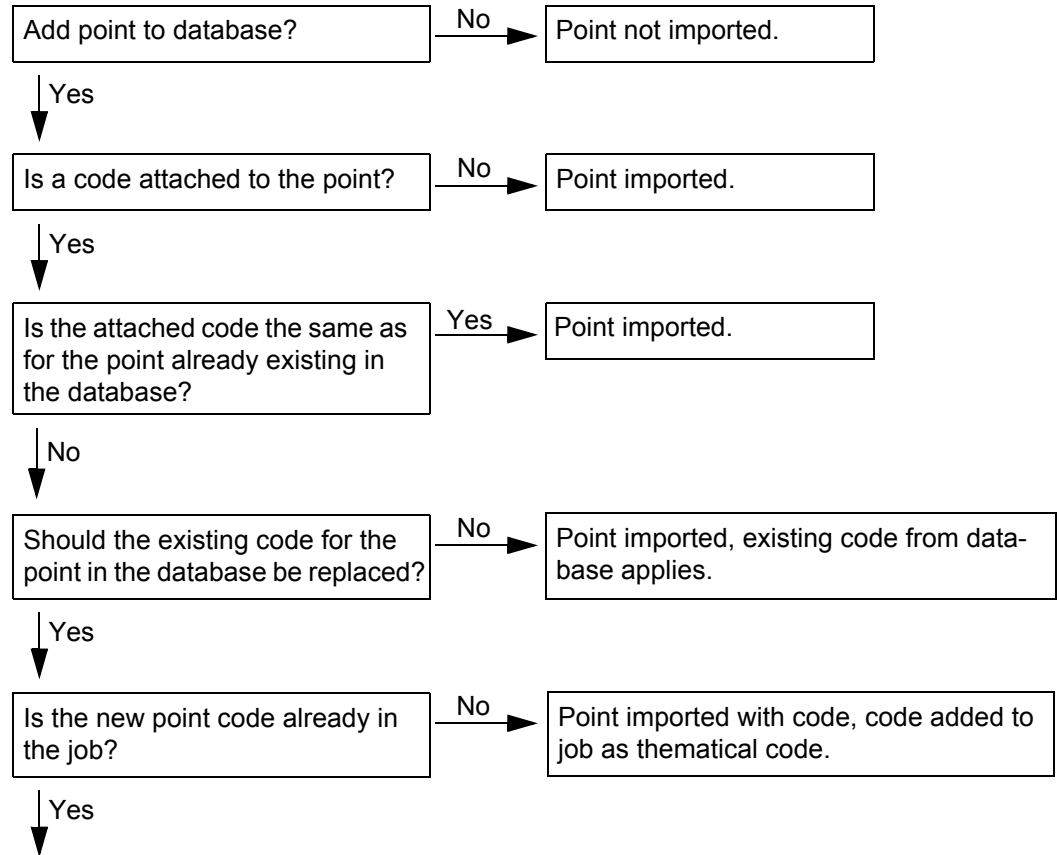
Refer to "6.3.1 Terminology".

While importing points to a job, checks are performed against point ID, class and coding of points already existing in the job.

Case 1: Point already exists in database with class CTRL



Case 2: Point already exists in database with a class other than CTRL



Point imported with code.

14.2

Accessing the Data Import Functionality

Access

Select **Main Menu: Convert...\Import Data to Job**.

OR

Press a hot key configured to access the screen **IMPORT Import Data to Job**. Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

Next step

IF importing data in	THEN
ASCII format	Refer to "14.3 Importing Data in ASCII Format".
GSI format	Refer to "14.4 Importing Data in GSI Format".
DXF format	Refer to "14.5 Importing Data in DXF Format".

14.3

Importing Data in ASCII Format

Requirements

At least one ASCII file with any file extension is stored in the \DATA directory of the CompactFlash card.

Access

Refer to "14.2 Accessing the Data Import Functionality" to access **IMPORT Import ASCII/GSI Data to Job**.

Import data step-by-step

Step	Description
1.	IMPORT Import ASCII/GSI Data to Job <Import: ASCII Data> <From File:> All files in the \DATA directory on the CompactFlash card can be selected. <To Job:> Choosing a job as destination for import makes this job the active job. All jobs from Main Menu: Manage...\Jobs can be selected. <Header:> This option allows up to ten header lines which may exist in an ASCII file to be skipped. Select the number of header lines.
2.	CONF (F2) defines the format of the data to be imported.
3.	IMPORT Define ASCII Import <Delimiter:> The separator between the import variables. <Multi Spaces:> Available for <Delimiter: Space> . <Multi Spaces: No> for space delimited data having one space between the variables. <Multi Spaces: Yes> for space delimited data having multi spaces between the variables.

Step	Description
	<No. Lines/Pt:> Available for <Delimiter: Line Feed>. The number of lines used to describe each point. Select the delimiter and the positions of the particular variables.
	DEFLT (F5) recalls the default ASCII import settings.
4.	CONT (F1) leads back to IMPORT Import ASCII/GSI Data to Job
5.	SHIFT HTS (F2) to access IMPORT Define Ht Type & Easting Import .
6.	IMPORT Define Ht Type & Easting Import <Import as:> The height type for the imported data. <Easting:> The Easting can be imported as written in the ASCII file or it can be multiplied by -1. This is required by some coordinate systems.
7.	CONT (F1) leads back to IMPORT Import ASCII/GSI Data to Job
8.	CONT (F1) imports the data.
	Points with a height > 20000 m are not imported.
9.	Information message: Are more data to be imported? • If yes, continue with step 10. • If no, continue with step 11.
10.	YES (F6) . Repeat steps 1. to 9.
11.	NO (F4) returns to the TPS1200+/TS30/TM30 Main Menu .

14.4

Importing Data in GSI Format

Requirements

At least one ASCII file in GSI format with the file extension *.gsi is stored in the GSI directory of the CompactFlash card.

Access

Refer to "14.2 Accessing the Data Import Functionality" to access **IMPORT Import ASCII/GSI Data to Job**.

Import data step-by-step

Step	Description
1.	IMPORT Import ASCII/GSI Data to Job <Import: GSI Data> <From File:> All files with extension *.gsi in the \GSI directory on the Compact-Flash card can be selected. <To Job:> Choosing a job as destination for import makes this job the active job. All jobs from Main Menu: Manage...\Jobs can be selected.
	CONF (F2) accesses IMPORT Define GSI Import . For <Switch WI81/WI82: Yes> all WI 81 data, normally Easting, is imported as Northing and all WI 82 data, normally Northing, is imported as Easting. This coordinate switch is necessary for "left handed" coordinate systems.
2.	SHIFT HTS (F2) to access IMPORT Define Ht Type & Easting Import .
3.	IMPORT Define Ht Type & Easting Import <Import as:> The height type for the imported data. <Easting:> The Easting can be imported as written in the *.gsi file or it can be multiplied by -1. This is required by some coordinate systems.

Step	Description
4.	CONT (F1) leads back to IMPORT Import ASCII/GSI Data to Job
5.	CONT (F1) imports the data.
	Points with a height > 20000 m are not imported.
6.	Information message: Are more data to be imported? • If yes, continue with step 7. • If no, continue with step 8.
7.	YES (F6) . Repeat steps 1. to 6.
8.	NO (F4) returns to the TPS1200+/TS30/TM30 Main Menu .

14.5

Importing Data in DXF Format

Requirements

At least one file in DXF format with the file extension *.dxf has to be stored in the \DATA directory of the CompactFlash card.

Access

Refer to "14.2 Accessing the Data Import Functionality" to access **DXF IMPORT Import DXF Data to Job**.

Import data step-by-step

Step	Description
1.	DXF IMPORT Import DXF Data to Job <From File:> All files with extension *.dxf in the \DATA directory on the CompactFlash card can be selected. <To Job:> Choosing a job as destination for import makes this job the active job. All jobs from Main Menu: Manage...\Jobs can be selected.
	CONF (F2) accesses Configuration. <Block Prefix:> Optional prefix to imported blocks. <Point Prefix:> Optional prefix to imported points. <Line Prefix:> Optional prefix to imported lines. <File Units:> Choosing the unit for the DXF data to be imported. <Create Vertex Points:> Option if points will be created at vertices of the imported line/arc/polyline elements. <Convrt White Elements:> Option if white colored elements will be converted to black colored elements.

Step	Description
	<Exclude Height:> Height value inside the DXF file are considered invalid and will not be converted.
2.	CONT (F1) leads back to DXF IMPORT Import DXF Data to Job
3.	CONT (F1) imports the data.
	Message: Do not remove CF Card!
4.	Information message: Are more data to be imported? If yes , continue with step 5. If no , continue with step 6.
5.	YES (F6) . Repeat steps 1. to 4.
6.	NO (F4) returns to the TPS1200+/TS30/TM30 Main Menu .

Description

This chapter explains the process of copying points from one job to another.

Important features:

- Points are copied as defined by the point filter settings.
- Points selected for copying may be viewed in a points listing. The point sort settings define the order of the points in the listing. The point filter settings define the points to be viewed in the listing.
- Only points are copied - observation data is not copied.
- When points are copied from one job to another:
 - their point codes and attached attributes are also copied.
 - their **Class** is retained.
 - their **Sub Class** is retained.
 - their **Source** is changed to **Copied Point**.
 - their **Point Coordinate Quality** is retained.
 - their **Instrument Flag** is retained.
 - their **Date and Time Stamp** is retained.

Access

Select **Main Menu: Convert...\Copy Points Between Jobs**.

COPY Copy Points Between Jobs

18:39

COPY

Copy Points Between Jobs

From Job : construction

Coord System : local

To Job : survey

Q2 a ↑

CONT FILT DATA CSYS

CONT (F1)

To copy a selection of points.

FILT (F4)

To define the point sort and/or point filter settings of points from the job <From Job>.

DATA (F5)

To view, edit and delete points, lines and areas stored with the job. Points, lines and areas are shown on separate pages. Selected sort and filter settings apply. Refer to "6.3 Point Management".

CSYS (F6)

To select a different coordinate system.

Description of fields

Field	Option	Description
<From Job>	Choicelist	Describes where the points are to be copied from. All jobs may be selected from Main Menu: Manage...\Jobs .
<Coord System>	Output	The coordinate system which is currently attached to the job <From Job>.
<To Job>	Choicelist	Describes where the points are to be copied to. All jobs may be selected from Main Menu: Manage...\Jobs .

16.1

ID Templates

16.1.1

Overview of Templates

Description

- ID templates are predefined templates for point, line or area numbers. ID templates save having to type in the ID for each object. They are useful when many points are collected.
- ID templates that are selected to be used suggest ID's for **Point ID**, **Line ID** and **Area ID** whenever points, lines and areas are to be surveyed.

Description of the default ID templates

Default ID Template	Description
0001	• Suggested as ID for measured points in default configuration sets. • This ID is automatically incremented.
Area0001	• Suggested as ID for areas in default configuration sets. • This ID is automatically incremented.
Auto0001	• Suggested as ID for auto points in default configuration sets. These points are automatically recorded at a specific rate. • This ID is automatically incremented.
Aux0001	• Suggested as ID for auxiliary points in default configuration sets. These points are used when measuring a hidden point. • This ID is automatically incremented.
Line0001	• Suggested as ID for lines in default configuration sets. • This ID is automatically incremented.

Default ID Template	Description
No Template Used	The last point ID during a survey will be displayed. This ID is automatically incremented if it contains numerical characters. If this ID is overwritten, the auto increment starts from the new ID. The automatic incrementation can be turned off when editing this ID template. Refer to "16.1.4 Editing an ID Template".
Time & Date	The current local time and date is the ID.
Use Code&String	- Allows the line/area ID assigned to a line/area object to be based on the code related to the line/area. - If line/area codes are being used then the line/area code is used as part of the line/area ID. - If point codes are being used then the point code is used as part of the line/area ID. - If attributes/strings are not being used then the numerical part of the line/area ID is automatically incremented.

Availability of the default ID templates

Default ID Template	Availability:			
	Survey Points	Auto Points	Lines	Areas
0001	✓	✓	✓	✓
Area0001	✓	✓	✓	✓
Auto0001	✓	✓	✓	✓
Aux0001	✓	✓	✓	✓
Line0001	✓	✓	✓	✓

Default ID Template	Availability:			
	Survey Points	Auto Points	Lines	Areas
No Template Used	✓		✓	✓
Time & Date	✓	✓	✓	✓
Use Code&String			✓	✓

Selecting the default ID templates

- A default ID template can be selected:
 - manually, by selecting it in the ID Template Library under **Config \Survey Settings \ID Templates**. The ID template becomes active as soon as it is highlighted on the screen and when **CONT (F1)** is pressed. The currently active configuration set is automatically updated, to include the selected ID template. To ensure that all default ID templates appear in the ID Template Library, press **SHIFT DEFLT (F5)**.
 - indirectly, by selecting a configuration set which includes the ID template.

16.1.2

Accessing ID Template Configuration

Access

Select **Main Menu: Config...\Survey Settings...\ID Templates.**

OR

Press a hot key configured to access the screen **CONFIGURE ID Templates.** Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER.** Refer to "2.2 USER Key" for information on the **USER** key.

OR

Within the configuration set wizard. Refer to "11.2 Accessing Configuration Set Management".

CONFIGURE ID Templates

17:19 CONFIGURE IR STD I

ID Templates

Survey Pts : 0001

Auto Pts : Auto0001

Auxil Pts : Aux0001

Lines : Line0001

Areas : Area0001

CONT Q2a ↑

CONT (F1)

To accept changes and return to the screen from where this screen was accessed.

Description of fields

Field	Option	Description
<Survey Pts:>	Choicelist	Sets the ID templates for measured points.
<Auto Pts:>	Choicelist	Sets the ID templates for auto points. These points are automatically recorded at a specific rate.
<Auxil Pts:>	Choicelist	Sets the ID templates for auxiliary points. These points are used when trying to find a stake-out point.
<Lines:>	Choicelist	Sets the ID templates for lines.
<Areas:>	Choicelist	Sets the ID templates for areas.

Next step

IF an ID template	THEN
is to be selected	select the desired ID template. CONT (F1) to close the screen and to return to the screen from where CONFIGURE ID Templates was accessed.
is to be created	Refer to "16.1.3 Creating a New ID Template".
is to be edited	Refer to "16.1.4 Editing an ID Template".
is to be deleted	Refer to "16.1.5 Deleting an ID Template".

16.1.3

Creating a New ID Template

Create ID template step-by-step

Step	Description
1.	Refer to "16.1.2 Accessing ID Template Configuration" to access CONFIGURE ID Templates .
2.	In CONFIGURE ID Templates highlight any field.
3.	ENTER to access CONFIGURE ID Template Library .
4.	Highlight an ID template. A copy of this ID template is taken for further configurations.
5.	NEW (F2) to access CONFIGURE New ID Template .
6.	CONFIGURE New ID Template <ID:> The name of the ID template and the format of the ID object. Any characters including spaces are allowed. Leading spaces are not accepted. <Increment:> ID's are incremented numerical or alphanumerical. <Increment By:> The amount by which the point ID is incremented. <Cursor Posn:> The character position at which the cursor is placed when ENTER is pressed in <Point ID:> when surveying points. <Cursor Posn: Last Character> means that the cursor is placed immediately to the right of the last character. Adapt the settings according to the requirements.
7.	CONT (F1) stores the new ID template into the ID template library and returns to CONFIGURE ID Template Library .
8.	CONT (F1) returns to CONFIGURE ID Templates .

Step	Description
9.	CONT (F1) returns to the screen from where CONFIGURE ID Templates was accessed.

Examples for incrementation

For <Increment: Numeric only>

The rightmost numeric part is incremented within the point ID.

<ID:>	<Increment By:>	Next point ID	Notes
Point994	5	Point999 Point1004 ...	-
994point	5	999point 1004point ...	-
123point123	-10	123point113	Right hand side numbers are incremented. Negative increments allowed.
Point11	-6	Point5 Point-1 Point-7 Point-13 ...	-
Abcdefghijklmn94	5	Abcdefghijklmno99 Point ID increment fail	Incrementation fails if next increment will result in more than 16 characters.

<ID:>	<Increment By:>	Next point ID	Notes
Abcdefghijklmno9	-5	Abcdefghijklmnop4 Point ID increment fail	Negative incrementing fails if next increment requires negative sign and will result in more than 16 characters.

For <Increment: Alphanumeric>

The rightmost character within the point ID is incremented regardless of whether that character is numeric or alphanumeric.

Template	Increment value	Next point ID's	Notes
Point994	5	Point999 Point99E Point99J ...	-
994point	5	994poiny Point ID increment fail	Lower case alpha characters increment until z is reached. Then a new point ID must be entered.
Abcdef	-5	Abcdea AbcdeV ... AbcdeB Point ID increment fail	Lower case alpha characters decrement from lower to upper case until A is reached. Then a new point ID must be entered.

Template	Increment value	Next point ID's	Notes
ABCDEB	5	ABCDEB ABCDEG ... Abcdez Point ID increment fail	Upper case alpha characters increment from upper to lower case until z is reached. Then a new point ID must be entered.

16.1.4

Editing an ID Template

Edit ID template step-by-step

Step	Description
1.	Refer to "16.1.2 Accessing ID Template Configuration" to access CONFIGURE ID Templates .
2.	In CONFIGURE ID Templates highlight any field.
3.	ENTER to access CONFIGURE ID Template Library .
4.	CONFIGURE ID Template Library Highlight the ID template to be edited. The ID template Time & Date cannot be edited. EDIT (F3) .
5.	CONFIGURE Edit ID Template The type of ID template selected for editing determines the availability of the fields on this screen. • Available for the default ID template No Template Used: <ID:> The name of the ID template cannot be changed since it is a default ID template. The other fields on this screen are the same as in CONFIGURE New ID Template. Refer to "16.1.3 Creating a New ID Template". • Available for a user defined ID template: All fields on this screen are the same as in CONFIGURE New ID Template. Refer to "16.1.3 Creating a New ID Template". Adapt the settings according to the requirements.
6.	CONT (F1) stores the changes and returns to CONFIGURE ID Template Library .

Step	Description
7.	CONT (F1) returns to CONFIGURE ID Templates .
8.	CONT (F1) returns to the screen from where CONFIGURE ID Templates was accessed.

16.1.5

Deleting an ID Template

Delete ID template step-by-step

Step	Description
1.	Refer to "16.1.2 Accessing ID Template Configuration" to access CONFIGURE ID Templates .
2.	In CONFIGURE ID Templates highlight any field.
3.	ENTER to access CONFIGURE ID Template Library .
4.	CONFIGURE ID Template Library Highlight the ID template to be deleted. DEL (F4) .
	It does not matter if the ID template is being used in a configuration set. The ID template will be rebuilt when that configuration set becomes active.
5.	YES (F4) returns to the CONFIGURE ID Template Library .
6.	CONT (F1) returns to CONFIGURE ID Templates .
7.	CONT (F1) returns to the screen from where CONFIGURE ID Templates was accessed.

16.1.6

Working Example

Description

- Application:
- Pick up points with many different point ID's.
 - Most point ID's require an incrementing number behind a text.
- Working technique: Application program Survey.
- Goal:
- The first point ID's for survey points are Bolt 001, Bolt 002, ...
 - A different point ID can be entered during the survey.
 - The following point ID's will be based on the entered point ID.
 - An individual point ID can be typed in for one point.

Requirement

Application program Survey is selected. Refer to "48 Survey - General" for more information on Survey.

Configuration of ID template step-by-step

Step	Description
1.	Refer to "16.1.3 Creating a New ID Template". Follow step 1. to 4.
2.	CONFIGURE New ID Template <ID: Bolt 001> <Increment: Numeric only> <Increment By: 1> <Cursor Posn: 1>
3.	CONT (F1) closes the screen and returns to CONFIGURE ID Template Library .
4.	CONT (F1) returns to CONFIGURE ID Templates .

**Field procedure
step-by-step**

Step	Description
5.	CONFIGURE ID Templates <Survey Pts: Bolt 001>
6.	CONT (F1) returns to the screen from where CONFIGURE ID Templates was accessed.

Step	Description
1.	Refer to "48.2 Surveying Points" to access SURVEY Survey: Job Name .
2.	SURVEY Survey: Job Name <Point ID: Bolt 001> is shown automatically.
3.	ALL (F1) . <Point ID: Bolt 002> is shown automatically.
4.	Repeat step 3. until all points with the ID Bolt XXX are surveyed.
5.	SURVEY Survey: Job Name The next point ID's are RoadXXXX, starting with Road0723. Type Road0723 <Point ID: Road0723> .
6.	ALL (F1) <Point ID: Road0724> is shown automatically.
7.	Repeat step 6. until all points with the ID RoadXXXX are surveyed.
8.	SURVEY Survey: Job Name The next required point ID is BM98. It is valid for one point. SHIFT INDIV (F5)
9.	SURVEY Survey: Job Name Type BM98 <Indiv Pt ID: BM98> .

Step	Description
10.	ALL (F1). The system changes back to the point ID's RoadXXXX.

Description

Display settings define the parameters shown on a page on the **SURVEY** screen.

Four display masks are definable.

Mask 1: Always shown on the **SURVEY** screen.

Mask 2: Can be shown or hidden on the **SURVEY** screen.

Mask 3: Can be shown or hidden on the **SURVEY** screen.

Mask 4: Never shown on the **SURVEY** screen. Reserved for application programs.

The settings on this screen define the layout of the four display masks.

Access

Select **Main Menu: Config...\Survey Settings...\Display Settings**.

OR

Press a hot key configured to access the screen **CONFIGURE Display Settings**. Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

OR

Within the configuration set wizard. Refer to "11.2 Accessing Configuration Set Management".

CONFIGURE Display Settings

18:45

CONFIGURE

IR STD I

Bluetooth 0 1

Display Settings

Define : Mask 1

Name : Survey

Use in Survey: Yes

CONT (F1)

To accept changes and return to the screen from where this screen was accessed.

DMASK (F3)

To configure the selected display mask. Refer to paragraph "CONFIGURE Define Display Mask n".

Q2 a ↑

CONT DMASK

Description of fields

Field	Option	Description
<Define:>	Mask 1, 2, 3 or 4	Selected display mask.
<Use in Survey:>	Output	Indicates if the display mask is shown or hidden as a page in SURVEY .

Next step

IF a display mask	THEN
is not to be edited	CONT (F1) closes the screen and returns to the screen from where CONFIGURE Display Settings was accessed.

IF a display mask	THEN
is to be edited	highlight the display mask and DMASK (F3) . Refer to paragraph "CONFIGURE Define Display Mask n".

CONFIGURE Define Display Mask n

18:47 CONFIGURE

Define Display Mask 1

Name : Survey

Visible : Yes

Fixed Lines : 2

1st Line : Point ID

2nd Line : Reflector Height

3rd Line : Line Space Full

4th Line : Hz-Angle

5th Line : V-Angle

6th Line : Horiz Dist

CONT CLEAR DEFLT

CONT (F1)

To accept changes and to return to
CONFIGURE Display Settings.

CLEAR (F4)

To set all fields to <XX. Line: Line Space
Full>.

DEFLT (F5)

To recall the default settings.

Description of fields

Field	Option	Description
<Visible:>	Yes or No	Shows or hides the display mask as a page in SURVEY .
<Fixed Lines:>	From 0 to 5	Defines how many lines do not scroll in the survey screen when that display mask is used.
<1st Line:>	Output	Fixed to <1st Line: Point ID>.

Field	Option	Description
<2nd Line:> to <16th Line:>		For each line one of the following options can be selected.
	Add. Constant	Output field for additive constant of currently selected reflector.
	Angle Right	Displays the horizontal angle difference between the backsight point and the current telescope position.
	Annotation 1-4	Input field for comments to be stored with the point.
	Attrib (free) 01-20	Output field for attributes for free codes.
	Attrib 01-20	Input field for attributes for point codes.
	Automation	Unavailable for SmartStation. Select automation type.
	Avg Max #Dist	Input field for maximum number of distance measurements in the averaging EDM mode.
	Azimuth	Output field for the azimuth.
	Backsight Pt ID	Output field for point ID of backsight point if Quickset method was used in Setup application program.
	Code	Output field for free codes.
	Code (free)	Input field for free codes.
	Code Desc	Output field for the description of codes.

Field	Option	Description
	Code Desc (free)	Output field for the description of free codes.
	Code Type	Output field for the type of code, for example point code, line code or area code.
	EDM Mode	Select EDM measurement mode.
	EDM Type	Select EDM type.
	Easting	Output field for Easting coordinate of measured point.
	Height	Output field for the height coordinate of the measured point.
	Height Diff	Output field for the height difference between station and reflector.
	Horiz Dist	Output field for horizontal distance.
	Hz-Angle	Output field for the horizontal angle.
	Instrument Ht	Output field for the instrument height.
	Line Space Full	Insert full line space.
	Line Space Half	Insert half line space.
	Linework	Choicelist with option for flagging a line/area. Refer to "16.3 Coding & Linework Settings".
	No. of Dists	Output field for number of averaged distances measured with EDM mode averaging.
	Northing	Output field for Northing coordinate of measured point.

Field	Option	Description
	Offset Cross	Input field for horizontal distance offset for measured point, perpendicular to the line of sight.
	Offset Height	Input field for height offset for measured point.
	Offset Length	Input field for horizontal distance offset, in the direction of line of sight.
	Offset Mode	Select offset mode.
	PPM Atmos	Output field for atmospheric ppm value.
	PPM Geom	Output field for geometric ppm value.
	PPM Total	Output field for the total ppm value.
	Point ID	Input field for the point number.
	Reflector	Select a reflector.
	Reflector Height	Input field for reflector height.
	SD-Last Rec	Output field for the last recorded distance.
	Slope Dist	Output field for measured slope distance.
	Station East	Output field for current station Easting coordinates.
	Station Height	Output field for current station height coordinates.
	Station ID	Output field for current station ID.

Field	Option	Description
	Station North	Output field for current station Northing coordinates.
	Std Dev	Output field of standard deviation in millimeters of averaged distances.
	Time at Point	Output field for the time from when the point is occupied until point occupation is stopped. Appears in the display mask during the point occupation.
	V-Angle	Output field for vertical angle.
	V-Display	Select vertical angle display.

Next step

Step	Description
1.	CONT (F1) returns to CONFIGURE Display Settings .
2.	CONT (F1) returns to the screen from where CONFIGURE Display Settings was accessed.

16.3

Coding & Linework Settings

Description

The settings on this screen define the method of coding, for both points and lines.
Refer to "8 Coding" for a complete description of coding.

Access

Select **Main Menu: Config...\Survey Settings...\Coding & Linework Settings**.

OR

Press a hot key configured to access the screen **CONFIGURE Coding & Linework**.
Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

OR

Within the configuration set wizard.

Refer to "11.2 Accessing Configuration Set Management".

CONFIGURE Coding & Linework, Coding page

15:12 | CONFIGURE | IR STD | I | [Icons]

Coding & Linework

Coding | Linework

Quick Code : On

Digits : 2

Rec Free Code: Before Point

Attributes : Default Values

Mand Attribs : Only If No Value

Thematic Codes: With Codelist

Show Codes : All Codes

Q2 a ↑

CONT | | | | PAGE

CONT (F1)

To accept changes and return to the screen from where this screen was accessed.

PAGE (F6)

To change to another page on this screen.

Description of fields

Field	Option	Description
<Quick Code:>	Never On Off	Prevents the use of quick coding completely. Allows the use of quick coding and activates it. Allows the use of quick coding, but keeps it deactivated.
<Digits:>	1, 2 or 3	Available unless <Quick Code: Never>. Sets the mostly used number of digits for the quick code. Quick codes with less digits can still be used. While typing a quick code during a survey, using ENTER after typing one or two digits of the quick code indicates the end of the input.
<Rec Free Code:>	After Point or Before Point	Determines if a free code measured with a quick code is stored before or after the point. This field is disabled when <Quick Code: Never>.
<Attributes:>	Default Values Last Used	Determines the attribute values displayed under certain circumstances. This is applicable to both the storing and displaying of attribute values. When available, the default attribute values, as stored in the job, are displayed and stored. When available, the last used attribute values as stored in the job are displayed and stored.

Field	Option	Description
<Mand Attribs:>	Always Prompt	The screen XX Enter Mandatory Attribute will always appear when codes, having one or more attributes of attribute type mandatory, are being stored. Attributes of attribute type mandatory or fixed can only be created in LGO.
	Only If No Value	The screen XX Enter Mandatory Attribute will only appear when codes, having one or more attributes of attribute type mandatory, are being stored without an attribute value. Attributes of attribute type mandatory can only be created in LGO.
	Code Change Only	The screen XX Enter Mandatory Attribute will only appear when a new code with a mandatory attribute was selected.
<Thematc Codes:>	With Codelist	Sets the coding method. Codes stored within the job codelist can be selected to code points, lines and areas.
	Without Codelist	Codes stored within the job codelist cannot be selected to code points, lines and areas. Each code must be entered.
<Show Codes:>	Only Pt Codes	Only point codes will be available in the choicelist for <Code:>/<Point Code:> in a display mask of an application program.

Field	Option	Description
	All Codes	All codes of the job codelist will be available in the choicelist for <Code:>/<Point Code:> in a display mask of an application program. Selecting a line/area code opens a new line/area.
<String Attrib:>	Choicelist	Available for <Show Codes: All Codes> . When this field is active, surveyed points that have the same code attached are strung to one line.

Next step

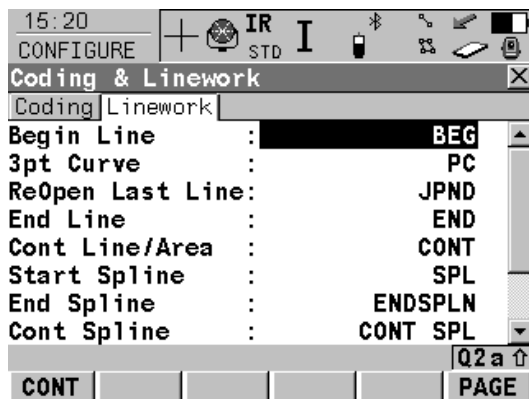
PAGE (F1) changes to the **Linework** page.

CONFIGURE Coding & Linework, Linework page

The flags for Linework are defined on this screen. A flag

- is stored as a property of a point.
- can be exported with a format file.
- is different to a code.

The flags defined on this screen are linked to the options available for **<Linework:>** in a display mask of an application program. The selection for **<Linework:>** in a display mask determines the flag stored with a point. The availability of **<Linework:>** in a display mask is configured in **CONFIGURE Define Display Mask n**. Refer to "9 Linework" for information on Linework.



CONT (F1)

To accept changes and return to the screen from where this screen was accessed.

PAGE (F6)

To change to another page on this screen.

Description of fields

Field	Option	Description
<Begin Line:>	User input	Opens a new line when the next point is stored. Any lines which are currently open are closed. The point may or may not be stored with a point code.
<3pt Curve:>	User input	Stores the linework flag for a curve through the next three measured points and continues a line/area.
<ReOpen Last Line:>	User input	Opens the last used line again.
<End Line:>	User input	Closes all open lines.
<Cont Line/Area:>	User input	Indicates a line/area is open.

Field	Option	Description
<Start Spline:>	User input	Stores the linework flag for beginning a spline and continues any open line/area.
<End Spline:>	User input	Stores the linework flag to stop a spline.
<Cont Spline:>	User input	Indicates a line/area is open with spline line type.
<Begin Area:>	User input	Opens a new area when the next point is stored. Any areas which are currently open are closed. The point may or may not be stored with a point code.
<ReOpen Last Area:>	User input	Opens the last used area again.
<Close Area:>	User input	Closes all open areas.

Next step

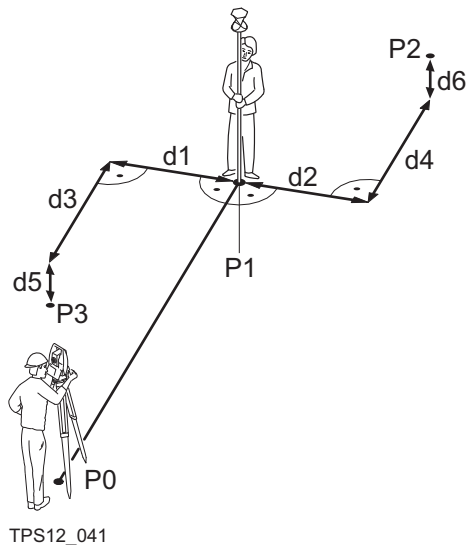
PAGE (F6) changes to the first page on this screen.

16.4

Offsets

Description

Offsets can be configured and entered. The offset values are applied to measured points. The Offset function allows offset points to be determined, for instance when the reflector cannot be set up directly on a point. Transverse, longitudinal and/or elevation offsets can be defined from the reflector position to the offset point. All of the displayed and recorded measurement data is in relation to the offset point. The values for target eccentricity is retained after storage with **<Offset Mode: Permanent>**. The values are set to zero with **<Offset Mode: Reset after REC>**.



- P0 Station
- P1 Current position
- P2 Offset point
- P3 Offset point
- d1 Offset cross -
- d2 Offset cross +
- d3 Offset length -
- d4 Offset length +
- d5 Offset height -
- d6 Offset height +



If configured in a display mask, the offset values appear also in the display mask in Survey.

Access

Select **Main Menu: Config...\Survey Settings...\Offsets.**

OR

Press a hot key configured to access the screen **CONFIGURE Offsets**. Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

OR

Within the configuration set wizard. Refer to "11.2 Accessing Configuration Set Management".

CONFIGURE Offsets

17:00
CONFIGURE
Offsets
Offset Mode : Reset after REC
Offset Cross : 0.000 m
Offset Length: 0.000 m
Offset Height: 0.000 m

CONT (F1)

To accept changes and return to the screen from where this screen was accessed.

OFS=0 (F5)

To set all offsets to 0.000.

CONT [] [] [] OFS=0 Q2 a ↑

Description of fields

Field	Option	Description
<Offset Mode:>	Reset after REC	The offset values are reset to 0.000 after a point is measured with REC (F3) or ALL (F1) .
	Permanent	The offset values are applied to every measured point until reset or changed.
<Offset Cross:>	User input	Sets cross offset of target point, perpendicular to the line of sight.
<Offset Length:>	User input	Sets length offset of target point, in the direction of the line of sight.
<Offset Height:>	User input	Sets height offset of target point.

Next step

CONT (F1) returns to the screen from where **CONFIGURE Offsets** was accessed.

Description

- It is possible to configure the instrument to monitor sequentially stored measurements and to notify the user if the coordinates lie within a defined range from each other.
- If configured, when a point is being stored the X,Y coordinates of the point being stored are compared to those of the last previously stored point. If the difference is less than the defined position tolerance then a warning is shown. It can now be decided whether to store the point or not.
- If configured, then backsight target points and resection target points which were measured during the setup procedure are also checked in this manner.

Access

Select **Main Menu: Config...\Survey Settings...\Target Check**.

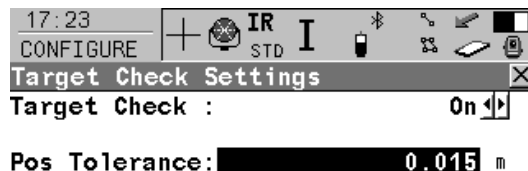
OR

Press a hot key configured to access the screen **CONFIGURE Target Check Settings**. Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

Configuring the target check



CONT (F1)

To accept the screen entries and continue.

Description of fields

Field	Option	Description
<Target Check:>	On	Target checking is activated.
	Off	Target checking is not activated.
<Pos Tolerance:>	User input	The position tolerance. The units are defined by Config \General Settings \Units & Formats .

17.1

EDM & ATR Settings

Description

- The settings on this screen define the active EDM **E**lectronic **D**istance **M**easurement and ATR **A**utomatic **T**arget **R**ecognition settings.
- Refer to "33 Functions" for detailed information on EDM and ATR.



- Descriptions apply in general to TPS1200+/TS30/TM30 instruments.
- Some options are only available on the TPS1200+ or the TS30/TM30 instrument.
- Available options depend on the purchased model, for example with or without ATR.

Access

Select **Main Menu: Config...\Instrument Settings...\EDM & ATR Settings.**

OR

Press a hot key configured to access the screen **CONFIGURE EDM & ATR Settings.**
Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER.**
Refer to "2.2 USER Key" for information on the **USER** key.

OR

Press **SHIFT USER.**
Refer to "3 Quick Settings - SHIFT USER" for information on the **SHIFT USER** key.

OR

Within the configuration set wizard.
Refer to "11.2 Accessing Configuration Set Management".

CONFIGURE
EDM & ATR Settings
Survey page
Setup page

Description

- This screen has two pages - the Survey page and the Setup page.
- The Survey page and Setup page contain identical fields.
- The settings made in the Survey page are used by all applications and all measurements taken outside of the Setup application program.
- The settings made in the Setup page are only used inside the Setup application program.
- Any changes made to the EDM & ATR Settings (e.g. via Icons, Quick Set, Hotkeys) while the Setup application program is active, only affect the Setup EDM & ATR settings.
- Any changes made to the EDM & ATR Settings (e.g. via Icons, Quick Set, Hotkeys) while the Setup application program is not active, only affect the Survey EDM & ATR settings.
- When entering the Setup application program, the Setup EDM & ATR Settings are active.
- When leaving the Setup application program, the Survey EDM & ATR Settings are active.
- Both Survey and Setup EDM & ATR Settings are part of the configuration sets.

Diagram

17:43

CONFIGURE

EDM & ATR Settings

Survey Setup

EDM Type : Reflector (IR)

EDM Mode : Standard

Reflector : Leica Circ Prism

Add. Constant: 0.0 mm

Automation : ATR

ATR Settings : Normal

Q2 a ↑

CONT TEST PAGE

CONT (F1)

To accept changes and return to
TPS1200+/TS30/TM30 Main Menu.

TEST (F4)

To access the **CONFIGURE EDM Test**
Signal/Frequency screen.

PAGE (F6)

To change to other page on screen.

Description of fields

Field	Option	Description
<EDM Type:>	Reflector (IR)	All fields are set to the last used options. The IR EDM exists for all instrument types and allows to measure the distance to a prism or a tape. IR is the EDM that can be used with ATR and LOCK. For <Automation: ATR> or <Automation: LOCK> <EDM Type: Reflector (IR)> is automatically set. Whenever <EDM Type: Reflector (IR)> is selected, the last setting for <Automation:> which was used with reflector is set.

Field	Option	Description
	Reflectrless (RL)	When activated, IR is displayed as an icon. <Automation: None> and <Reflector: Reflectorless> are selected. The other fields are set to the last used options.
	Long Range (LO)	When activated, RL is displayed as an icon. <Automation: None> is selected. Last used options are reset for the other fields. When activated, LO is displayed as an icon.
<EDM Mode:>	Standard	Available for all <EDM Type:> options. Standard single distance measurement. When activated, STD is displayed as an icon.
	Fast	Available only for <EDM Type: Reflector (IR)> . Fast single distance measurement. When activated, FAST is displayed as an icon.
	Tracking	Available unless <EDM Type: Long Range (LO)> . Continuous distance measurement. When activated, TRK is displayed as an icon.

Field	Option	Description
	SynchroTrack	Available only for <EDM Type: Reflector (IR)>. This is the measurement mode for the interpolation of angle measurements in IR LOCK Tracking mode. In difference to normal IR LOCK Tracking mode, where angle measurements are only assigned to certain distance measurements, SynchroTrack will perform a linear interpolation between the previous and following angle measurement, based upon the timestamp of the EDM measurement. Using this interpolation procedure, a higher accuracy for all dynamic applications (e.g. machine guidance) is possible. When activated, SYNC is displayed as an icon.
	Average	Available for all <EDM Type:> options. Repeats measurements in standard measuring mode. The average distance of <AVG Max #Dist:> and the standard deviation for the averaged distance are calculated. When activated, AVG is displayed as an icon.
	Precise	Available for TS30/TM30 and only for <EDM Type: Reflector (IR)>. When activated, PRCS is displayed.

Field	Option	Description
<AVG Max #Dist:>	User input	Available if <EDM Mode: Average >. Input field for the maximum number of distances to be averaged from 2 to 999 distances.
<Reflector:>	Choicelist	Reflector names as configured in Main Menu: Manage...\Reflectors .
<Add. Constant:>	Output	The additive constant stored with the chosen reflector.
<Automation:>	None ATR LOCK	Measurements are done without ATR. Positioning to static prisms. Unavailable for SmartStation/TM30/TS30+Smart-Antenna. The instrument locks onto and follows the moving prism.
<ATR Settings:>	Choicelist Normal Low Vis On Low Vis Always On S-Range On	ATR Settings. Normal Mode is turned on. Low Visibility Mode is turned on. To increase the instrument measuring ability during suboptimal weather conditions. Available only when ATR or LOCK mode is activated. This mode is automatically deactivated when the instrument is turned off. Low Visibility Mode is permanently turned on. Short Range Mode is turned on.

Field	Option	Description
	S-Range Always On	This mode is designed for survey work at close range from the instrument (up to 60-80 m). Under these conditions the instrument LOCK Mode is significantly stabilised. This mode has a considerable influence on the range (restriction to 100-150 m) for <Automation: ATR>. This mode is automatically deactivated when the instrument is turned off. Short Range Mode is permanently turned on.
<Target View:>	Choicelist Off On Always On	Available only for <Automation: ATR>. Reduces the ATR field of view to the central area of interest. The ATR field of view is not reduced. The ATR field of view is reduced. This mode is automatically deactivated when the instrument is turned off. The ATR field of view is permanently reduced.

Next step

IF EDM	THEN
is not to be tested	CONT (F1) closes the screen and returns to TPS1200+/TS30/TM30 Main Menu .

IF EDM	THEN
is to be tested	TEST (F4) to test the EDM signal strength and frequency.

17.2

Search Windows

Description

- The settings on this screen define the size of search windows for prisms to be searched in. The prisms can be searched with ATR in the ATR window or with PowerSearch in the PS window.
- Refer to "33.2 Prism Search Methods" for additional information.

Access

Select **Main Menu: Config...\Instrument Settings...\Search Windows**.

OR

Press a hot key configured to access the screen **CONFIGURE Search Windows**.

Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**.

Refer to "2.2 USER Key" for information on the **USER** key.

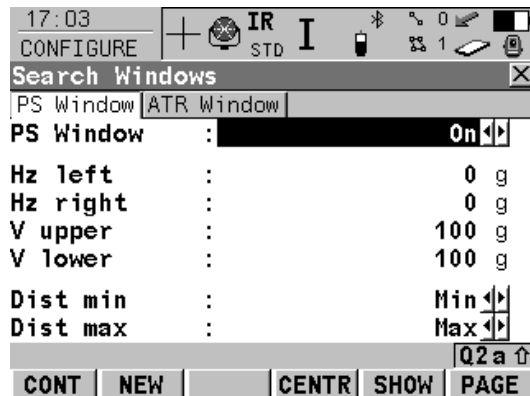
OR

Within the configuration set wizard.

Refer to "11.2 Accessing Configuration Set Management".

CONFIGURE Search Windows, PS Window page

Not available only for TM30.



CONT (F1)

To accept changes and return to
TPS1200+/TS30/TM30 Main Menu.

NEW (F2)

To define new PowerSearch window.

CENTR (F4)

To centre the PowerSearch window to the
current position of the telescope.

SHOW (F5)

To position the telescope to corners of Power-
Search window.

PAGE (F6)

To change to other page on screen.

Description of fields

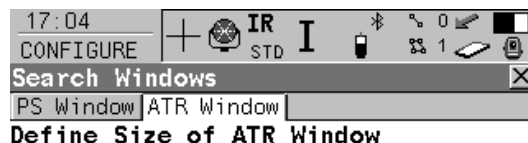
Field	Option	Description
<PS Window:>	On Off	PowerSearch searches in the defined window. PowerSearch searches from 0° to 360° within ±20 gon from horizon.
<Hz left:> <Hz right:> <V upper:> <V lower:>	Output	The left, right, upper and lower boundaries of the PowerSearch window.
<Dist min:>	Min and from 25 m to 175 m	Minimum distance of the search range for the PS window to be defined.

Field	Option	Description
<Dist max:>	From 25 m to 175 m and Max	Maximum distance of the search range for the PS window to be defined.

Next step

PAGE (F6) changes to the **ATR Window** page.

CONFIGURE Search Windows, ATR Window page



Hz Search : **4** g
V Search : **4** g

CONT (F1)

To accept changes and return to
TPS1200+/TS30/TM30 Main Menu.

DEFLT (F5)

To recall the default ATR window settings.

PAGE (F6)

To change to other page on screen.



Description of fields

Field	Option	Description
<Hz Search:>	User input	Horizontal extent of window.

Field	Option	Description
		This field is disabled when <Target View: On> or <Target View: Always On> . <Target view active> is displayed at the bottom on this page when the field is disabled.
<V Search:>	User input	Vertical extent of window. This field is disabled when <Target View: On> or <Target View: Always On> . <Target view active> is displayed at the bottom on this page when the field is disabled.

Next step

CONT (F1) returns to **TPS1200+/TS30/TM30 Main Menu**.

17.3

Automatic Prism Search

Description

- The settings on this screen define the behaviour of automatic prism search after the target is lost in lock mode.
- Refer to "33 Functions" for information on ATR, PowerSearch, lock and automation behaviour.

Access

Select **Main Menu: Config...\Instrument Settings...\Automatic Prism Search.**

OR

Press a hot key configured to access the screen **CONFIGURE Automatic Prism Search.**
Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER.**
Refer to "2.2 USER Key" for information on the **USER** key.

OR

Within the configuration set wizard.
Refer to "11.2 Accessing Configuration Set Management".

CONFIGURE Automatic Prism Search



After Prediction
Search with : No Search

CONT (F1)

To accept changes and return to
TPS1200+/TS30/TM30 Main Menu.



DEFLT (F5)

To recall the default settings.

Description of fields

Field	Option	Description
<Predict for:>	From 1 s to 5 s	If the target is lost when <Automation: LOCK> the path of the reflector is predicted for the selected amount of seconds.
<Search with:>	No Search	Perform no search after prediction.
	ATR	Perform search after prediction with ATR in a dynamic ATR window.
	PowerSearch	Not available for TM30. Perform search after prediction with PowerSearch. For <PS Window: On> search in PS window and for <PS Window: Off> search in dynamic PS window.

Field	Option	Description
	Last Point	If the target is lost when <Automation: LOCK> , then the instrument turns back to the last stored point. The field of view is disabled while the instrument is repositioning.

Next step

CONT (F1) closes the screen and returns to **TPS1200+/TS30/TM30 Main Menu**.

Description

- The settings on this screen define the atmospheric ppm, the geometric ppm and the refraction. The geometric ppm can also be determined by a resection calculation.
 - For standard application programs the distance is corrected on account of atmospheric influences. The geometrical correction and the projection distortions are set to 0.00. Heights are reduced with the standard refraction coefficient.
 - Refer to TPS1200+ User Manual/TS30/TM30 User Manual for information on calculations.
-

Access

Select **Main Menu: Config...\Instrument Settings...\TPS Corrections**.

OR

Press a hot key configured to access the screen **CONFIGURE TPS Corrections**.

Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**.

Refer to "2.2 USER Key" for information on the **USER** key.

OR

Within the configuration set wizard.

Refer to "11.2 Accessing Configuration Set Management".

CONFIGURE TPS Corrections, AtmosPPM page

The atmospheric distance corrections are derived from the dry air temperature, air pressure or elevation above mean sea level MSL and relative air humidity or wet bulb temperature.

17:08
CONFIGURE
TPS Corrections
AtmosPPM | GeomPPM | Refraction
Temperature : 12.0 °C
Atm Pressure : 1013.3 mbar
Rel Humidity : 60.0 %
Atmospheric ppm: 0.0

Q2 a ↑
CONT P<>E %<>T' PPM=0 PAGE

CONT (F1)

To accept changes and return to
TPS1200+/TS30/TM30 Main Menu.

P<>E (F3)

To change <Atm Pressure:> to <Elev above
MSL:> and back.

%<>T' (F4)

To change <Rel Humidity:> to <Temp Wet-
bulb:> and back.

PPM=0 (F5)

To set <Atmospheric ppm: 0.0>.

PAGE (F6)

To change to other page on screen.

Description of fields

Field	Option	Description
<Temperature:>	User input	Sets the temperature.
<Atm Pressure:> or <Elev above MSL:>	User input	Sets the atmospheric pressure or the elevation above mean sea level dependent on selection.
<Rel Humidity:> or <Temp Wet-bulb:>	User input	Sets the relative air humidity or the wet bulb temper- ature dependent on selection.
<Atmospheric ppm:>	User input or Output	The atmospheric ppm is either set or calculated from the above values.

Next step

PAGE (F6) changes to the **GeomPPM** page.

CONFIGURE TPS Corrections, GeomPPM page

- The geometric distance correction (geometric ppm) is derived from the map projection distortion (map projection ppm), the height above reference datum correction (height ppm) and an individual correction (individual ppm).
- The calculation of the map projection ppm follows the formula for the Transversal Mercator Projection. The individual factors are: the scale factor of the line of projection central meridian, Gauss-Krüger = 1.0, UTM = 0.9996, etc. and the offset from the line of projection.
- The calculation of the height ppm is derived from the height of the instrument station above the reference datum. Normally this is the height above mean sea level MSL.

17:07		IR STD I		0 1	
CONFIGURE					
TPS Corrections					
AtmosPPM		GeomPPM		Refraction	
Calc Scale	:	Manually			
Scale at C.M.	:	1.000000000000			
Offset to C.M.	:	0.000	m		
Map Proj ppm	:	0.0			
Ht above Ref	:	0.000	m		
ppm above Ref	:	0.0			
Individual ppm	:	0.0			
Geometric ppm	:	0.0			
				Q2 a ↑	
CONT			PPM=0	PAGE	

CONT (F1)

To accept changes and return to
TPS1200+/TS30/TM30 Main Menu.

PPM=0 (F5)

To set **<Geometric ppm: 0.0>**.
Only available when **<Calc Scale: Manually>**.

PAGE (F6)

To change to other page on screen.

Description of fields

Field	Option	Description
<Calc Scale:>	Choicelist	To manually or automatically calculate the geometric ppm value.
	Manually	The geometric ppm value is manually calculated.
	Automatically	The geometric ppm value is automatically calculated.
<Scale at C.M.:>	User input	The scale at the central meridian. Only available when <Calc Scale: Manually> .
<Offset to C.M.:>	User input	The offset to the central meridian. Only available when <Calc Scale: Manually> .
<Map Proj ppm:>	Output	The map projection ppm value. If this value cannot be calculated, then ----- is displayed and is also ignored in the calculation of the geometric ppm value.
<Ht above Ref:>	User input	The height of the instrument station above the reference datum. Only available when <Calc Scale: Manually> .
<ppm above Ref:>	Output	The height ppm value calculated from <Ht above Ref:> . Only available when <Calc Scale: Manually> .

Field	Option	Description
<Height ppm:>	Output	The height ppm value calculated from the height coordinates of the current TPS station stored in the System RAM. If this value cannot be calculated, then ---- is displayed and is also ignored in the calculation of the geometric ppm value. Only available when <Calc Scale: Automatically>.
<Individual ppm:>	User input	The individual ppm value. Only available when <Calc Scale: Manually>.
<Geometric ppm:>	Output	For <Calc Scale: Manually>: Geometric ppm = Map Proj ppm + ppm above Ref + Individual ppm. For <Calc Scale: Automatically>: Geometric ppm = Map Proj ppm + Height ppm.

Additional calculation method for the geometric ppm value

The geometric ppm value can also be calculated by a resection calculation. The scale factor from the resection is used for <Individual ppm:>. $\text{Individual ppm} = (s-1) \times 10^6$. $s = 1 + \text{ppm} \times 10^{-6}$. The <Geometric ppm:> value is calculated with the following:

- <Scale at C.M.: 1>,
- <Offset to C.M.: 0>,
- <Map Proj ppm: 0> and
- <Ht above Ref: 0>.

Automatic calculation of the geometric ppm value

When **<Calc Scale: Automatically>** is set:

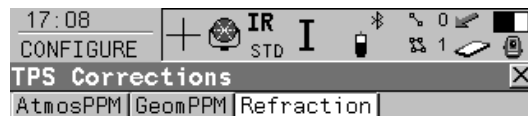
- the ppm values for **<Map Proj ppm>**, **<Height ppm>** and **<Geometric ppm>** are automatically calculated. The coordinates of the current instrument station stored in the System RAM are used, which are based on the currently active coordinate system.
- each time an application program is accessed, the geometric ppm value is automatically calculated. The coordinates of the current instrument station stored in the System RAM are used (these may have been updated), which are based on the currently active coordinate system (this may have changed). This way, the user is always working with the correct geometric ppm value.
- when either the **WGS84** or **<None>** coordinate system is chosen, then the geometric ppm value cannot be automatically calculated. A message dialog will appear, allowing the user to either manually enter the ppm values or accept ppm values of 0.

Next step

PAGE (F6) changes to the **Refraction** page.

CONFIGURE TPS Corrections, Refraction page

The refraction correction is taken into account during the calculation of the height difference. Refer to TPS1200+ User Manual/TS30/TM30 User Manual for information on refraction calculation.



Refraction Correction

Correction : **On**
Ref coeff (k) : 0.13

CONT (F1)

To accept changes and return to
TPS1200+/TS30/TM30 Main Menu.

DEFLT (F5)

Sets **<Correction: On>** and **<Ref coeff (k): 0.13>**.

PAGE (F6)

To change to other page on screen.



Description of fields

Field	Option	Description
<Correction:>	On or Off	Refraction correction is applied to measurements.
<Ref coeff (k):>	User input	Available if <Correction: On> . Refraction coefficient to be used for calculation.

Next step

CONT (F1) returns to the screen from where **CONFIGURE TPS Corrections** was accessed.

17.5

Compensator

Description

The compensator and the Hz correction can be deactivated if raw data is to be displayed and recorded.

Access

Select **Main Menu: Config...\Instrument Settings...\Compensator**.

OR

Press a hot key configured to access the screen **CONFIGURE Compensator**.

Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**.

Refer to "2.2 USER Key" for information on the **USER** key.

OR

Within the configuration set wizard.

Refer to "11.2 Accessing Configuration Set Management".

OR

ICONS.

CONFIGURE Compensator



Compensator : On  

Hz-Correction: On 



CONT (F1)

To accept changes and return to
TPS1200+/TS30/TM30 Main Menu.

Description of fields

Field	Option	Description
<Compensator:>	On	Vertical angles are relative to plumb line. The horizontal angle is corrected for the transversal tilt errors if <Hz-Correction: On> .
	Off	Vertical angles are relative to vertical/standing axis.
<Hz-Correction:>	On	The horizontal angles are corrected for the line of sight, tilting axis and if <Compensator: On> transversal tilt errors.
	Off	Horizontal angles are not corrected.

Next step

CONT (F1) returns to **TPS1200+/TS30/TM30 Main Menu**.

17.6

Instrument ID

Description

- The settings on this screen define the instrument identification number. This number is used for the generation of the file names.
- Using format files, the instrument ID can be output together with data from the instrument. By doing so, it can be identified which instrument was used for certain measurements.

Access

Select **Main Menu: Config...\Instrument Settings...\Instrument ID.**

CONFIGURE Instrument ID



CONT (F1)

To accept changes and return to
TPS1200+/TS30/TM30 Main Menu.

DEFLT (F5)

To recall the default instrument ID.



Description of fields

Field	Option	Description
<Instrument ID:>	User input	Sets a four digit number as instrument identification number. By default the last four numbers of the serial number are used.

Next step

CONT (F1) returns to **TPS1200+/TS30/TM30 Main Menu**.

Description

The settings on this screen offer the possibility to limit the motorization to a certain part of the horizontal and/or vertical circle as used telescope and lens accessories may obstruct a full rotation of the telescope. General positioning functions are then restricted to these boundaries.

Access

Select **Main Menu: Config...\Instrument Settings...\Telescope Accessories.**

CONFIGURE**Telescope Accessories,
Hz Limit page**

Hz Begin : 0°00'00"
 Hz End : 90°00'00"
 Use Limit : No

CONT (F1)

To accept changes and return to
TPS1200+/TS30/TM30 Main Menu.

NEW (F2)

To define new horizontal limits for instrument rotation.

SHOW (F5)

To define new horizontal limits for instrument rotation.

**Description of fields**

Field	Option	Description
<Hz Begin:>	Output/User	The boundaries of the window within the instrument is allowed to turn.
<Hz End:>	input	

Field	Option	Description
<Use Limit:>	Yes	Instrument turning is restricted to the defined window.
	No	Instrument rotates without any limitation, from 0 to 400 gon.

Next step

PAGE (F6) returns to the **V Limit** page.

CONFIGURE Telescope Accessories, V Limit page

17:41

CONFIGURE

IR STD I

Telescope Accessories

Hz Limit V Limit

Eyepiece Accessories

V Begin : 45°00'00"

V End : 135°00'00"

Lens Accessories

V Begin : 45°00'00"

V End : 135°00'00"

Use Limit : None

CONT NEW SHOW PAGE

CONT (F1)

To accept changes and return to
TPS1200+/TS30/TM30 Main Menu.

NEW (F2)

To define new vertical limits for telescope rota-
tion.

SHOW (F5)

To position the telescope to its rotation limits.

Description of fields

Field	Option	Description
<V Begin:> <V End:>	Output/User input	Vertical extent of the window in which the instrument is allowed to turn the telescope. The value of the current limit refers to the vertical reading of the present line of sight direction.
<Use Limit:>	None Eyepiece Lens Eyepce & Lens	Telescope turns without any limitation from 0 to 400 gon. The movement of the telescope is limited by the stored Eyepiece Accessories Limits. The movement of the telescope is limited by the stored Lens Accessories Limits. The movement of the telescope is limited by the combination of both areas with the least vertical extend.

Next step

CONT (F1) returns to **TPS1200+/TS30/TM30 Main Menu**.

18.1

Wizard Mode

Description

The settings on this screen define the behaviour of the configuration set wizard.

Access

Select **Main Menu: Config...\General Settings...Wizard Mode**.

OR

Within the configuration set wizard. Refer to "11.2 Accessing Configuration Set Management".

CONFIGURE
Wizard Mode**CONT (F1)**

To accept changes and to return to **TPS1200+/TS30/TM30 Main Menu** or to continue with the subsequent screen within the configuration set wizard.

LIST (F6)

To access **CONFIGURE Quick Access**. Lists all screens within a configuration set. Allows to access these individual screens and change settings.



Description of fields

Field	Option	Description
<Wizard Mode:>	View All Screens	All configuration screens are shown in the configuration set wizard. Application program configuration screens are not included. They can be configured within each application program.
	Reduced	A reduced set of screens are shown in the configuration set wizard.

Next step

CONT (F1) returns to **TPS1200+/TS30/TM30 Main Menu** or continues with the subsequent screen within the configuration set wizard.

18.2

Hot Keys & User Menu

Description

The settings on this screen assign a particular function, screen or application program to each of the first and second level of hot keys, including the user definable Smartkey **F13**, and to the **USER** key. Refer to "2 Configurable Keys" for more information on hot keys and the **USER** key.

Access

Select **Main Menu: Config...\General Settings...\Hot Keys & User Menu**.

OR

Press a hot key configured to access the screen **CONFIGURE Hot Keys & User Menu**. Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

OR

Within the configuration set wizard. Refer to "11.2 Accessing Configuration Set Management".

OR

Hold a hot key down for two seconds. This is also possible after pressing **SHIFT**. This is only valid for TPS1200+ instruments.

CONFIGURE Hot Keys & User Menu, Hot Keys page

To configure the first level of hot keys.



F7 : FUNC Select Free Code
F8 : MGMT Data
F9 : MGMT Reflectors
F10: FUNC ATR On/Off
F11: FUNC EDM IR/RL
F12: FUNC Power Search



CONT (F1)

To accept changes and return to the screen from where this screen was accessed.

PAGE (F6)

To change to another page on this screen.

Description of fields

Field	Option	Description
<F7:> to <F12:>	Choicelist	All functions, screens or application programs which can be assigned to the particular key.
<F13:>	Choicelist	Available for TS30/TM30. All functions, screens or application programs which can be assigned to the user definable Smartkey.

Next step

PAGE (F6) changes to the **Shift Hot Keys** page.

CONFIGURE

Hot Keys & User Menu, Shift Hot Keys page

To configure the second level of hot keys.

The functionality on this page is identical to the one on the **Hot Keys** page.

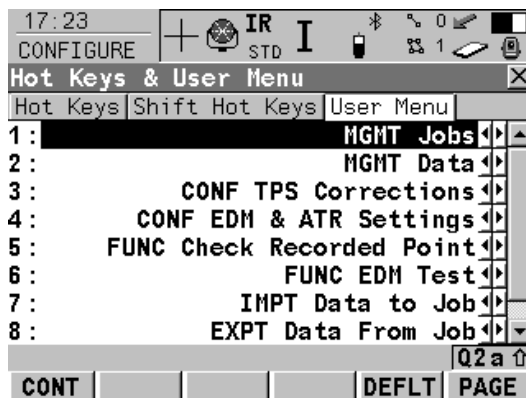
Field	Option	Description
<F7:> to <F10:>	Choicelist	All functions, screens or application programs which can be assigned to the particular key.
<F11:>	Output	The lights, display, beeps and text settings can be edited. Refer to "18.5 Lights, Display, Beeps, Text".
<F12:>	Output	The electronic level is shown. Refer to "31.7 STATUS: Level & Laser Plummet".

Next step

PAGE (F6) changes to the **User Menu** page.

CONFIGURE

Hot Keys & User Menu, User Menu page



CONT (F1)

To accept changes and return to the screen from where this screen was accessed.

PAGE (F6)

To change to another page on this screen.

Description of fields

Field	Option	Description
<1:> to <9:>	Choicelist	All functions, screens or application programs which can be assigned to the individual lines in the user defined menu.

Next step

PAGE (F6) changes to the first page on this screen.

18.3

Units & Formats

Description

The settings on this screen define

- the units for all types of measurement data displayed.
 - information related to some types of measurement data.
 - the order in which coordinates are displayed.
-

Access

Select **Main Menu: Config...\General Settings...\Units & Formats**.

OR

Press a hot key configured to access the screen **CONFIGURE Units & Formats**. Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

OR

Within the configuration set wizard. Refer to "11.2 Accessing Configuration Set Management".

CONFIGURE Units & Formats, Units page

17:27
CONFIGURE + IR STD I 0 1

Units & Formats

Units | Angle | Time | Format

Distance Unit: **Metre (m)**

Distance Dec : 3 Decimals

Angle Unit : 400 gon

Angle Dec : 4 Decimals

Grade Unit : h:v

Area Unit : m²

Volume Unit : m³

Q2 a ↑

CONT PAGE

CONT (F1)

To accept changes and return to the screen from where this screen was accessed.

PAGE (F6)

To change to another page on this screen.

Description of fields

Field	Option	Description
<Distance Unit:>		The units shown for all distance and coordinate related fields.
	Metre (m)	Metres [m]
	Int Ft (fi)	International feet [fi], storage in US feet
	Int Ft/Inch (fi)	International feet [fi], inches and 1/8 inches (0' 00 0/8 fi), storage in US feet
	US Ft (ft)	US feet [ft]
	US Ft/Inch (ft)	US feet, inches and 1/8 inches (0' 00 0/8 fi) [ft]

Field	Option	Description
<Distance Dec:>	From 0 Decimal to 4 Decimals	The number of decimal places shown for all distance and coordinate related fields. This is for data display and does not apply to data export or storage. The available options depend on the selected <Distance Unit:> .
<Angle Unit:>	400 gon, 360 ° ' ", 360° dec or 6400 mil	The units shown for all angular and coordinate related fields. More angle settings can be defined on the Angle page.
<Angle Dec:>	From 2 Decimals to 4 Decimals From 1 Decimal to 3 Decimals 0.1", 1", 5", 10", 60" 4 Decimals 5 Decimals	The number of decimal places shown for all angular and coordinate related fields. This is for data display and does not apply to data export or storage. Available for <Angle Unit: 400 gon> or <Angle Unit: 360° dec>. Available for <Angle Unit: 6400 mil>. Available for <Angle Unit: 360 ° ' ">. Available for TS30/TM30 and <Angle Unit: 6400 mil>. Available for TS30/TM30 and <Angle Unit: 400 gon> or <Angle Unit: 360° dec>.
<Grade Unit:>		The input and output format for grades.

Field	Option	Description
	h:v v:h % (v/h * 100) Elev Angle	Horizontal by vertical distance. Vertical by horizontal distance. Percentage of vertical by horizontal distance. Elevation angle.
<Area Unit:>	m², Int Acres (Ai), US Acres (A), Hectares (ha), ft² or ft²	The units shown for all area related fields.
<Temp Unit:>	Celsius (°C) or Fahrenheit (°F)	The units shown for all temperature related fields.
<Press Unit:>	mbar, mmHg, Inch Hg (inHg), hPa or psi	The units shown for all pressure related fields. psi = pounds per square inch.

Next step

PAGE (F6) changes to the **Angle** page. Refer to paragraph "CONFIGURE Units & Formats, Angle page".

CONFIGURE Units & Formats, Angle page



CONT (F1)

To accept changes and return to the screen from where this screen was accessed.

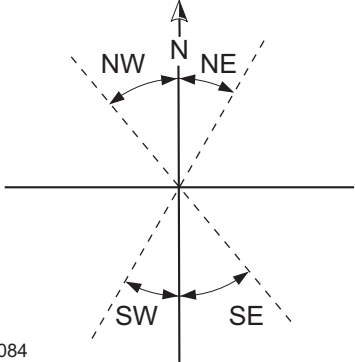


PAGE (F6)

To change to another page on this screen.

Description of fields

Field	Option	Description
<Direc Ref:>	North Azimuth, South Azimuth, North Anti- clock, or Bearing	Sets the reference direction as well as the direction from where and how azimuths are computed. For <Direc Ref: Bearing>, the azimuth/bearing fields in other screens are called <Bearing:>. NE, SW, SE and NW indicate the quadrant of the bearing.

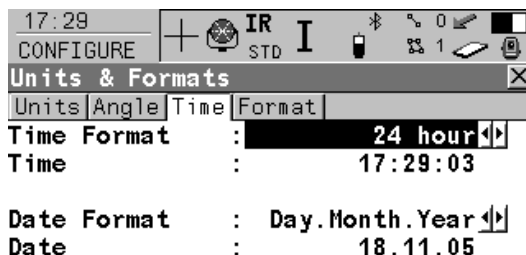
Field	Option	Description
		 GPS12_084 For all other options, the azimuth/bearing fields in other screens are called <Azimuth:>.
<V-Display:>	Zenith Angle Elev Angle Elev Angle %	V = 0 in zenith. V = 0 horizontal elevation angle. V-angles are positive above the horizon and negative below it. V = 0 horizontal. V-angles are expressed in % and are positive above the horizon and negative below it.
<V-Angle:>	Hold after DIST	The vertical angle is fixed after a distance measurement with DIST (F2) , whereas the horizontal angle is continuously updated with the telescope movement.

Field	Option	Description
	Running	The vertical angle is continuously updated with the telescope movement.  The active reflector height is applied in the calculation of remote point elevations. The reflector height must be set to zero to display and record the elevation of the targeted remote point.

Next step

PAGE (F6) changes to the **Time** page. Refer to paragraph "CONFIGURE Units & Formats, Time page".

CONFIGURE Units & Formats, Time page



17:29 CONFIGURE IR STD I 0 1

Units & Formats [X]

Units Angle Time Format

Time Format : 24 hour

Time : 17:29:03

Date Format : Day.Month.Year

Date : 18.11.05

CONT (F1)

To accept changes and return to the screen from where this screen was accessed.



Q2 a ↑

CONT [] [] [] PAGE

PAGE (F6)

To change to another page on this screen.

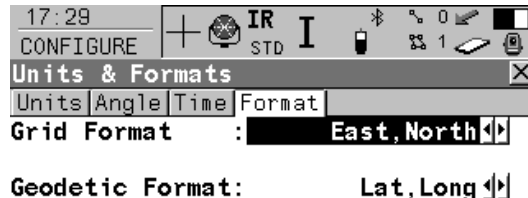
Description of fields

Field	Option	Description
<Time Format:>	24 hour or 12 hour (am/pm)	How the time is shown in all time related fields.
<Date Format:>	Day.Month.Year, Month/Day/Year or Year/Month/Day	How the date is shown in all date related fields.

Next step

PAGE (F6) changes to the **Format** page. Refer to paragraph "CONFIGURE Units & Formats, Format page".

CONFIGURE Units & Formats, Format page



CONT (F1)

To accept changes and return to the screen from where this screen was accessed.

PAGE (F6)

To change to another page on this screen.



Description of fields

Field	Option	Description
<Grid Format:>	East,North or North,East	The order in which grid coordinates are shown in all screens. The order in display masks depends on the user settings.
<Geodetic Format:>	Lat,Long or Long,Lat	The order in which geodetic coordinates are shown in all screens. The order in display masks depends on the user settings.

Next step

PAGE (F6) changes to the first page on this screen.

18.4

Language

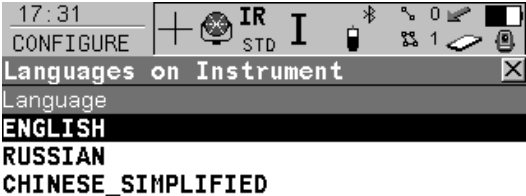
Description

The setting on this screen defines the language used on the instrument. Three languages can be stored on the instrument at one time - English and two others. English cannot be deleted. Refer to "25.2 System Languages".

Access

Select **Main Menu: Config...\General Settings...\Language.**

CONFIGURE
Languages on Instru-
ment



- CONT (F1)**
To accept changes and return to
TPS1200+/TS30/TM30 Main Menu.
- DEL (F4)**
To delete the highlighted language.



Description of fields

Column	Option	Description
<Language:>	Choicelist	Sets the language.

Column	Option	Description
		The selected language is used for the system software. If a language is not available for the system software, the English language is used instead. Application programs run in the language they were loaded.

Next step

CONT (F1) returns to **TPS1200+/TS30/TM30 Main Menu**.

18.5

Lights, Display, Beeps, Text

Description

The settings on this screen allow the lights and screen appearance to be configured, turn the notification beeps on and off and define the behaviour of the keys.

Access

Select **Main Menu: Config...\General Settings...\Lights, Display, Beeps, Text.**
OR
Press **SHIFT F11**.

CONFIGURE

Lights, Display, Beeps,
Text,
Lights page

17:56 CONFIGURE IR STD I [Icons]

Lights, Display, Beeps, Text

Lights Display Beeps Text

Redlaser : On

Laser Guide : On

Intensity : 50%

Reticule : Off

Intensity : 50%

CONT PAGE Q2 a

CONT (F1)

To accept changes and return to
TPS1200+/TS30/TM30 Main Menu.

PAGE (F6)

To change to another page on this screen.

Description of fields

Field	Option	Description
<Redlaser:>	On or Off	To turn the redlaser of RL EDM on and off.

Field	Option	Description
<EGL:>	On or Off	To turn the Emitting Guide Light (EGL) on and off. This field is only available if EGL is fitted
<Laser Guide:>	On or Off	To turn the Laser Guide (GUS74) on and off. This field is only available if GUS74 is fitted
<Intensity:>	From 0 % to 100 %	To adjust the EGL/Laser Guide intensity using the left and right arrow keys.
<Reticule:>	On or Off	To turn the reticule illumination on and off.
<Intensity:>	From 0 % to 100 %	To adjust the reticule illumination intensity using the left and right arrow keys.

Next step

PAGE (F6) changes to the **Display** page.

CONFIGURE
Lights, Display, Beeps,
Text,
Display page

This page contains the screen display settings for the TPS1200+/TS30/TM30 instrument.

17:11

CONFIGURE

IR STD I

Lights, Display, Beeps, Text

Lights Display Beeps Text

Touch Screen : Off

Screen Beep : Off

Screen Illum : On for 1 min

Key Illum : Off

Contrast : 50%

Heating : Off

CONT CALIB PAGE

CONT (F1)

To accept changes and return to the screen from where this screen was accessed.

CALIB (F5)

To calibrate the touch screen.

PAGE (F6)

To change to another page on this screen.

Description of fields

Field	Option	Description
<Touch Screen:>	On or Off	Turns touch screen on and off.
<Screen Beep:>	Off, Soft or Loud	Controls the beep upon touching the touch screen.
<Screen Illum:>	Always On, On for 1 min, On for 2 min, On for 5 min	Controls the screen illumination to be on, or on for the specified time after the last key was pressed.

Field	Option	Description
<Key Illum:>	Off, Same as Screen or Always On	Controls the keyboard illumination.
<Brightness:>	From 1 to 5	To adjust the screen brightness.

Next step

PAGE (F6) changes to the **Beeps** page.

CONFIGURE

Lights, Display, Beeps,
Text,
Beeps page

18:02
CONFIGURE + IR STD I [Icons]
Lights, Display, Beeps, Text [X]
Lights | Display | Beeps | Text
Warning Beeps: Loud [Left] [Right]
WarnBeeps RCS: Off [Left] [Right]
Key Beeps : Loud [Left] [Right]
Key Beeps RCS: Off [Left] [Right]
Hz-Sectr Beep: Off [Left] [Right]
Sector Angle : 100.0000 g
CONT [] [] [] [] Q2 a ↑
PAGE

CONT (F1)

To accept changes and return to the screen from where this screen was accessed.

PAGE (F6)

To change to another page on this screen.

Description of fields

Field	Option	Description
<Warning Beeps:>	Off, Soft or Loud	Controls the beep for acoustic warning signals for the TPS1200+/TS30/TM30 instrument.
<WarnBeeps RCS:>	Off, Soft or Loud	Controls the beep for acoustic warning signals for the RX1200 controller.
<Key Beeps:>	Off, Soft or Loud	Controls the beep upon key presses for the TPS1200+/TS30/TM30 instrument.
<Key Beeps RCS:>	Off, Soft or Loud	Controls the beep upon key presses for the RX1200 controller.
<Hz-Sectr Beep:>	On or Off	Turns the Hz-sector beep on and off. The instrument beeps when within 5 gon/4°30' of the defined sector, there is a long and consistent beep within 0.5 gon/27' and no beep within 0.005 gon/16".
<Sector Angle:>	User input	Input field for sector angle for which a beep should sound.

Next step

PAGE (F6) changes to the **Text** page.

CONFIGURE

Lights, Display, Beeps,
Text,
Text page

18:03
CONFIGURE
Lights, Display, Beeps, Text
Lights Display Beeps Text
Key Rpt Delay: 0.2 sec

Alpha Mode : Function Keys

Deflt αNum : ABCDEFGHIJKLMNOP

CONT (F1)

To accept changes and return to the screen from where this screen was accessed.

CONT Q2 a PAGE

PAGE (F6)

To change to another page on this screen.

Description of fields

Field	Option	Description
<Key Rpt Delay:>	User input	Key repeat delay is the time between the initial key press and when the key starts repeating. For example in numeric mode press and hold 1. Behaviour on screen: 1 - delay - 11111111111. In alpha mode the focus stays on one field and scrolls through the available characters: S - delay - T U 7 S T U 7. Time between the initial key press and when the key starts repeating. Alphanumeric, numeric, CE or arrow keys in all general screens are delayed by the specified time.

Field	Option	Description
<Alpha Mode:>	Function Keys or Numeric Keys	Alphanumeric input can either be through function or numeric keys.
<Deflt αNum:>	Up to 6 choices	Available if <Alpha Mode: Function Keys >. Sets the set of extra characters available through αNUM or on F1-F6 whenever an entry is made. The choices available depend on the character sets loaded on the instrument and the language configured to be used on the instrument.

Next step

PAGE (F6) changes to the next page.

Description

- The settings on this screen
 - define the instrument start up screen.
 - define the behaviour of the instrument and SmartAntenna when starting up and when powering down.
 - define a PIN code which needs to be entered when starting up the instrument.

Start Up

- The screen entered after turning on the instrument can be configured.

Power Down

- Once power is restored after a power loss the instrument returns to the screen in which it was operating when the power failed. After restarting, the instrument uses the same job and configuration set as before the power loss. If either the job or configuration set are not available the first in the list is used.
- Two types of power loss could be experienced:
 - Sudden power loss: Internal or external battery being removed
 - Gradual power loss: Internal or external battery running down naturally

PIN Code

- A **P**ersonal **I**dentification **N**umber protection can be activated.

Type	Description
PIN protection active	Instrument prompts for PIN code entry

Type	Description
	• after starting up. • when changing the PIN code in CONFIGURE Start Up & Power Down.
PIN code generation	By the user.
Attempts for correct PIN code	Five. After five false attempts, a Personal UnbloCking code must be typed in.
PUK code generation	• By Leica Geosystems. • For instruments delivered with firmware version 2.10 or higher, the PUK code comes with the instrument. • For instruments delivered with firmware versions lower than v2.10, contact a Leica representative to obtain a PUK code.

Access

Select **Main Menu: Config...\General Settings...\Start Up & Power Down**.

OR

Within the configuration set wizard. Refer to "11.2 Accessing Configuration Set Management".

CONFIGURE

Start Up & Power Down Start Up & Power Down page

07:31

CONFIGURE

Start Up & Power Down

Start Up & Power Down | PIN Code

Start Screen : Main Menu

Power Down : With Confirmation

Auto Power Down Behaviour

Mode : Remain On

After Time : 10 min

SmartAntenna

Switch Off : After 5 Min(s)

Q2 a ↑

CONT PAGE

CONT (F1)

To accept changes and return to
TPS1200+/TS30/TM30 Main Menu.

Description of fields

Field	Option	Description
<Start Screen:>	Choicelist	Determines the first screen which is shown after turning on the instrument.
<Power Down:>	With Confirmation Directly	Sets the behaviour of the instrument shut down. Instrument shut down must be confirmed. The instrument is shut down immediately without confirmation.
<Mode:>	Turn Off	The instrument turns off if no events have occurred after the time set in <After Time:>.

Field	Option	Description
	Remain On	The instrument does not power down automatically.
<After Time:>	User input	Available unless <Mode: Remain On> is selected. Minutes after which the instrument should turn off.
<Power Source:>	Battery Int Battery Ext	Available for TS30/TM30. Determines the power source to be used when internal and external battery are attached at the same time. The instrument uses the internal battery. The instrument uses the external battery.
<Switch Off:>	Choicelist	This option determines when SmartAntenna is turned off. The selected time is activated whenever SmartStation leaves GPS mode. This option is directly linked to <Switch Off:> in CONFIGURE Logging of Raw Obs . Refer to "22.6 Logging of Raw Obs" for details.
<Switch On:>	If Device Found If ATX Found	Device attached to port 2 are automatically powered up. SmartAntenna attached to port 2 is automatically powered up.

Next step

PAGE (F6) changes to the **PIN Code** page.

CONFIGURE Start Up & Power Down, PIN Code page

- The appearance of the screen varies with the setting for <Use PIN:> when this screen is accessed.

<Use PIN: No>

No PIN code has been set before.

- The PIN code protection can be activated.
- Then a PIN code can be typed in.

07:39	+	IR	I	Bluetooth	Wi-Fi	Battery
CONFIGURE						
Start Up & Power Down						
Start Up & Power Down PIN Code						
Use PIN	:	No				
New PIN	:	-----				

					Q2 a ↑
CONT					PAGE

<Use PIN: Yes>

A PIN code has been set before.

- The PIN code must be typed in order to change settings on this page.
- Then the PIN code protection can be deactivated.
- Or the PIN code can be changed.

07:39	+	IR	I	Bluetooth	Wi-Fi	Battery
CONFIGURE						
Start Up & Power Down						
Start Up & Power Down PIN Code						
PIN Code	:	12345				
Use PIN	:	Yes				
Change PIN	:	No				
New PIN	:	-----				

					Q2 a ↑
CONT					PAGE

Description of fields

Field	Option	Description
Use PIN	Yes or No	Activates the PIN code protection. This setting is not part of the configuration set.
New PIN	User input	The PIN code must be a number with four to six digits.
PIN Code	User input	The PIN code as previously defined on this page. The correct PIN code must be typed in within five attempts or the PUK code is required. Refer to "1 Instrument Protection with PIN".
Change PIN	Yes or No	Activates <New PIN:> to type in a new PIN code.

Next step

PAGE (F6) changes to the first page on this screen.

19.1

Overall Concept

Terminology

Term	Description
Interface	The procedures, codes and protocols that enable two entities to interact for an exchange of data. Each interface is given a meaningful display name which enables easy distinction between interfaces.
Port	A connection through which a separate device may communicate with the instrument.
Device	The hardware which is connected to the chosen port.

Concept

Table

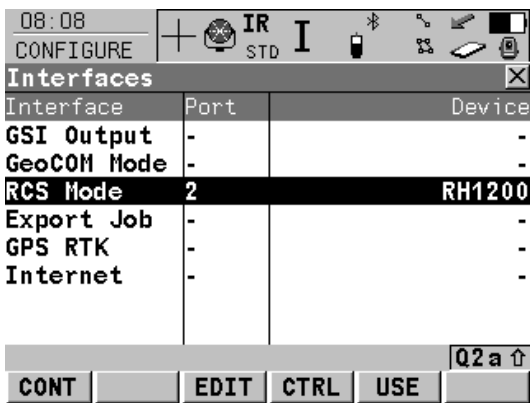
This table gives an overview of the interaction between an interface, port and device.

Concept		Example
Interface	What type of information is to be communicated between the instrument and device ?	RCS Mode
Port	Which port is being used to connect the device to the instrument ?	Port 2(Handle)

Concept		Example
Device	Which device is being connected to the port and what are its communication settings and individual parameters ?	Baud Rate: 115200 Parity: None Data Bits: 8 Stop Bit: 1 Link Number: 1, Set as: Base

Screen

This screen gives an overview of all interfaces with the currently assigned port and device.

Point	Description
1.	 • CONFIGURE Interfaces - EDIT (F3) refers to interface parameters.

Point	Description
	To configure the parameters related to the highlighted interface (switching on/off the interface, port selection, device selection and device communication settings). • CONFIGURE Interfaces - CTRL (F4) refers to device parameters. To configure additional parameters related to the highlighted device. • CONFIGURE Interfaces - USE (F5) enables the immediate turning on/off of an interface, without the need for editing/configuring. The last used settings are automatically recalled.
2.	One port can only connect to one device at a time.
3.	One port may be used by more than one interface at a time.

Further information

IF more information is required on	THEN
interfaces	Refer to "19.2 Interfaces"
ports	Refer to "19.3 Ports"
devices	Refer to "19.4 Devices"
EDIT (F3) interface parameters	Refer to "20 Config...\Interfaces... - Editing The Interface"
CTRL (F4) device parameters	Refer to "21 Config...\Interfaces... - Controlling The Device"

19.2

19.2.1

Description

Interfaces

Overview of Interfaces

- The instrument has various interfaces configured to be used with a port and a device. The configuration varies depending on the individual application.
- Additional interfaces are always available when the instrument is fitted with Communication side cover. Communication side cover is used by RadioHandle with RCS and by SmartAntenna Adapter with SmartStation.

Available interfaces

TPS1200+

without Communication side cover

08:10		
CONFIGURE		
IR STD I		
Interfaces		
Interface	Port	Device
GSI Output	-	-
GeoCOM Mode	-	-
RCS Mode	1	TCPS27
Export Job	-	-
Q2 a ↑		
CONT	EDIT	CTRL USE

TPS1200+/TS30/TM30

with Communication side cover

11:38		
CONFIGURE		
IR STD I		
Interfaces		
Interface	Port	Device
GSI Output	-	-
GeoCOM Mode	-	-
RCS Mode	2	RH1200
Export Job	-	-
GPS RTK	-	-
Internet	-	-
Q2 a ↑		
CONT	EDIT	CTRL USE

19.2.2

Accessing CONFIGURE Interfaces

Access

Select **Main Menu: Config...Interfaces...**

OR

Press a hot key configured to access the screen **CONFIGURE Interfaces**.

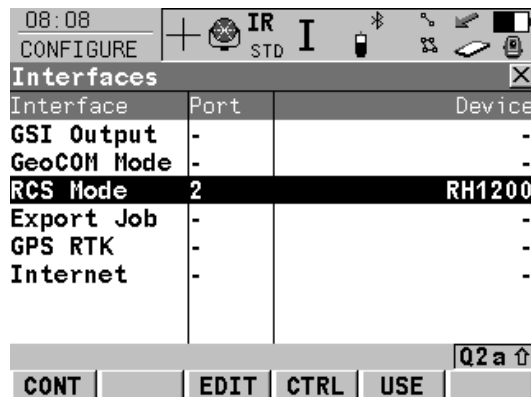
Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

CONFIGURE Interfaces

- The screen gives an overview of all interfaces with the currently assigned port and device.
- The number of interfaces, ports and devices increases when the instrument is fitted with Communication side cover.



Interface	Port	Device
GSI Output	-	-
GeoCOM Mode	-	-
RCS Mode	2	RH1200
Export Job	-	-
GPS RTK	-	-
Internet	-	-

Q2a ↑

CONT EDIT CTRL USE

CONT (F1)

To return to the screen from where this screen was accessed.

EDIT (F3)

To configure the parameters related to the highlighted interface.

CTRL (F4)

Available for certain devices connected to certain interfaces. To configure additional parameters.

USE (F5)

To turn the highlighted interface on or off. If the interface is turned on then the settings which were last used with that interface are active. If the device which was last used with that interface is no longer available, the RS232 is assigned to that interface.

SHIFT CONEC (F4) and SHIFT DISCO (F4)

Available for a real-time interface configured to use a device of type digital cellular phone or modem. To dial the number of another station configured in the active configuration set and to hang up again.

Next step

IF	THEN
an interface is to be turned on/off, a port is to be selected or a device is to be selected	Highlight the interface and EDIT (F3) . Refer to "20 Config...\Interfaces... - Editing The Interface"
a device attached to an interface is to be configured	Highlight the relevant interface and CTRL (F4) . Refer to "21 Config...\Interfaces... - Controlling The Device"
an interface is to be turned on/off	Highlight the relevant interface and USE (F5) .

19.3

Ports

Description

- The instrument is always fitted with the port located at the instrument base (port 1). Additional ports are available when Communication side cover is fitted (port 2 and port 3).
- The list of available devices always depends on the selected port.

Available ports

Type

TPS1200+ without Communication side cover	Port	TPS1200+/TS30/TM30 with Communication side cover
5 pin LEMO-0 for power and/or communication	Port 1	For power and/or communication For TPS1200+: 5 pin LEMO-0 For TS30/TM30: 8 pin LEMO-1
not applicable	Port 2 (Handle)	Hotshoe connection for RadioHandle with RCS and SmartAntenna Adapter with SmartStation
not applicable	Port 3 (BT)	Bluetooth module for communication with only Bluetooth capable devices.

Location

Port	Description
Port 1	This port is located at the base of the instrument and is always available.
Port 2 (Handle)	This port is located on top of Communication side cover.
Port 3 (BT)	This port is housed within Communication side cover.

19.4

19.4.1

Description

Devices

Overview of Devices

- A device is the hardware which is connected to the chosen port. Devices are used to transmit and receive measurement data in TPS mode and GPS real-time data in GPS mode. Devices are also used by TPS1200+/TS30/TM30 to communicate with the RX1200 controller.
- Before using any device with TPS1200+/TS30/TM30 it is necessary to configure the interface with which it will be used. Refer to "20 Config...\Interfaces... - Editing The Interface" for information on how to configure interfaces.
- Some devices may be used with different interfaces for different applications. For example, a radio can be used for remote control with TPS1200+/TS30/TM30 but also to send GeoCOM commands from a computer to TPS1200+/TS30/TM30.

Further information

IF more information is required on	THEN
digital cellular phones	Refer to "19.4.5 Device - Digital Cellular Phones".
modems	Refer to "19.4.6 Device - Modems".
radios for GPS real-time	Refer to "19.4.7 Device - Radios for GPS Real-Time".
radios for remote control	Refer to "19.4.8 Device - Radios for Remote Control".
RS232	Refer to "19.4.9 Device - RS232".
GPRS / Internet Devices	Refer to "19.4.10 Device - GPRS / Internet Devices".

19.4.2

Accessing CONFIGURE Devices / CONFIGURE GPRS Internet Devices

Description

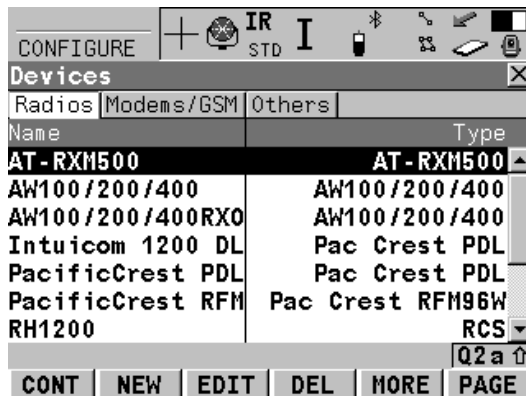
- Allows devices to be created, edited, selected and deleted.
- Refer to "21 Config...\Interfaces... - Controlling The Device" for more information.

Access step-by-step

Step	Description
1.	Main Menu: Config...\Interfaces...
2.	Highlight the appropriate interface based on the type of device that needs to be configured. For example, highlight Real-Time when a radio is to be configured.
3.	EDIT (F3) to access CONFIGURE XX .
4.	DEVICE (F5) to access CONFIGURE Devices / CONFIGURE GPRS Internet Devices . Refer to paragraph "CONFIGURE Devices; CONFIGURE GPRS Internet Devices".

CONFIGURE
Devices;
CONFIGURE GPRS
Internet Devices

This screen may consist of several pages and provides different devices for selection depending on which interface the screen was accessed from. The functionality described below is always the same.



CONT (F1)

To select the highlighted device and return to the screen from where this screen was accessed.

NEW (F2)

To create a new device. Refer to "19.4.3 Creating a New Device".

EDIT (F3)

To edit the highlighted device. Refer to "19.4.4 Editing a Device".

DEL (F4)

To delete the highlighted device.

MORE (F5)

To display information about the type of device and the creator of the device.

PAGE (F6)

To change to another page on this screen.

SHIFT ALL (F4) or SHIFT FILT (F4)

Available for Internet and bluetooth devices. To list all devices or to hide devices which are not Internet or bluetooth capable.

SHIFT DEFLT (F5)

To recall previously deleted default devices and to reset default devices to the default settings.

Description of columns

Column	Description
Name	Names of available devices.
Type	Type of device defined when creating the device.
Creator	The creator of the device. The creator can either be Default if the device is a default, or User if the device has been created.  If a Default device is edited by using EDIT (F3) then its creator is still displayed as Default.

Next step

IF the desired device is	THEN
present in the list	highlight the desired device. CONT (F1) to close the screen and to return to the screen from where CONFIGURE Devices / CONFIGURE GPRS Internet Devices was accessed.
is not present in the list	NEW (F2) . Refer to "19.4.3 Creating a New Device".
is present in the list but needs to be edited	highlight the desired device. EDIT (F3) . Refer to "19.4.4 Editing a Device".

19.4.3

Creating a New Device

Description

Allows a new device to be configured.

Access step-by-step

Step	Description
1.	Refer to "19.4.2 Accessing CONFIGURE Devices / CONFIGURE GPRS Internet Devices" to access CONFIGURE Devices / CONFIGURE GPRS Internet Devices .
2.	Highlight a device of the same type as the device to be created, from the list.
3.	NEW (F2) to access CONFIGURE New Device .

CONFIGURE New Device

08:17 CONFIGURE IR STD I

New Device

Name : new radio

Type : RCS

Baud Rate : 115200

Parity : None

Data Bits : 8

Stop Bit : 1

STORE Q2 a ↑

STORE (F1)

To store the new device and to return to the screen from where this screen was accessed.

ATCMD (F4)

Available for digital cellular phones and modems. To configure communication commands. Refer to paragraph "Editing a Device".

Description of fields

Field	Option	Description
<Name:>	User input	Name of new device.
<Type:>	Output	Same device type as was highlighted when NEW (F2) was used.
<Baud Rate:>	From 300 to 115200	Frequency of data transfer from instrument to device in bits per second.
<GPRS/Internet:>	Yes or No	Available for digital cellular phones and modems. Defines the device as an Internet capable device and adds it to the list in CONFIGURE GPRS Internet Devices .
<Parity:>	None , Odd or Even	Error checksum at the end of a block of digital data.
<Terminator:>	CR/LF CR	To define the terminator. The terminator is a carriage return followed by a line feed. Not available for RS232 GeoCOM and TCPS27 device. The terminator is a carriage return.
<Data Bits:>	7 or 8	Number of bits in a block of digital data.
<Stop Bits:>	1 or 2	Number of bits at the end of a block of digital data.

Field	Option	Description
<Flow Control:>	None or RTS/CTS	Available for some devices. Activates hardware handshake. When the receiver/device is ready for data, it asserts the Request To Send line indicating it is ready to receive data. This is read by the sender at the Clear To Send input, indicating it is clear to send the data.

Next step

IF the device is a	THEN
radio or device other than digital cellular phone or modem	STORE (F1) to close the screen and to return to the screen from where CONFIGURE Device was accessed.
digital cellular phone or modem	ATCMD (F4) . Refer to paragraph "Editing a Device".

CONFIGURE GSM/Modem AT Command Lines

For <GPRS/Internet: Yes> in **CONFIGURE New Device**, this screen consists of two pages:

GSM/CSD page: The AT commands configure the devices for normal digital cellular phone/modem mode.

GPRS/Internet page The AT commands configure the devices for GPRS/Internet mode. Please refer to the manual of the GPRS / Internet device for information about which AT commands need to be entered or contact the supplier.

The following table lists the fields of both pages.

Description of fields

Field	Option	Description
<Init 1:>	User input	Initialisation sequence to initialise digital cellular phone/modem.
<(cont):>	User input	Allows the <Init X:> or the <Connect:> string to continue onto a new line.
<Init 2:>	User input	Initialisation sequence to initialise digital cellular phone/modem.
<Dial:>	User input	Dialing string used to dial the phone number of the real-time reference.
<Hangup:>	User input	Hangup sequence used to end the network connection.
<Escape:>	User input	Escape sequence used to switch to the command mode before using the hangup sequence.
<Connect:>	User input	Dialing string used to dial into the Internet.

When the device is used, between <Init 1:> and <Init 2:>, a check for the PIN is performed. Refer to "Appendix G AT Commands" for more information about AT commands.

Next step

STORE (F1) returns to **CONFIGURE Devices / CONFIGURE GPRS Internet Devices**.

19.4.4

Editing a Device

Access step-by-step

Step	Description
1.	Refer to "19.4.2 Accessing CONFIGURE Devices / CONFIGURE GPRS Internet Devices" to access CONFIGURE Devices / CONFIGURE GPRS Internet Device .
2.	Highlight the device to be edited from the list.
3.	EDIT (F3) to access CONFIGURE Edit Device .

CONFIGURE Edit Device

The availability of options may change depending on the selected device. Most fields are identical with the creation of a new device. Refer to "19.4.3 Creating a New Device" for information on the fields.

Next step

STORE (F1) to close the screen and to return to the screen from where **CONFIGURE Edit Device** was accessed.

19.4.5

Device - Digital Cellular Phones

Description

Digital cellular phones comprise of the technologies CDMA and GSM with its subgroup GPRS.

Typical uses

- To transmit real-time data.
- To receive real-time data.
- To download raw observations from a remote location.
- To steer a receiver.

Example use

Step	Description
1.	Reference and rover must both be equipped with a digital cellular phone.
2.	Ensure that the digital cellular phone at the reference is on.
3.	The rover digital cellular phone contacts the selected reference of which the phone number was pre-defined. Refer to "19.4.3 Creating a New Device".
4.	One rover can dial in to the reference digital cellular phone at a time.
5.	As soon as the reference digital cellular phone is contacted, real-time data is sent to the rover digital cellular phone that has called.
	Several digital cellular phone numbers can be pre-defined on the rover. Dialing a different number dials that particular reference station.

Requirements for using digital cellular phones

Always required:

- AT command language must be supported by the digital cellular phone. Refer to "19.4.3 Creating a New Device".
- Working area must be covered by a digital cellular phone network.

Sometimes required:

- The network operator must support data transmission.
- SIM card. This is the same SIM card as normally used in mobile phones. The SIM card must be enabled to transmit data. Contact the service provider to enable the SIM card.
- **Personal Identification Number**
- Registration

Supported digital cellular phones

Default digital cellular phones fitting into a clip-on-housing

- CDMA MultiTech MTMMC-C (US)
- CDMA MultiTech MTMMC-C (CAN)
- Siemens MC75
-

Default digital cellular phones not fitting into a clip-on-housing

These digital cellular phones must be connected with a cable. Refer to "Appendix E Cables" for information on cables.

- Siemens M20
- Siemens S25/S35i
- Siemens TC35
- Wavecom M1200 Series

These digital cellular phones can be connected via bluetooth or cable using the implemented standard device provided for the below mentioned cellular phone manufacturers.

- Motorola RAZR v3
- Motorola E1000
- Nokia 6021
- Siemens S55
- Siemens S65
- Siemens S65v

- Nokia 6230(i)
- Nokia 6310(i)
- Nokia 6630
- Nokia 6822a
- Nokia N80
- Siemens M75
- SonyEricsson K700i
- SonyEricsson K750i
- SonyEricsson K800i
- SonyEricsson P900
- SonyEricsson S700i
- SonyEricssonT610

User defined digital cellular phones

Other digital cellular phones than those listed above can be used. Their settings must be defined by creating a new digital cellular phone configuration. Refer to "19.4.3 Creating a New Device". These digital cellular phones must be connected with a cable. Refer to "Appendix E Cables" for information on cables. Please contact the local selling unit or dealer for further information.

Advantages

- Unlimited range of the data link between reference and rover.
- Free of jamming from other users.
- Cheaper in price in the initial costs of buying.

Disadvantages



Fees are charged for the time that the digital cellular phone network is being used.

Reference and rover can both be equipped with a digital cellular phone and a radio. On the reference they operate simultaneously. On the rover, use the radio when within radio range of the reference and the digital cellular phone when radio reception is not possible.

19.4.6

Device - Modems

Typical uses

- To transmit NMEA messages.
- To transmit real-time data
- To download raw observations from a remote location.

Example of use

Step	Description
1.	The reference is equipped with a modem.
2.	The rover is equipped with a digital cellular phone.
3.	Ensure that the modem is switched on.
4.	The rover digital cellular phone contacts the selected reference of which the phone number was pre-defined. Refer to "19.4.3 Creating a New Device".
5.	One rover can dial in to the reference modem at a time.
6.	As soon as the reference modem is contacted, it sends its data to the rover digital cellular phone that has called.
	Several modem numbers can be pre-defined on the rover. Dialing a different number changes the reference station.

Requirements for using modem

AT command language must be supported by the modem. Refer to "19.4.3 Creating a New Device".

Supported modems

Default modems

- AirLink CDMA
- U.S. Robotics 56K

Modems must be connected with a cable. Refer to "Appendix E Cables" for information on cables.

User defined modems

Other modems than those listed above can be used. Their settings must be defined by creating a new modem configuration. Refer to "19.4.3 Creating a New Device".

Typical uses

- To transmit real-time data.
- To receive real-time data.
- To download raw observations from a remote location.
- To steer a receiver.

Example of use

Step	Description
1.	Reference and rover must both be equipped with radios using the same frequency range and the same data format.
2.	The reference radio continuously sends out real-time data until the receiver is turned off, the configuration is changed or the radio is detached.
3.	The rover radio continuously receives real-time data until the receiver is turned off, the configuration is changed or the radio is detached.
4.	Several rovers can receive data from the same reference at the same time.
	Several reference radios can transmit real-time data simultaneously using different radio channels. Changing to a different radio channel on the rover changes the reference from which real-time data is received.

Supported radios**Default radios fitting into a clip-on-housing**

- Intuicom 1200 Data Link
- Pacific Crest PDL, receive
- Satelline 3AS, transceive

Default radios not fitting into a clip-on-housing

These radios must be connected with a cable. Refer to "Appendix E Cables" for information on cables.

- AT-RXM500, Akasaka Tech
- Pacific Crest RFM96W
- Satelline 2ASx
- Satelline 2ASxE

User defined radios

Other radios than those listed above can be used. Their settings must be defined by creating a new radio configuration. Refer to "19.4.3 Creating a New Device". These radios must be connected with a cable. Refer to "Appendix E Cables" for information on cables.

Reference and rover can both be equipped with a radio and a digital cellular phone. On the reference they operate simultaneously. On the rover, use the radio when within radio range of the reference and the digital cellular phone when radio reception is not possible.



19.4.8

Device - Radios for Remote Control

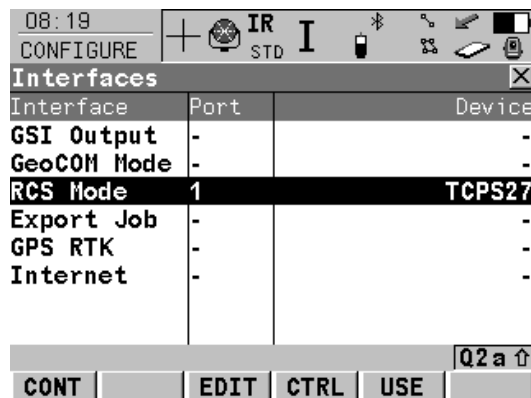
Typical uses

- To remote control the TPS1200+/TS30/TM30.
- To transmit data between TPS1200+/TS30/TM30 and computer.

Supported radios

- The default radios used with TPS1200+/TS30/TM30 for remote control are RadioHandle and TCPS27. TPS1200+/TS30/TM30 has to be set to the correct communication mode to send and receive data and commands via the radio. A radio is also integrated in the RX1250T/RX1250Tc controller to allow communication. Refer to RX1200 User Manual for more information.
- Communication side cover must be fitted to TPS1200+/TS30/TM30 when operating with RadioHandle.

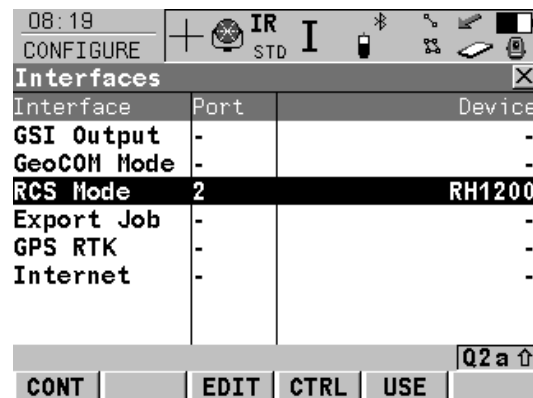
TPS1200+ interface settings with TCPS27



The screenshot shows the 'Interfaces' configuration screen. At the top, there is a status bar with the time '08:19', a 'CONFIGURE' button, and various icons including a plus sign, a radio, 'IR STD', a battery, and a signal strength indicator. Below the status bar, the title 'Interfaces' is followed by a close button 'X'. The main area is a table with three columns: 'Interface', 'Port', and 'Device'. The 'RCS Mode' row is highlighted in black, showing '1' in the Port column and 'TCPS27' in the Device column. Other rows include 'GSI Output', 'GeoCOM Mode', 'Export Job', 'GPS RTK', and 'Internet', all with dashes in the Port and Device columns. At the bottom, there is a navigation bar with buttons for 'CONT', 'EDIT', 'CTRL', 'USE', and a 'Q2 a ↑' button.

Interface	Port	Device
GSI Output	-	-
GeoCOM Mode	-	-
RCS Mode	1	TCPS27
Export Job	-	-
GPS RTK	-	-
Internet	-	-

TPS1200+/TS30/TM30 interface settings with RadioHandle



The screenshot shows the 'Interfaces' configuration screen for the TPS1200+/TS30/TM30. It has the same layout as the previous screenshot, with a status bar at the top and a 'Q2 a ↑' button at the bottom. In this configuration, the 'RCS Mode' row is highlighted in black, showing '2' in the Port column and 'RH1200' in the Device column. Other rows include 'GSI Output', 'GeoCOM Mode', 'Export Job', 'GPS RTK', and 'Internet', all with dashes in the Port and Device columns.

Interface	Port	Device
GSI Output	-	-
GeoCOM Mode	-	-
RCS Mode	2	RH1200
Export Job	-	-
GPS RTK	-	-
Internet	-	-

User defined radios

Other radios than the default radios can be used. Their settings must be defined by creating a new radio configuration. Refer to "19.4.3 Creating a New Device". These radios must be connected with a cable. Refer to "Appendix E Cables" for information on cables.

19.4.9

Device - RS232

Typical uses

- To exchange information with a device via an RS232 interface.
- RS232_GeoCOM can be used to control the instrument via GeoCOM commands from a computer.
- RS232_GSI can be used to send data from the instrument to a computer.
- Port 1 is used to connect to RS232 devices with a cable. Refer to "Appendix E Cables" for information on cables.

Example of use

Step	Description
1.	A device with an RS232 interface must be connected to the instrument.
2.	Information can be exchanged between the instrument and the device. For example measurement data can be continuously sent out from the instrument. Commands to steer the instrument are sent from an external device.
3.	A connection is maintained until the instrument is turned off, the configuration is changed or the device is detached.

Supported RS232

Default RS232 devices

- RS232
- RS232_GSI
- RS232_GeoCOM

User defined RS232

All settings can be defined.

Description

- GPRS is a telecommunication standard for transmitting data packages using the Internet Protocol.
- When using GPRS technology charges are made based on the amount of transferred data and not as for normal digital cellular phones where charges are made for the connection time.

Typical uses

To access the Internet with SmartStation in order to receive real-time data from the Internet.

Example use

Step	Description
	This is an example use for receiving data from the Internet.
1.	SmartStation must be equipped with a GPRS / Internet device.
2.	The GPRS / Internet device accesses the Internet where SmartStation connects for example to NTRIP.
3.	SmartStation receives real-time corrections from this other computer in the Internet.

Requirements for using GPRS / Internet devices

- AT command language must be supported by the digital cellular phone. Refer to "19.4.3 Creating a New Device".
 - **Access Point Name** of a server from the network provider. The APN can be thought of as the home page of a provider supporting GPRS data transfer.
 - SIM card. This is the same SIM card as normally used in mobile phones. The SIM card must be enabled to transmit data. Contact the service provider to enable the SIM card.
 - **Personal Identification Number**
 - Registration
-

Supported GPRS / Internet devices

Default GPRS / Internet devices fitting into a clip-on-housing

- Siemens MC75

User defined GPRS / Internet devices

Other GPRS capable devices than those listed above can be used as long as they use AT commands. Their settings must be defined by creating a new GPRS / Internet device configuration. Refer to "19.4.3 Creating a New Device". These GPRS / Internet devices must be connected with a cable. Refer to "Appendix E Cables" for information on cables. Please contact the local selling unit or dealer for further information.

Advantages

- Unlimited range of the data link between reference and rover.
 - Free of jamming from other users.
 - Fees are charged for the amount of data being transferred.
-

20.1

GSI Output

Description

Data is streamed through the serial port (RS232) and is stored to the active job. GSI data is stored when **<Use Interface: Yes>** and either **ALL (F1)** or **REC (F3)** is pressed. The format of the data depends on the option selected in **<Output Format:>**.

Access step-by-step

Step	Description
1.	Refer to "19.2.2 Accessing CONFIGURE Interfaces" to access CONFIGURE Interfaces
2.	CONFIGURE Interfaces Highlight GSI Output .
3.	EDIT (F3) to access CONFIGURE GSI Output .

CONFIGURE GSI Output

08:28

CONFIGURE

GSI Output

Use Interface: Yes

Port : Port 1

Device : RS232

Protocol : RS232 GSI

GSI Format : GSI8 Polar&Cart.

CONT (F1)

To accept changes and return to the screen from where this screen was accessed.

Q2 a ↑

CONT

DEVICE

DEVICE (F5)

To create, select, edit or delete a device.

Description of fields

Field	Option	Description
<Use Interface:>	Yes or No	Activates the interface.
<Port:>	Output	This field is available when <Use Interface: Yes>. Port to be used.
<Device:>	Output	This field is available when <Use Interface: Yes>. Device to be used.
<Protocol:>		This field is available when <Use Interface: Yes>. Protocol defines if the system expects a handshake or no handshake.

Field	Option	Description
	RS232 GSI	A handshake is required. A data block is sent out from the instrument and a receive confirmation (?) is expected. This handshake requires that GeoCom Mode be activated.
	None	No handshake is required.
<GSI Format:>	Output	This field is available when <Use Interface: Yes> .
	GSI8 Polar&Cart.	GSI Polar and Cartesian (8 data characters) (Point ID, Hz, V, SlopeDist, PPM, E, N, Elev.)
	GSI16 Polar	GSI Polar (16 data characters) (Point ID, Hz, V, SlopeDist, PPM, reflector height)
	GSI16 Cartesian	GSI Cartesian (16 data characters) (E, N, Elev, Reflector Height)
	Pt,N,E,Ht,Date	Coordinate data (Northing BEFORE Easting)
	Pt,E,N,Ht,Date	Coordinate data (Easting BEFORE Northing)
	Pseudo NMEA GGA	Based on NMEA (N ational M arine E lectronics A ssociation), which is a standard for interfacing marine electronic devices.
	GSI8 Polar	GSI Polar (8 data characters) (Point ID, Hz, V, SlopeDist, PPM)
	GSI16 Polar2	GSI Polar (16 data characters) (Point ID, Hz, V, SlopeDist, PPM)

Next step

IF a device is	THEN
not to be created or edited	CONT (F1) closes the screen and returns to the screen from where CONFIGURE GSI Output was accessed.
to be created or edited	DEVCE (F5) to create or edit a device.

Output format - GSI Format

GSI data is transmitted in blocks. Every block consists of several data words, refer to the examples below. Every data word begins with a two character Word Index, the WI code, specifying the data type within this block. Each GSI-8 word has in total 16 characters, consisting of 7 information characters followed by 8 data characters and by the blank character ASCII code 32 at the end of the data word. The GSI-16 block is similar to the GSI-8 block but the block begins with * and the data word contains 16 characters for large values such as UTM coordinates, large alphanumeric codes, attributes or point ID's.

Example 1 shows a GSI-8 block sequence with the words for point ID (11), Easting coordinate (81) and Northing coordinate (82). Example 2 shows a GSI-16 block sequence with the words for point ID (11), horizontal (21) and vertical angle (22).

There are no hardcoded GSI files available

Type	GSI8 Polar&Cart	GSI16 Polar	GSI16 Cartesian
WI 11	Point ID	Point ID	Point ID
WI 21	Azimuth	Azimuth	-

Type	GSI8 Polar&Cart	GSI16 Polar	GSI16 Cartesian
WI 22	V	V	-
WI 31	SlopeDist	SlopeDist	-
WI 51	PPM Total/mm	PPM Total/mm	-
WI 81	East	-	East
WI 82	North	-	North
WI 83	Elev.	-	Elev.
WI 87	Refl. Ht	-	Refl. Ht

Example 1: GSI8

Each word has 16 characters of which 8 characters are used for the data block.

Word 1	Word 2	Word 3
110001+0000A110	81..00+00005387	82..00-00000992
110002+0000A111	81..00+00007586	82..00-00003031
110003+0000A112	81..00+00007536	82..00-00003080
110004+0000A113	81..00+00003839	82..00-00003080
110005+0000A114	81..00+00001241	82..00-00001344

Example 2: GSI16

Each word has 24 characters of which 16 characters are used for the data block.

Word 1	Word 2	Word 3
*110001+000000000PNC0055	21.002+0000000013384650	22.002+0000000005371500

*110002+000000000PNC0056 21.002+0000000012802530 22.002+0000000005255000
 *110003+000000000PNC0057 21.002+0000000011222360 22.002+0000000005433800
 *110004+000000000PNC0058 21.002+0000000010573550 22.002+0000000005817600
 *110005+000000000PNC0059 21.002+0000000009983610 22.002+0000000005171400

GSI Word information

Pos.	Name	Description of values	Applicable for
1-2	Word Index (WI)		
3	No significance	∴ No information.	WI 11, WI 21, WI 22, WI 31, WI 51, WI 81, WI 82, WI 83, WI 87
4	Automatic index information	∴ No information. 0: <Compensator: Off> 3: <Compensator: On>	WI 21, WI 22
5	Input mode	∴ No information. 0: Measured values transferred from instrument 1: Manual input from keyboard 2: Measured value, <Hz-Correction: On>. 3: Measured value, <Hz-Correction: Off>. 4: Result calculated from functions	WI 21, WI 22, WI 31, WI 51, WI 81, WI 82, WI 83, WI 87

Pos.	Name	Description of values	Applicable for
6	Units	.: No information. 0: <Distance Unit: Metre (m)>, last digit 1 / 1000 m 1: <Distance Unit: Us ft (ft)>, last digit 1 / 1000 ft 2: <Angle Unit: 400 gon> 3: <Angle Unit: 360 ° dec> 4: <Angle Unit: 360 ° ' ' ' > 5: <Angle Unit: 6400 mil> 6: <Distance Unit: Metre (m)>, last digit 1 / 10000 m 7: <Distance Unit: Us ft (ft)>, last digit 1 / 10000 ft	WI 21, WI 22, WI 31, WI 81, WI 82, WI 83, WI 87
7	Sign	+: Positive value -: Negative value	WI 21, WI 22, WI 31, WI 51, WI 81, WI 82, WI 83, WI 87
8-15 8-23	Data	Data includes a sequence of 8 (16) numerical or alphanumerical characters.  Certain data blocks are allowed to carry more than one value for example ppm/mm. This data is automatically transferred with the according sign before each single value.	WI 11, WI 21, WI 22, WI 31, WI 51, WI 81, WI 82, WI 83, WI 87
16 24	Sepa- rating character	: Blank	WI 11, WI 21, WI 22, WI 31, WI 51, WI 81, WI 82, WI 83, WI 87

**Output format -
Pt,N,E,Ht,Date**

Format

Point ID, Northing, Easting, Elevation, Date, Time <CR/LF>

Description of fields

The format settings are defined in **CONFIGURE Units & Formats**.

Field	Description
Point ID	Text describing the point identification
Northing	The northing coordinate.
Easting	The easting coordinate.
Elevation	The height coordinate.
Date	The measurement/origination date.
Time	The measurement/origination time.
<CR/LF>	Carriage Return Line Feed

Example

2004,4997.635,6010.784,393.173,09/10/2001,16:34:12.2
2005,4997.647,6010.765,393.167,09/10/2001,16:34:12.4
2006,4997.657,6010.755,393.165,09/10/2001,16:34:12.7

**Output format -
Pt,E,N,Ht,Date**

Format

This output format is identical to the Pt,N,E,Ht,Date format except the order of the Easting and Northing variables are reversed.

Output format - Pseudo NMEA GGA

Description

This output format is based on NMEA (**N**ational **M**arine **E**lectronics **A**ssociation), which is a standard for interfacing marine electronic devices.

Format

\$GPGGA,Time,Northing,N,Easting,E,1,05,1.0,Elevation,M,0.0,M,0.0,0001*99 <CR/LF>

Description of Fields

Field	Description
\$GPGGA	Sentence identification (header including talker identification). A Talker ID appears at the beginning of the header of each NMEA message.
Time	UTC time of position (hhmmss.ss)
Northing	The northing coordinate (always output with 2 decimal places)
N	Fixed text (N)
Easting	The easting coordinate (always output with 2 decimal places)
E	Fixed text (E)
GPS Quality Indicator	Fixed number (1=no real time position, navigation fix)
Number of satellites	Number of satellites in use (00 to 12)
HDOP	Fixed number (1.0)
Elevation	The height coordinate (always output with 2 decimal places)

Field	Description
Elevation units	Elevation units (F or M). The format settings are defined in CONFIGURE Units & Formats, Units page.
Height Geoid	Fixed number (0.0)
Height units	Fixed text (M)
Time since last DGPS update	Fixed number (0.0)
DGPS reference station id	Fixed number (0.0001)
Checksum	Fixed number (*99)
<CR/LF>	Carriage Return Line Feed

Example

```
$GPGGA,171933.97,7290747.02,N,3645372.06,E,1,05,1.0,1093609.54,F,0.0,M,0.0,0.0001*99
$GPGGA,171934.20,7290747.02,N,3645372.06,E,1,05,1.0,1093609.54,F,0.0,M,0.0,0.0001*99
$GPGGA,171934.45,7290747.03,N,3645372.06,E,1,05,1.0,1093609.54,F,0.0,M,0.0,0.0001*99
```



Fields are always separated by a comma. A comma is never placed before the Checksum field. When information for a field is not available, the position in the data string is empty.

20.2

GeoCOM Mode

Description

The GeoCOM Mode permits communication of the TPS1200+/TS30/TM30 with a 3rd party device.

Access step-by-step

Step	Description
1.	Refer to "19.2.2 Accessing CONFIGURE Interfaces" to access CONFIGURE Interfaces
2.	CONFIGURE Interfaces Highlight GeoCOM Mode .
3.	EDIT (F3) to access CONFIGURE GeoCOM Mode .

CONFIGURE GeoCOM Mode

08:27 CONFIGURE IR STD I [Icons]

GeoCOM Mode

Use Interface: **Yes**

Port : Port 1

Device : RS232 GeoCOM

Protocol : RS232 GeoCOM

CONT (F1)

To accept changes and return to the screen from where this screen was accessed.

DEVICE (F5)

To create, select, edit or delete a device.

CONT [] [] [] DEVICE Q2 a ↑

Description of fields

Field	Option	Description
<Use Interface:>	Yes or No	Activates the interface.
<Port:>	Output	Available if <Use Interface: Yes>. Port to be used.
<Device:>	Output	Available if <Use Interface: Yes>. Device to be used.
<Protocol:>	Output	Available if <Use Interface: Yes>. Protocol to be used.
<Terminator:>	Output	The terminator is carriage return followed by a line feed.

Next step

IF a device is	THEN
not to be created or edited	CONT (F1) closes the screen and returns to the screen from where CONFIGURE GeoCOM Mode was accessed.
to be created or edited	DEVCE (F5) to create or edit a device.

20.3

RCS Mode

Description

- RCS stands for Remote Control Surveying.
- This enables the instrument to be remotely controlled by an RX1200 controller.

Access step-by-step

Step	Description
1.	Refer to "19.2.2 Accessing CONFIGURE Interfaces" to access CONFIGURE Interfaces
2.	CONFIGURE Interfaces Highlight RCS Mode .
3.	EDIT (F3) to access CONFIGURE RCS Mode .

CONFIGURE RCS Mode

08:28
CONFIGURE
RCS Mode
Use Interface: Yes
Port : Port 2 (Handle)
Device : RH1200
Protocol : RCS

CONT (F1)

To accept changes and return to the screen from where this screen was accessed.

DEVCE (F5)

To create, select, edit or delete a device.

CONT DEVCE Q2 a ↑

Description of fields

Field	Option	Description
<Use Interface:>	Yes or No	Activates the interface.
<Port:>	Output	Available if <Use Interface: Yes>. Port to be used.
<Device:>	Output	Available if <Use Interface: Yes>. Device to be used.
<Protocol:>	Output	Available if <Use Interface: Yes>. Protocol to be used.

Next step

IF a device is	THEN
not to be created or edited	CONT (F1) closes the screen and returns to the screen from where CONFIGURE RCS Mode was accessed.
to be created or edited	DEVCE (F5) to create or edit a device.

20.4

Export Job

Description

- The Export Job interface allows data from a job to be exported from the instrument to an external device. Refer to "13.4 Exporting Data from a Job to another Device" for information on how to export data via RS232.
- The settings on this screen define the port and the device to which the data should be exported.

Access

Select **Main Menu: Config...\Interfaces....** Highlight **Export Job. EDIT (F3)**.

OR

Select **Main Menu: Convert...\Export Data from Job.** Set **<Export To: RS232>. IFACE (F5)**.

CONFIGURE

Export Job Interface

The availability of the fields depend on the setting for **<Device:>**.

08:29
CONFIGURE
Export Job Interface
Use Device : Yes
Port : Port 1
Device : RS232

CONT (F1)

To accept changes and return to the screen from where this screen was accessed.

DEVICE (F5)

To create, select, edit or delete a device.

CONT [] [] DEVICE Q2 a ↑

Description of fields

Field	Option	Description
<Use Device:>	Yes or No	Activates the interface.
<Port:>	Output	Available if <Use Interface: Yes>. Port to be used.
<Device:>	Output	The device currently assigned to the selected port within the active configuration set. The device which is selected determines the availability of the next fields.

Next step

CONT (F1) returns to the screen from where **CONFIGURE Export Job Interface** was accessed.

Description

- The settings on this screen allow real-time related parameters to be configured. This includes defining if SmartStation should work as a rover and the real-time messages to be used.
- Refer to "22.1 Real-Time Mode" for detailed information.

20.6

Internet

Description

- The Internet interface
 - allows accessing the Internet using SmartStation and normally a GPRS device.
 - can be used together with the Real-Time interface to receive real-time data from a NTRIPCaster via Internet communication. Refer to "34.1 Overview" for information about NTRIP.
- The settings on this screen define the port and parameters required for accessing the Internet.

Access

Select **Main Menu: Config...Interfaces....** Highlight **Internet**. **EDIT (F3)**.

CONFIGURE Internet Interface

08:30
CONFIGURE

Internet Interface

Internet : Yes

Port : Port 2 (Handle)

Device : Siemens MC45

IP Address: Dynamic

Set IP Addr: 192.168.1.3

User ID : abcdef

(cont) : -----

Q2 a ↑

CONT DEVICE

CONT (F1)

To accept changes and return to the screen from where this screen was accessed.

DEVICE (F5)

To create, select, edit or delete a device. Refer to "19.4.2 Accessing CONFIGURE Devices / CONFIGURE GPRS Internet Devices".

Description of fields

Field	Option	Description
<Internet:>	Yes or No	Activates the Internet interface.
<IP Address:>		In order to get access to the Internet, an IP address is required. This IP address identifies the receiver in the Internet.
	Dynamic	The IP address to get access to the Internet is provided by the network provider dynamically. Each time SmartStation wants to access the Internet via the device a new IP address is assigned to the receiver. When using GPRS to connect to the Internet then the network provider always dynamically assigns the IP address.
	Static	The IP address to get access to the Internet is provided by the network provider permanently. Each time SmartStation wants to access the Internet via the device the same IP address identifies Smart-Station. This is important if SmartStation is used as a TCP/IP server. This option should only be selected if a static IP address is available for SmartStation.
<Set IP Adr:>	User input	Available for <IP Address: Static> . To set the IP address.
<User ID:>	User input	Some providers ask for a user ID to allow connecting to the Internet via GPRS. Contact your provider if a user ID needs to be used.

Field	Option	Description
		It is possible to show/hide the User ID. Refer to "28 Tools...\Licence Keys" for further details.
<(cont):>	User input	Allows the <User ID:> string to continue onto a new line.
<Password:>	User input	Some providers ask for a password to allow connecting to the Internet via GPRS. Contact your provider if a password is required.

Next step

CONT (F1) returns to the screen from where **CONFIGURE Internet Interface** was accessed.

21.1

Digital Cellular Phones

21.1.1

Overview

Description

For digital cellular phones, information such as

- the reference stations that can be contacted
- the phone numbers of the reference stations and
- the type of protocol to be used

can be defined.

Changing the reference station to be dialled is of interest in two cases.

Case 1: Two real-time reference stations, each equipped with a digital cellular phone, are set up at two locations belonging to different network providers.

When leaving the area of one reference, the station can be changed and the other reference can be called.

Case 2: Set up as in case 1.

Two separate fixes from each reference for each point can be obtained, providing redundancy for future least squares adjustment operations.

Technologies

CDMA

Code **D**ivision **M**ultiple **A**ccess is a high speed data transmission for very effective and flexible use of available resources such as band width. Users of a cellular phone network occupy the same frequency band. The signal is especially coded for each user.

GSM

Global **S**ystem for **M**obile Communications is a more efficient version of CDMA technology that uses smaller time slots but faster data transfer rates. It is the world's most commonly used digital network.

Next step

IF using a digital cellular phone of technology	THEN
GSM	Refer to "21.1.2 Configuring a GSM Connection".
CDMA	Refer to "21.1.3 Configuring a CDMA Connection".

21.1.2

Configuring a GSM Connection

Configure GSM connection step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to "19.2.2 Accessing CONFIGURE Interfaces" to access CONFIGURE Interfaces .	
2.	In CONFIGURE Interfaces highlight an interface which has a digital cellular phone of GSM technology attached.	19.2.2
3.	CTRL (F4) to access CONFIGURE GSM Connection .	
4.	CONFIGURE GSM Connection <GSM Type:> The type of digital cellular phone highlighted when CONFIGURE GSM Connection was accessed. <Bluetooth:> SmartStation detects automatically if the attached device is bluetooth capable. Some GSM's ask for the identification number of the Bluetooth. The identification number of Leica's Bluetooth is 0000. <ID Address:> Available for <Bluetooth: Yes> . The ID address of the Bluetooth device to be used. Refer to the device's user manual for information about the ID address. <Station:> The digital cellular phone reference station to be dialled. Opening the choicelist accesses CONFIGURE Stations to Dial where new reference stations can be created and existing reference stations can be selected or edited.	21.9

Step	Description	Refer to chapter
	<Number:> The number of the digital cellular phone at the selected <Station:> as configured in CONFIGURE Stations to Dial. <Protocol:> The configured protocol of the digital cellular phone at the selected <Station:> as configured in CONFIGURE Stations to Dial. <Auto CONEC:> Allows for automatic connection between the rover and the reference when a point is occupied during a survey. <Net Data Rate:> The network baud rate. Select Autobauding for an automatic search of the network baud rate. For digital cellular phones of GSM technology that do not support autobauding choose the baud rate from the choicelist. <Connection:> Define if the digital cellular phone uses Radio Link Protocol. Select Non-Transparent for digital cellular phones that use RLP. For digital cellular phones that do not use RLP select Transparent. Check with the network provider if the digital cellular phone uses RLP. Select the digital cellular phone reference station to be dialled.	41
	NEAR (F2) finds the nearest reference station with a digital cellular phone of GSM technology. Available when reference stations to dial are already created in CONFIGURE Stations to Dial. Coordinates of these stations must be known.	21.9

Step	Description	Refer to chapter
5.	CODES (F3) accesses CONFIGURE GSM Codes to enter the Personal Identification Number of the SIM card. If the PIN is locked for any reason, for example the wrong PIN was entered, input the Personal UnbloCking code for access to the PIN.	
	SRCH (F4) available for <Bluetooth: Yes> , to search for all available Bluetooth devices. If more than one Bluetooth device is found a list of available devices is provided.	
	SHIFT CMND (F4) allows AT commands to be sent to the digital cellular phone.	
6.	CONT (F1) returns to CONFIGURE Interfaces .	

21.1.3

Configure CDMA connection step-by-step

Configuring a CDMA Connection

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to "19.2.2 Accessing CONFIGURE Interfaces" to access CONFIGURE Interfaces .	
2.	In CONFIGURE Interfaces highlight an interface which has a digital cellular phone of CDMA technology attached.	
3.	CTRL (F4) to access CONFIGURE CDMA Connection .	
4.	CONFIGURE CDMA Connection <CDMA Type:> The type of digital cellular phone highlighted when CONFIGURE CDMA Connection was accessed. <Station:> The digital cellular phone reference station to be dialled. Accesses CONFIGURE Stations to Dial where new reference stations can be created and existing reference stations can be selected or edited. <Number:> The number of the digital cellular phone at the selected <Station:> as configured in CONFIGURE Stations to Dial . <Auto CONEC:> Allows for automatic connection between the rover and the reference when a point is occupied during a survey. Select the digital cellular phone reference station to be dialled.	21.9 41

Step	Description	Refer to chapter
	NEAR (F2) finds the nearest reference station with a digital cellular phone of CDMA technology. Available when reference stations to dial are already created in CONFIGURE Stations to Dial . Coordinates of these stations must be known.	21.9
5.	CONT (F1) returns to CONFIGURE CDMA Connection .	
	SHIFT CMND (F4) allows AT commands to be sent to the digital cellular phone.	Appendix G
	SHIFT INFO (F2) provides information about the CDMA device being used, such as the manufacturer, the model and the electronic serial number. For registration purposes, send the electronic serial number to the network provider in order to receive the service programming code and the mobile directory number. These numbers must be typed in in CONFIGURE CDMA Registration.	
6.	SHIFT REG (F3) to access CONFIGURE CDMA Registration .	
7.	CONFIGURE CDMA Registration The settings allow the CDMA digital cellular phone to be registered over the air. <Prog Code:> Type in the service program code provided by the network provider. <My Phone No:> Type in the mobile directory number provided by the network provider.	

Step	Description	Refer to chapter
	CLEAR (F5) deletes the input of the highlighted field.	
8.	CONT (F1) returns to CONFIGURE Interfaces .	

Description

For modems, information such as

- the reference stations that can be contacted and
- the phone numbers of the reference stations can be controlled.

Changing the reference station to be dialled is of interest in two cases.

- Case 1: Two real-time reference stations, each equipped with a digital cellular phone, are set up at two locations belonging to different network providers. When leaving the area of one reference, the station can be changed and the other reference can be called.
- Case 2: Set up as in case 1. Two separate fixes from each reference for each point can be obtained, providing redundancy for future least squares adjustment operations.

Configure modem connection step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to "19.2.2 Accessing CONFIGURE Interfaces" to access CONFIGURE Interfaces .	
2.	In CONFIGURE Interfaces highlight an interface which has a modem attached.	
3.	CTRL (F4) to access CONFIGURE Modem Connection .	
4.	CONFIGURE Modem Connection	

Step	Description	Refer to chapter
	<Modem Type:> The type of modem highlighted when CONFIGURE Modem Connection was accessed. <Station:> The modem reference station to be dialled. Accesses CONFIGURE Stations to Dial where new reference stations can be created and existing reference stations can be selected or edited. <Number:> The number of the modem at the selected <Station:> as configured in CONFIGURE Stations to Dial. Select the modem reference station to be dialled.	21.9
	NEAR (F2) finds the nearest reference station with a modem. Available when reference stations to dial are already created in CONFIGURE Stations to Dial. Coordinates of these stations must be known.	21.9
5.	CONT (F1) returns to CONFIGURE Interfaces .	

Description

For radios the channels on which the radio broadcasts can be changed. Changing channels changes the frequency at which the radio operates. The following radios support channel changing:

- AT-RXM500
- Pacific Crest PDL
- Pacific Crest RFM96W
- Sateline 2ASx
- Sateline 2ASxE
- Sateline 3AS

Changing radio channels is of interest in three cases.

- Case 1: Two real-time reference stations are set up at two locations, each broadcasting on a different channel.
If the signal from one reference station is jammed, the channel can be changed and the other reference can be used.
- Case 2: Set up as in case 1.
Two separate fixes for each point can be obtained, providing redundancy for future least squares adjustment operations.
- Case 3: One real-time reference and one real-time rover are being used.
If the signal is blocked due to radio interference, the channel at the reference and the rover can be changed in order to work on a different frequency.
-

Requirements for channel changing

- Pacific Crest radios:
- Channel changing must be activated by a Pacific Crest dealer.
 - A special licence might be required.
- Satellite radios:
- The radio must be in programming mode. This can be set by a Satellite dealer.



Channel changing may contravene radio broadcasting regulations in certain countries. Before operating with radios, check the regulations in force in the working area.



The number of channels available and the frequency spacing between channels depends on the radio used.



If channel changing is to be used, when configuring the reference real-time interface, set **<Ref Stn ID:>** in **CONFIGURE Additional Reference Options, General** page to a different ID for each reference site. By doing so, the rover can recognise if the incoming real-time data after channel changing is being received from a different reference station or if the original reference station is using a new frequency. In the first case, the ambiguities are recomputed.

Configure radio channel step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to "19.2.2 Accessing CONFIGURE Interfaces" to access CONFIGURE Interfaces .	
2.	In CONFIGURE Interfaces highlight an interface which has a radio attached.	
3.	CTRL (F4) to access CONFIGURE Radio Channel .	

Step	Description	Refer to chapter
4.	CONFIGURE Radio Channel <Radio Type:> The type of radio highlighted when CONFIGURE Radio Channel was accessed. <Channel:> The radio channel. The channel used must be within minimum and maximum allowed input values. The minimum and maximum allowed input values for a radio depend on the number of channels supported by the radio and the spacing between the channels. <Actual Freq:> Available for <Radio Type: Satellite 3AS>. Displays the actual frequency of the radio. Type in the radio channel.	
	SCAN (F5) provides information such as the station ID, latency and the data format of incoming signals from reference stations broadcasting on the same radio channel. This information can be used to select appropriate reference stations to dial.	21.8
5.	CONT (F1) returns to CONFIGURE Interfaces screen.	

Description

For radios the channels on which the radio broadcasts can be changed. Changing channels changes the frequency at which the radio operates. This may be necessary to enable multiple pairs of radios to work simultaneously in the same area without interfering with each other. The following radios for remote control support channel changing:

- RadioHandle
- TCPS27

**Configure
TCPS27/RH1200
connection step-by-
step**

Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Access CONFIGURE Interfaces .	19.2.2
2.	Highlight the interface RCS Mode with either RadioHandle or TCPS27 attached as the device.	
3.	CTRL (F4) to access CONFIGURE TCPS27 / RH1200 .	
4.	CONFIGURE TCPS27 / RH1200. <Radio Type:> The type of protocol, which is fixed as RCS. <Link Number:> The assigned channel number (from 0 to 15).  The link number for the RX1200 controller and the radio must be the same. The communication settings for the RX1200 controller and the radio must also be same. <Set as:> The option Remote or Base are available. Remote sets the radio into remote mode.	

Step	Description	Refer to chapter
	Base sets the radio into base mode.  The radio modules inside the RX1200 controller and the radio must be set to opposite settings. It is recommended to set the RX1200 controller to Remote and the radio to Base.	

Description

RS232 is a standard serial communication method that is able to transfer data without the need for predefined time slots. RS232 can be used, with a Bluetooth housing, to provide a wireless connection to another Bluetooth enabled device, for example, a computer.

Configure RS232 connection step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to "19.2.2 Accessing CONFIGURE Interfaces" to access CONFIGURE Interfaces .	
2.	In CONFIGURE Interfaces highlight an interface which has an RS232 device attached.	
3.	CTRL (F4) to access CONFIGURE RS232 Connection .	
4.	CONFIGURE RS232 Connection <Type:> The type of device highlighted when CONFIGURE RS232 Connection was accessed. <Bluetooth:> SmartStation detects automatically if the attached device is bluetooth capable. Some devices ask for the identification number of the Bluetooth. The identification number of Leica's Bluetooth is 0000. <ID Address:> Available for <Bluetooth: Yes>. The ID address of the Bluetooth device to be used. Refer to the device's user manual for information about the ID address.	

Step	Description	Refer to chapter
	SRCH (F4) available for <Bluetooth: Yes> , to search for all available Bluetooth devices. If more than one Bluetooth device is found a list of available devices is provided.	
	SCAN (F5) provides information such as the station ID, latency and the data format of incoming signals from reference stations. This information can be used to select appropriate reference stations to dial.	21.8
5.	CONT (F1) returns to CONFIGURE Interfaces .	

Description

GPRS / Internet devices can be used to access the Internet from SmartStation.

Configure Internet connection step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to "19.2.2 Accessing CONFIGURE Interfaces" to access CONFIGURE Interfaces .	
2.	In CONFIGURE Interfaces highlight the Internet interface which has a GPRS / Internet device attached.	
3.	CTRL (F4) to access CONFIGURE GPRS/Internet Connection .	
4.	CONFIGURE GPRS/Internet Connection <Device:> The type of GPRS / Internet device highlighted when CONFIGURE GPRS/Internet Connection was accessed. <Bluetooth:> SmartStation detects automatically if the attached device is bluetooth capable. Some devices ask for the identification number of the Bluetooth. <ID Address:> Available for <Bluetooth: Yes> . The ID address of the Bluetooth device to be used. Refer to the device's user manual for information about the ID address.	

Step	Description	Refer to chapter
	<APN:> Available for some GPRS / Internet devices. The Access Point Name of a server from the network provider, which allows access to data services. Contact your provider to get the correct APN. Mandatory for using GPRS. CODES (F3) Available for digital cellular phones of GSM technology. Accesses CONFIGURE GSM Codes to enter the Personal Identification Number of the SIM card. If the PIN is locked for any reason, for example the wrong PIN was entered, input the Personal Unblocking code for access to the PIN.	
	SRCH (F4) Available for <Bluetooth: Yes> , to search for all available Bluetooth devices. If more than one Bluetooth device is found a list of available devices is provided.	
	SHIFT CMND (F4) allows AT commands to be sent to the GPRS / Internet device.	Appendix G
5.	CONT (F1) returns to CONFIGURE Interfaces .	



Description

The Internet connection is available for SmartStation.

The Internet connection allows SmartStation to be connected to the Internet to receive real-time data. A GPRS / Internet device must be attached.

Requirements

For Internet

- **<Internet: Yes>** in **CONFIGURE Internet Interface**.
- **<Port: NETx>** assigned to an interface in **CONFIGURE Interfaces**.

Configure port NET step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to "19.2.2 Accessing CONFIGURE Interfaces" to access CONFIGURE Interfaces .	
2.	CONFIGURE Interfaces Highlight an interface which has an Internet device attached.	19
3.	CTRL (F4) to access CONFIGURE Set NET Port .	
4.	CONFIGURE Set NET Port, General page <Name:> The name of the port NET that was attached to the interface that was highlighted when this page was accessed.	

Step	Description	Refer to chapter
	<User:> How SmartStation will operate in the Internet. <User: Client> must be selected when using NTRIP as Internet application. Inside the Internet NTRIPClients and NTRIPServers are considered as clients. <User: Server> must be selected when SmartStation is the server. <Server:> The server to be accessed in the Internet. Opening the choicelist accesses CONFIGURE Server to Connect where new servers can be created and existing servers can be selected or edited. <IP Address:> The IP address of the selected <Server:> as configured in CONFIGURE Server to Connect. For <User: Server>: Output of the IP address associated with the NET port as configured in CONFIGURE Set NET Parameter. <Host:> The host name of the selected <Server:> as configured in CONFIGURE Server to Connect. For RX1250 receivers only. <TCP/IP Port:> The TCP/IP port number of the selected <Server:> as configured in CONFIGURE Server to Connect. <Auto CONEC:> Available for <User: Client>. For <R-Time Mode: Rover> in CONFIGURE Real-Time Mode Allows for automatic connection between SmartStation and the Internet when a point is occupied during a survey. Ending the point occupation also ends the Internet connection.	34.1 21.10
5.	PAGE (F6) to access CONFIGURE Set NET Port, Ranges page	

Step	Description	Refer to chapter
6.	CONFIGURE Set NET Port, Ranges page For <User: Server> in CONFIGURE Set NET Port, General page, the fields are input fields. The fields <Range X From:> and <Range X To:> can be used to prevent a user with an IP address outside the defined ranges from accessing the receiver. Enter the IP address ranges.	
	CLEAR (F5) returns the fields back to their default values.	
7.	CONT (F1) returns to the screen from where CONFIGURE Set NET Port was accessed.	

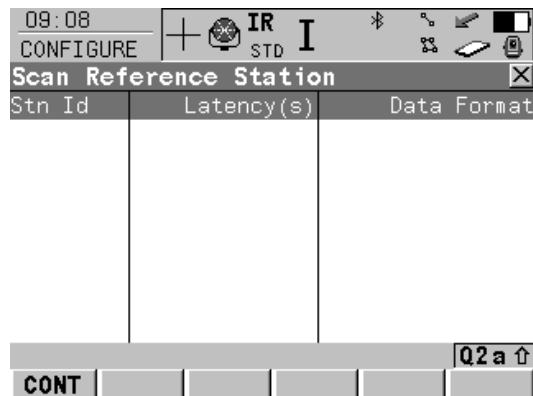
Description

CONFIGURE Scan Reference Station provides information about the reference stations, with specific types of devices attached, for example a radio, from which real-time corrections are being received. This can also be useful for finding out if anyone else in the area is using a particular radio channel.

Access step-by-step

Step	Description	Refer to chapter
1.	Refer to "19.2.2 Accessing CONFIGURE Interfaces" to access CONFIGURE Interfaces .	
2.	In CONFIGURE Interfaces highlight an interface which has an appropriate device attached.	19.2.2
3.	CTRL (F4) to access CONFIGURE RS232 Connection or CONFIGURE Radio Channel .	
4.	SCAN (F5) to access CONFIGURE Scan Reference Station .	

CONFIGURE Scan Reference Station



CONT (F1)

To select the highlighted reference station and to continue with the subsequent screen.

CH- (F2) and CH+(F3)

Available for scanning reference stations with radios attached. To switch the radio to one channel lower/higher than the current channel. The reference stations displayed change to those broadcasting on the new channel.

Description of columns

Column	Description
Stn ID	Station ID of available reference stations from which a signal is being received. For radios, the reference station radios transmitting on the same channel will be listed.
Latency (s)	Time delay, in seconds and configured on the reference, from when the reference collects the data to when the data is transmitted.
Data Format	Format of the data from the reference station.

21.9

21.9.1

Description

Configuring the Stations to Dial

Overview

CONFIGURE Stations to Dial allows new stations to be created, provides a list of reference stations that can be dialled and allows existing stations to be edited.

For digital cellular phones of any technology and for modems, the phone numbers of the device at the reference station must be known. For a reference station to be dialled, a name, the phone number and, if available, the coordinates can be configured.

The configuration is possible for rover and reference digital cellular phones and modems.

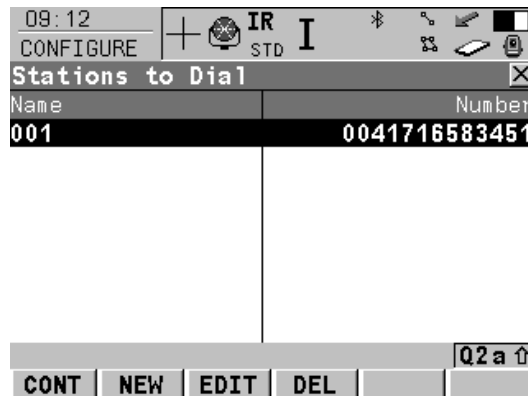
21.9.2

Accessing CONFIGURE Stations to Dial

Access step-by-step

Step	Description	Refer to chapter
1.	Refer to "19.2.2 Accessing CONFIGURE Interfaces" to access CONFIGURE Interfaces .	
2.	In CONFIGURE Interfaces highlight an interface which has a digital cellular phone of any technology or modem attached.	19.2.2
3.	CTRL (F4) to access CONFIGURE XX Connection .	
4.	Open the choicelist for <Station:> to access CONFIGURE Stations to Dial .	

CONFIGURE Stations to Dial



CONT (F1)

To select the highlighted station and to return to the screen from where this screen was accessed.

NEW (F2)

To create a new station. Refer to "21.9.3 Creating a New Station to Dial".

EDIT (F3)

To edit a station. Refer to "21.9.4 Editing a Station to Dial".

DEL (F4)

To delete the highlighted station.

Description of columns

Column	Description
Name	Name of all available reference stations.
Number	Phone number of the station to dial.

Create new station to dial step-by-step

Step	Description
1.	Refer to "21.9.2 Accessing CONFIGURE Stations to Dial" to access CONFIGURE Stations to Dial .
2.	NEW (F2) to access CONFIGURE New Station to Dial .
3.	CONFIGURE New Station to Dial <Name:> A unique name for the new reference station to be dialled. The name may be up to 16 characters long and may include spaces. Input optional. <Number:> The number of the reference station to dial. If the survey is to be undertaken across country borders it is necessary to input the phone number using standard international dialing codes. For example, +41123456789. Otherwise it can be input as a standard digital cellular phone number. <Protocol:> Available for digital cellular phones of GSM technology. The configured protocol of the digital cellular phone of GSM technology. <Protocol: Analog> For conventional phone networks. <Protocol: ISDN v.110> For GSM networks. Type in the number to be dialled.
4.	Are the approximate coordinates of the reference station to be typed in? • If yes, continue with step 5. • If no, continue with step 6.
5.	CONFIGURE New Stations to Dial <Enter Coords: Yes> Type in the coordinates of the reference station.
	COORD (F2) views other coordinate types.

Step	Description
	SHIFT ELL H or SHIFT ORTH (F2) Available for local coordinates. Changes between the ellipsoidal and the orthometric height.
6.	STORE (F1) returns to the screen from where CONFIGURE New Points to Dial was accessed.

21.9.4

Editing a Station to Dial

Access step-by-step

Step	Description
1.	Refer to "21.9 Configuring the Stations to Dial" to access CONFIGURE Stations to Dial .
2.	EDIT (F3) to access CONFIGURE Edit Station to Dial .
3.	All following steps are identical with the creation of a new station to dial. Refer to "21.9.3 Creating a New Station to Dial". Follow the instructions from step 3. onwards.

21.10

21.10.1

Configuring the Server to Connect

Overview

Description

CONFIGURE Server to Connect allows new servers to be created, provides a list of servers that can be accessed in the Internet and allows existing servers to be edited. For servers to be accessed in the Internet, the IP address or the host name (for RX1250 receivers only) and the TCP/IP port must be known. For a server to be accessed, a name can be configured.

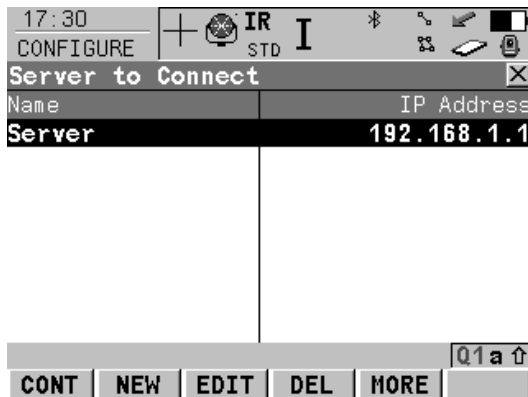
21.10.2

Accessing CONFIGURE Server to Connect

Access step-by-step

Step	Description	Refer to chapter
1.	Refer to "19.2.2 Accessing CONFIGURE Interfaces" to access CONFIGURE Interfaces .	
2.	In CONFIGURE Interfaces highlight an interface which has an Internet/Ethernet interface attached.	19
3.	CTRL (F4) to access CONFIGURE XX Connection .	
4.	Open the choicelist for <Server:> to access CONFIGURE Server to Connect .	

CONFIGURE Server to Connect



CONT (F1)

To select the highlighted server and to return to the screen from where this screen was accessed.

NEW (F2)

To create a new server. Refer to "21.10.3 Creating a New Server".

EDIT (F3)

To edit a server. Refer to "21.10.4 Editing a Server to Connect".

DEL (F4)

To delete the highlighted server.

MORE (F5)

To change between the IP Address (for RX1250 receivers: Host) and the TCP/IP Port of the server.

Description of columns

Column	Description
Name	Name of all available servers.
IP Address	IP addresses of all available servers.
Host	Host names of all available servers. For RX1250 receivers only.
TCP/IP Port	TCP/IP Port numbers of all available servers.

21.10.3

Creating a New Server

Create new server to be accessed step-by-step

Step	Description
1.	Refer to "21.10.2 Accessing CONFIGURE Server to Connect" to access CONFIGURE Server to Connect .
2.	NEW (F2) to access CONFIGURE New Server .
3.	CONFIGURE New Server <Name:> A unique name for the new server to be accessed. The name may be up to 16 characters long and may include spaces. <IP Address:> Type in the IP address of the server to be accessed in the Internet. <Host:> Type in the host name of the server to be accessed in the Internet. For RX1250 receivers only. <TCP/IP Port:> The port of the Internet server through which the data is provided. Each server has several ports for various services.
4.	STORE (F1) returns to the screen from where CONFIGURE New Points to Dial was accessed.

21.10.4

Editing a Server to Connect

Access step-by-step

Step	Description
1.	Refer to "21.10 Configuring the Server to Connect" to access CONFIGURE Server to Connect .
2.	EDIT (F3) to access CONFIGURE Edit Server .
3.	All following steps are identical with the creation of a new server. Refer to "21.10.3 Creating a New Server". Follow the instructions from step 3. onwards.

22.1

Real-Time Mode

22.1.1

Configuration of Real-Time

Description

The settings on this screen allow GPS real-time related parameters to be configured. This includes defining whether SmartStation should operate as a rover (static, as on a tripod) and the type of GPS real-time messages to be used.

Access

Select **Main Menu: Config...\SmartStation...\Real-Time Mode**.

OR

Select **Main Menu: Config...\Interfaces....** Highlight **GPS RTK. EDIT (F3)**.

OR

Press a hot key configured to access the screen **CONFIGURE Real-Time Mode**.

Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

OR

Within the configuration set wizard.

Refer to "11.2 Accessing Configuration Set Management".

CONFIGURE Real-Time Mode

09:17

CONFIGURE

IR STD I

Real-Time Mode

R-Time Mode: Rover

R-Time Data: Leica

Port : Port 2(Handle)

Device : Siemens MC45

Ref Sensor : GX1230

Ref Antenna: ATX1230 SmartStn

Q2a ↑

CONT ROVER DEVE

CONT (F1)

To accept changes and return to the screen from where this screen was accessed.

ROVER (F2)

To configure additional settings relevant to rover operations. Refer to paragraph "CONFIGURE Additional Rover Options, General page".

DEVCE (F5)

To create, select, edit or delete a device.

Description of fields

Field	Option	Description
<R-Time Mode:>	None	SmartStation is not to be used as a GPS real-time rover.
	Rover	Activates a rover GPS real-time interface.
<R-Time Data:>	Leica	The proprietary Leica real-time GPS data format supporting GPS L1/L2 and GLONASS L1/ L2. This is recommended when working exclusively with Leica receivers.

Field	Option	Description
	Leica 4G	The proprietary Leica real-time GNSS data supporting GPS L1/ L2/ L5, GLONASS L1/ L2 and Galileo E1/E5a/E5b/Alt-BOC. This is recommended when working exclusively with Leica receivers with Leica SmartWorx v7.0 or higher.
	CMR CMR+ RTCM v3.1	CMR and CMR+ are compacted formats used to receive data from third party receivers. Message according to RTCM version 3. A new standard format for transmission of Global Navigation Satellite System correction information. Higher efficiency than RTCM v2.x. Supports GPS real-time services with significantly reduced bandwidth. Message types for real-time GNSS operation: • 1001: L1-only GPS real-time observables • 1002: Extended L1-only GPS real-time observables • 1003: L1 & L2 GPS real-time observables • 1004: Extended L1 & L2 GPS real-time observables • 1005: Stationary GPS real-time reference station Antenna Reference Point

Field	Option	Description
		• 1006: Stationary GPS real-time reference station ARP with antenna height • 1007: Antenna descriptor • 1008: Antenna descriptor and serial number • 1009: L1-only GLONASS real-time observables • 1010: Extended L1-only GLONASS real-time observables • 1011: L1 & L2 GLONASS real-time observables • 1012: Extended L1 & L2 GLONASS real-time observables Network RTK Messages according to Master-Auxiliary Concept: • 1014: Network Auxiliary Station Data message. This message contains details of the reference stations in the network, for example the master station and its coordinates, and the coordinate differences between the master and its auxiliaries. • 1015: Ionospheric Correction Differences message

Field	Option	Description
		• 1016: Geometric Correction Differences message • 1021: Helmert / Abridged Molodensky transformation • 1022: Molodensky-Badekas transformation • 1023: Transformation Residual Message, ellipsoidal grid representation; CSCS/position & geoid/height residuals are supported • 1024: Transformation Residual Message, plane grid representation; CSCS/position & geoid/height residuals are supported • 1025: Projection types except LCC2SP, OM • 1026: Projection type Lambert Conic Conformal (LCC2SP) • 1027: Projection type Oblique Mercator (OM) • 1029: Unicode Text String message • 1032: Physical Reference Station Position message • 1033: Receiver and Antenna Descriptor message • 1037: GLONASS Ionospheric Correction Differences message (phase)

Field	Option	Description
		• 1038: GLONASS Geometric Correction Differences message (phase) • 1039: GLONASS Combined Geometric and Ionospheric Correction Differences message (phase) • 1068: GLONASS Ionospheric Correction Differences message (code) • 1069: GLONASS Geometric Correction Differences message (code) • 1070: GLONASS Combined Geometric and Ionospheric Correction Differences message (code) Pseudorange and phase range values for L1 and L2. Depending on the type of receiver, the data for L1-only or for L1 and L2 are sent out. Accuracy at the rover: • For L1-only: 0.25 - 1 m rms. • For L1 and L2: 1 - 5 cm rms after a successful ambiguity resolution.

Field	Option	Description
	RTCM 1,2 v2	Message according to RTCM version 2.x. Differential and delta differential GPS corrections. Message 3 is also generated. Use for DGPS applications. Accuracy at the rover: 0.25 - 1 m rms.
	RTCM 9,2 v2	Message according to RTCM version 2.x. GPS partial correction set and delta differential GPS corrections. Message 3 is also generated. Use for DGPS applications with a slow data link in the presence of interference. Accuracy at the rover: 0.25 - 1 m rms.
	RTCM 18,19 v2)	Message according to RTCM version 2.x. Uncorrected carrier phase and pseudorange. Message 3 is also generated. Use for GPS real-time operations where the ambiguities will be resolved at the rover. Accuracy at the rover: 1 - 5 cm rms after a successful ambiguity resolution.
	RTCM 20,21 v2	Message according to RTCM version 2.x. GPS real-time carrier phase corrections and high-accuracy pseudorange corrections. Message 3 is also generated. Use for GPS real-time operations. Accuracy at the rover: 1 - 5 cm rms after a successful ambiguity resolution.
<Port:>		Port to which the device is attached.

Field	Option	Description
	Port 1	For communication and/or power For TPS1200+: 5 pin LEMO-0. For TS30/TM30: 8 pin LEMO-1 This port is located at the base of the instrument.
	Port 2(Handle)	Hotshoe connection for RadioHandle with RCS and SmartAntenna Adapter with SmartStation. This port is located on top of Communication side cover.
	Port 3(BT)	Bluetooth module for communication with only Bluetooth capable devices. This port is housed within Communication side cover.
	NETx	Available for an activated Internet interface. If these ports are not assigned to a specific interface, then these ports are additional remote ports.
<Ref Sensor:>	Choicelist	The receiver type used at the reference. If the GPS real-time data format does not contain the information of the receiver type certain corrections based on the information of the receiver type are applied in order to provide correct results. The real-time data formats Leica , Leica 4G , CMR , CMR+ and RTCM v3.1 contain this information. This is mainly important when a System300 receiver or a receiver from a different manufacturer is used as reference.

Field	Option	Description
<Ref Antenna:>	Choicelist	The antenna used at the reference. If the GPS real-time data format does not contain the information of the antenna certain corrections based on the information of the antenna are applied in order to provide correct results. The real-time data formats Leica, Leica 4G, RTCM v2.3, CMR, CMR+ and RTCM v3.1 contain this information.  If the reference data is corrected by absolute antenna calibration values and a Leica standard antenna is being used on the rover, select ADVNULLANTENNA as reference antenna.

Next step

IF additional rover options	THEN
are not to be configured	CONT (F1) closes the screen and returns to the screen from where CONFIGURE Real-Time Mode was accessed.
are to be configured	ROVER (F2) . Refer to paragraph "CONFIGURE Additional Rover Options, General page".

CONFIGURE Additional Rover Options, General page

The available fields depend on the selected **<R-Time Data:>** in **CONFIGURE Real-Time Mode**.

17:24

CONFIGURE

Additional Rover Options

General | NTRIP | RTCM Options

Accept Ref : Any Received

Ref Stn ID : 0

Ref Network : None

Send User ID : No

User ID 1 : 000001

User ID 2 : 000001

CONT GGA PAGE

CONT (F1)

To accept changes and return to the screen from where this screen was accessed.

GGA (F4)

To activate the sending of a GGA message for reference network applications.

Refer to "22.1.2 Configuration of GGA Message Sending for Ref Network Applications".

GETID (F5)

Available for **<Accept Ref: User Defined>**.

To display and select the station ID of the available reference stations, the latency of the message and the data format. When using radios, the radio channel can be switched and the stations received on the new frequency are displayed.

1st (F6)

Available for **<Accept Ref: First Received>**.

To force the system to try to establish a new connection with a different reference station.

PAGE (F6)

To change to another page on this screen.

Description of fields

Field	Option	Description
<Accept Ref:>		The reference station of which GPS real-time data is to be accepted.
	User Defined	Incoming GPS real-time data is accepted from the reference station defined in <Ref Stn ID:> .
	First Received	Incoming GPS real-time data from the first recognised reference station is accepted.
	Any Received	Incoming GPS real-time data from any reference station is accepted.
<Ref Stn ID:>	User input	Available for <Accept Ref: User Defined> . The special ID of the reference station from which GPS real-time data is to be received. The allowed minimum and maximum values vary.
	From 0 to 31	For <R-Time Data: Leica> and <R-Time Data: CMR/CMR+> .
	From 0 to 1023	For <RTCM Version: 1.x> and <RTCM Version: 2.x> .
	From 0 to 4095	For <R-Time Data: Leica 4G> and <R-Time Data: RTCM v3> .
<Ref Network:>	None, VRS or FKP	Defines the type of reference network to be used.

Field	Option	Description
<Send User ID:>	Yes or No	Activates the sending of a Leica proprietary NMEA message defining the user.
<User ID 1:> and <User ID 2:>	User input	Available for <Send User ID: Yes>. The specific user ID's to be sent as part of the Leica proprietary NMEA message. By default the serial number of the instrument is displayed.
<RTCM Version:>	1.x, 2.1, 2.2 or 2.3	Available for <R-Time Data: RTCM XX v2> in CONFIGURE Real-Time Mode . The same version must be used at the reference and the rover.
<Bits / Byte:>	6 or 8	Defines the number of bits/byte in the RTCM message being received.

Next step

PAGE (F6) changes to the **NTRIP** page.

CONFIGURE Additional Rover Options, NTRIP page

17:25

CONFIGURE

IR STD

Additional Rover Options

General NTRIP RTCM Options

Use NTRIP: Yes

User ID : -----

(cont) : -----

Password: -----

Mountpnt: -----

Q2 a ↑

CONT SRCE PAGE

CONT (F1)

To accept changes and return to the screen from where this screen was accessed.

SRCE (F5)

To download the NTRIP source table if **<Mountpnt:>** is unknown. To do this, the GPRS Internet interface must already be configured. Refer to "34.2.3 Using the NTRIP Service with SmartStation".

PAGE (F6)

To change to another page on this screen.

Description of fields

Field	Option	Description
<Use NTRIP:>	Yes or No	Activates NTRIP.
<User ID:>	User input	A user ID is required to receive data from the NTRIP-Caster. Contact the NTRIP administrator for information.
<(cont):>	User input	Allows the <User ID:> string to continue onto a new line.

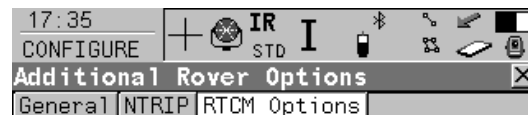
Field	Option	Description
<Password:>	User input	A password is required to receive data from the NTRIPCaster. Contact the NTRIP administrator for information.
<Mountpnt:>	User input	The NTRIPSource from where GPS real-time data is required. SRCE (F5) to download the NTRIPSource table if <Mountpnt:> is unknown.

Next step

PAGE (F6) changes to the **RTCM Options** page.

CONFIGURE Additional Rover Options, RTCM Options page

This page is only available for <R-Time Data: RTCM v3.1> in **CONFIGURE Real-Time Mode**.



Use Auto CrdSys : **No** [Left Arrow] [Right Arrow]

RTCM Info Msg : **Log** [Left Arrow] [Right Arrow]

CONT (F1)

To accept changes and return to the screen from where this screen was accessed.



PAGE (F6)

To change to another page on this screen.

Description of fields

Field	Option	Description
<Use Auto CrdSys:>	Yes or No	To set a RTCM coordinate system received by a reference network as active coordinate system.  Is marked grey and set to No for <Ref Network: None> in CONFIGURE Additional Rover Options, General page.

Field	Option	Description
<RTCM Info Msg:>		Defines whether to show and/or log an info message (RTCM message 1029), which is received from a reference network.
	No	The info message will not be shown.
	Show	The info message will only be shown.
	Log	The info message will only be logged to a text file.
	Show and Log	The info message will be displayed and logged to a text file.

Next step

Step	Description
1.	CONT (F1) returns to CONFIGURE Real-Time Mode .
2.	CONT (F1) returns to TPS1200+/TS30/TM30 Main Menu .

22.1.2

Configuration of GGA Message Sending for Ref Network Applications

Description

- Most reference networks require an approximate position of the rover. For reference network applications, a rover dials into the reference network and submits its approximate position in form of a NMEA GGA message.
- By default, the receiver sends GGA messages with updated current positions automatically when a reference network is selected.
- Surveying regulations in some countries require that one certain position can be selected. This position is then sent to the reference network as GGA message through the real-time interface every five seconds.
- Refer to "F.3 GGA - Global Positioning System Fix Data" for information on GGA message format.

Access step-by-step

Step	Description
1.	Refer to "22.1.1 Configuration of Real-Time" to access CONFIGURE Real-Time Mode .
2.	Press ROVER (F2) to access CONFIGURE Additional Rover Options .
3.	Press GGA (F5) to access CONFIGURE Send GGA NMEA .

OR

Press a hot key configured to access the screen **CONFIGURE Send GGA NMEA**.
Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**.
Refer to "2.2 USER Key" for information on the **USER** key.

CONFIGURE Send GGA NMEA



GGA Position : **LAST/HERE Posn**

WGS84 Lat : 0°00'00.00000" N
WGS84 Long : 0°00'00.00000" E
WGS84 Ell Ht : 0.000 m



CONT (F1)

To accept changes and return to the screen from where this screen was accessed.

COORD (F2)

Available for **<GGA Position: From Job>** and **<GGA Position: LAST/HERE Posn>**. To view other coordinate types. Local coordinates are available when a local coordinate system is active.

LAST (F3)

Available for **<GGA Position: LAST/HERE Posn>**. To use the same coordinates in the GGA message as when the receiver was last used in a reference network application. This is possible when position coordinates from a previous reference network application are still stored in the System RAM.

HERE (F4)

Available for **<GGA Position: LAST/HERE Posn>**. To use the coordinates of the current navigation position in the GGA message.

SHIFT ELL H (F2) and SHIFT ORTH (F2)

To change between the ellipsoidal and the orthometric height. Available for local coordinates.

Description of fields

Field	Option	Description
<GGA Position:>	Automatic	The current rover position is sent to the reference network. The position is updated and sent every five seconds.
	From Job	A point from the active job can be selected in <Point ID:> . The position of this point is sent to the reference network every five seconds.
	LAST/HERE Posn	The position last used in a reference network application or the current navigation position can be selected using LAST (F3) or HERE (F4) . The selected position is sent every five seconds.
	None	No GGA message is sent to the reference network.
<Point ID:>	Choicelist	Available for <GGA Position: From Job> . The coordinates of this point are sent out as position in the GGA message. Opening the choicelist opens MANAGE Data: Job Name . Refer to "6.2 Accessing Data Management".

Next step

Step	Description
1.	CONT (F1) returns to CONFIGURE Additional Rover Options .

Step	Description
2.	CONT (F1) returns to CONFIGURE Real-Time Mode .
3.	CONT (F1) returns to the screen from where CONFIGURE Real-Time Mode was accessed.

22.2

Point Occupation Settings

Description

The settings on this screen define the way in which points are occupied and recorded.

Access

Select **Main Menu: Config...\SmartStation...\Point Occupation Settings**.

OR

Press a hot key configured to access the screen **CONFIGURE Point Occupation Settings**. Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

OR

Within the configuration set wizard.

Refer to "11.2 Accessing Configuration Set Management".

CONFIGURE Point Occupation Settings

09:25 CONFIGURE IR STD I Bluetooth File Transfer

Point Occupation Settings

Pt Occupation: Normal

Auto OCCUPY : Yes

Auto STOP : Yes

STOP Criteria: Positions

Beep On STOP : No

Auto STORE : No

Beep On STORE: No

End Survey : Manual

Q2 a ↑

CONT PARAM

CONT (F1)

To accept changes and return to the screen from where this screen was accessed.

PARAM (F3)

To configure the time interval after which a point occupation can be stopped automatically.

Description of fields

Field	Option	Description
<Pt Occupation:>	Normal	The way in which coordinates for a point are recorded. This field is fixed to <Pt Occupation: Normal> .
<Auto OCCUPY:>	No Yes Timed	Starts point occupation when pressing OCCUPY (F1) . Starts point occupation automatically when entering SETUP New Station Point . Starts point occupation automatically at a certain time. The start time is specified in SETUP New Station Point .
<Auto STOP:>	Yes or No	Stops the measurements automatically when the parameter defined for <STOP Criteria:> reaches 100 %.
<STOP Criteria:>	Accuracy or Positions	Available for <Auto STOP: Yes> . Defines the method used for <Auto STOP:> . The setting determines the computation of the duration of the point occupation. Parameters for the selected method are defined with PARAM (F3) . Available for <R-Time Mode: Rover> .

Field	Option	Description
	Time, Observations or No. of Satellites	Available for <R-Time Mode: None> .
<% Indicator:>	None or Positions None, Time, Observations or No. of Satellites	Available for <Auto STOP: No> . This is an indicator when to stop the point occupation. Parameters for the selected method are defined with PARAM (F3) . Available for <R-Time Mode: Rover> . Available for <R-Time Mode: None> .
<Beep On STOP:>	Yes or No	Activates that a beep is made when the point occupation is ended by <Auto STOP:> .
<Auto STORE:>	Yes or No	Stores points automatically after stopping the point occupation.
<Beep On STORE:>	Yes or No	Activates that a beep is made when the point is stored by <Auto STORE:> .

Field	Option	Description
<End Survey:>	Manual	Defines the instrument behaviour once a point is stored. Exits GPS SURVEY when pressing ESC .
	Automatically	Exits GPS SURVEY automatically when pressing STORE (F1) and returns to main menu.

Next step

IF parameters for <Auto STOP:>	AND	THEN
are not to be configured	-	CONT (F1) closes the screen and returns to the screen from where CONFIGURE Point Occupation Settings was accessed.
are to be configured	<R-Time Mode: None>	PARAM (F3) changes to CONFIGURE Post-Process Stop Criteria .
are to be configured	<R-Time Mode: Rover>	PARAM (F3) changes to CONFIGURE Real-Time Stop Criteria . Refer to paragraph "CONFIGURE Real-Time Stop Criteria".

CONFIGURE Real-Time Stop Criteria



Auto STOP/%Indicator based on

Pos Quality < : 0.050 m
Ht Quality < : 0.070 m

For a min number of positions

Positions : 5
Position Update : 1.00 s



CONT (F1)

To accept changes and to return to
CONFIGURE Point Occupation Settings.

Description of fields

The parameters shown on this screen depend on the setting for <STOP Criteria:> in **CONFIGURE Point Occupation Settings.**

Field	Option	Description
<Pos Quality <:> and <Ht Quality <:>	User input	Sets the maximum position and height qualities for each point occupation. Calculating the qualities starts when OCUPY (F1) is pressed. SmartStation stops measuring when the position and height qualities are both less than the configured values.
<Positions:>	User input	Point is occupied for a minimum number of positions even when the <Pos Quality <:> and <Ht Quality <:> is already less than the specified maximum.

Field	Option	Description
<Position Update:>	User input	Sets the number the positions which must be observed before SmartStation stops measuring. Counting the number of positions starts when OCUPY (F1) is pressed.

Next step

Step	Description
1.	CONT (F1) returns to CONFIGURE Point Occupation Settings .
2.	CONT (F1) returns to TPS1200+/TS30/TM30 Main Menu .

22.3

Satellite Settings

Description

The settings on this screen define which satellite system, satellites and satellite signals will be used by SmartStation.

Access

Select **Main Menu: Config...\SmartStation...\Satellite Settings**.

OR

Within the configuration set wizard.

Refer to "11.2 Accessing Configuration Set Management".

CONFIGURE Satellite Settings

17:31 CONFIGURE IR STD I [Battery] [Signal]

Satellite Settings

GLONASS : Yes

GALILEO : No

GPS L2C : Automatic

GPS L5 : No

Cut Off Angle: 10 °

Loss of Lock : No Beep/Message

SV Health : Automatic

CONT [] [] [] [a ↑]

CONT (F1)

To accept changes and return to
TPS1200+/TS30/TM30 Main Menu.

SHIFT INIT (F4)

To delete the current almanacs stored on
SmartStation and to download new almanacs.

Description of fields

Field	Option	Description
<GLONASS:>	Yes or No	Defines if GLONASS satellite signals are accepted by the receiver when tracking satellites.
<Galileo:>	Yes or No	Defines if Galileo satellite signals are accepted by the receiver when tracking satellites.
<GPS L2C:>	Automatic or Always Track	Defines if the L2C signal will be tracked. The recommended setting is Automatic .
<GPS L5:>	Yes or No	Defines if the GPS L5 signal will be tracked.
<Cut Off Angle:>	User input	Sets the elevation in degrees below which satellite signals are not recorded and are not shown to be tracked. Recommended settings: • For GPS real-time: 10°. • For other applications: 15°.
<Loss of Lock:>	Beep & Message or No Beep/Message	Activates an acoustic warning signal and a message given by SmartStation when satellites are lost and therefore no position can be computed.
<SV Health:>	Automatic	Incoming satellite signals are monitored. Data from signals which are flagged as unhealthy are neither recorded nor used for real-time computations.

Next step

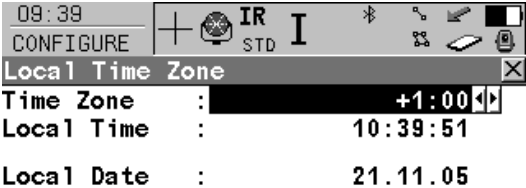
CONT (F1) returns to **TPS1200+/TS30/TM30 Main Menu**.

22.4

Local Time Zone

Description	The settings on this screen help SmartStation to quickly locate and track satellites.
Access	Select Main Menu: Config...\SmartStation...\Local Time Zone . OR Within the configuration set wizard. Refer to "11.2 Accessing Configuration Set Management".

CONFIGURE
Local Time Zone



CONT (F1)
To accept changes and to return to
TPS1200+/TS30/TM30 Main Menu.

Description of fields

Field	Option	Description
<Time Zone:>	From -13:00 to +13:00	The time zone for the current location and local date.
<Local Time:>	User input	Setting the local time supports a very fast satellite acquisition.
<Local Date:>	User input	Setting the local date supports a very fast satellite acquisition.

Next step

CONT (F1) returns to **TPS1200+/TS30/TM30 Main Menu**.

22.5

Quality Control Settings

Description

The settings on this screen define the limits for coordinate quality and DOP values accepted for point occupations.

Access

Select **Main Menu: Config...\SmartStation...\Quality Control Settings**.

OR

Press a hot key configured to access the screen **CONFIGURE Quality Control Settings**.
Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

OR

Within the configuration set wizard.

Refer to "11.2 Accessing Configuration Set Management".

CONFIGURE

Quality Control Settings

09:42 CONFIGURE IR STD I Bluetooth File Transfer

Quality Control Settings

CQ Control : Pos & Height

Maximum CQ : 0.050 m

DOP Limit : GDOP

Maximum DOP : 20.0

Allow 2D Posn: Yes

CONT (F1)

To accept changes and return to the screen from where this screen was accessed.

Description of fields

Field	Option	Description
<CQ Control:>	None, Pos Only, Height Only or Pos & Height	The type of coordinate quality to be checked before storing a point. If activated, the limit defined in <Maximum CQ:> is checked before storing a point. A warning signal is given when the limit is exceeded. Refer to "6.3.1 Terminology" for information on coordinate quality.
<Maximum CQ:>	User input	Available unless <CQ Control: None> . The maximum acceptable coordinate quality.
<DOP Limit:>	None, GDOP, PDOP, HDOP or VDOP	If activated, the limit defined in <Maximum DOP:> is checked. GPS positions are unavailable when the limit is exceeded.
<Maximum DOP:>	User input	Available unless <DOP Limit: None> . The maximum acceptable DOP value.
<Allow 2D Posn:>	Yes	2D positions can be obtained with only three satellites available. The height is fixed to that of the last position computed with height.
	No	2D positions cannot be obtained with only three satellites available.

Next step

CONT (F1) returns to **TPS1200+/TS30/TM30 Main Menu**.

22.6

Logging of Raw Obs

Description

- When using SmartStation, it is possible to add the ability to log raw GPS data.
- The settings on this screen define the logging of raw observations.
- This is a protected option and is only activated by the entry of a license key.

Access

This menu option is licence protected and is only activated by the entry of a licence key. The licence key can only be loaded from the CompactFlash card.

Select **Main Menu: Config...\Survey Settings...\Logging of Raw Obs.**

OR

Press a hot key configured to access the screen **CONFIGURE Logging of Raw Obs.**
Refer to "2.1 Hot Keys" for information on hot keys.

OR

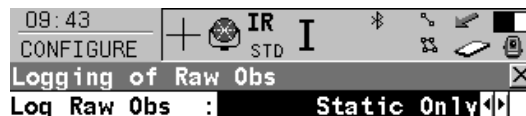
Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

OR

Within the configuration set wizard. Refer to "11.2 Accessing Configuration Set Management".

CONFIGURE

Logging of Raw Obs



Log Rate : 1.0s ↵

SmartAntenna & Logging

Switch Off : After 5 Min(s) ↵



CONT (F1)

To accept changes and return to the screen from where this screen was accessed.

Description of fields

Field	Option	Description
<Log Raw Obs:>	Never	Available unless <R-Time Mode: Reference> . No raw observation logging during either static or moving intervals.
	Static Only	Available unless <R-Time Mode: Reference> . Raw observation logging during static intervals when occupying a point. The receiver has to be stationary.
<Log Rate:>	From 0.05s to 300.0s	Available unless <Log Raw Obs: Never> or <Log Raw Obs: No> . Rate at which raw observations are logged.

Field	Option	Description
<Switch Off:>	Choicelist	This option determines when SmartAntenna is turned off. The selected time is activated whenever SmartStation leaves GPS mode. This option is directly linked to <Switch Off:> in CONFIGURE Start Up & Power Down. Refer to "18.6 Start Up & Power Down" for details.

Next step

CONT (F1) returns to **TPS1200+/TS30/TM30 Main Menu**.

23

Tools...\Format Memory Device

Description

Allows the CompactFlash card, the internal memory, if fitted, and the System RAM to be formatted. All data will be erased. Refer to "Appendix B Memory Types" for more information on the types of memory devices available.

Access

Select **Main Menu: Tools...\Format Memory Device.**

TOOLS

Format Memory Device



Memory Device: **CF Card**

Format Method: **Format Quick**

- CONT (F1)**
To format a memory device and return to the screen from where this screen was accessed.
- PROGS (F4)**
To format the application programs memory.
- SYSTEM (F5)**
To format System RAM memory.



Description of fields

Field	Option	Description
<Memory Device:>		The type of memory to be formatted.
	Output	For instruments without internal memory.

Field	Option	Description
	CF Card or Internal Memory	For instruments with CompactFlash card and internal memory.
<Format Method:>	Format Quick	After formatting, data is not visible anymore but still exists on the memory device and is overwritten as and when required.
	Format Complete	Data is fully deleted.

Next step

IF	THEN
the CompactFlash card or internal memory is to be formatted	CONT (F1) to format the selected memory device and return to TPS1200+/TS30/TM30 Main Menu .
the application programs memory is to be formatted	PROGS (F4) to format the application programs memory. All loadable application programs are deleted.
the System RAM is to be formatted	SYSTEM (F5) to format the System RAM.



If the System RAM is formatted all system data such as user defined configuration sets, user defined antennas, codelists, geoid field files and CSCS field files will be lost.

Description

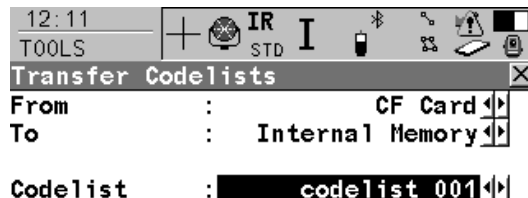
This chapter describes the basic procedure for transferring objects between the CompactFlash card, the System RAM and the internal memory, if fitted. Refer to "Appendix C Directory Structure of the Memory Device" for information about file types and locations of files on the CompactFlash card.

Access

Select **Main Menu: Tools...\Transfer Objects...\XX**.

TOOLS**Transfer XX**

The available fields on the screen depend on the option selected in **Main Menu: Tools...\Transfer Objects....**

**CONT (F1)**

To transfer an object and return to the screen from where this screen was accessed.

ALL (F3)

Available for some transfer object options. To transfer all objects.



Description of fields

Field	Option	Description
<From:>	CF card System RAM Internal Memory	Memory device to transfer object from. Transfer from CompactFlash card. Transfer from System RAM. Available unless object to transfer is a job. Transfer from internal memory, if fitted. Available if the object to transfer is a job.
<To:>	Output	Memory device to transfer object to. Memory device not selected in <From:> .
<Codelist:>	Choicelist	To select the codelist to be transferred.
<Config Set:>	Choicelist	To select the configuration set to be transferred.
<Coord Sys:>	Choicelist	To select the coordinate system to be transferred.
<File:>	Choicelist Output	To select the geoid field file, the CSCS field file or the entire contents of the System RAM to be transferred, depending on the transfer option chosen. The select the modem or GSM station or the server to be transferred as a binary file. CDMA stations are also transferred.
<Format File:>	Choicelist	To select the format files to be transferred.
<Job:>	Choicelist	Available for instruments with internal memory. To select the job to be transferred between Compact-Flash card and internal memory.

Field	Option	Description
<Antenna:>	Choicelist	To select the antenna records to be transferred.

Next step

IF all XX	THEN
are to be transferred	ALL (F3) transfers all objects in list.
are not to be transferred	CONT (F1) transfers selected object.

25.1

Application Programs

Description

Application program uploads are possible from the CompactFlash card to the application programs memory. These files are stored in the \SYSTEM directory of the memory device and use the extension *.a*.

Access

Select **Main Menu: Tools...\Upload System Files...\Application Programs.**

TOOLS

Upload Application Programs

12:16
TOOLS

IR STD

Upload Application Programs

From : CF Card
To : Instrument

Program : GPSS en
Version : v2.00

CONT DEL Q2 a ↑

CONT (F1)

To upload an application program and return to the screen from where this screen was accessed.

DEL (F4)

To delete an application program.

Description of fields

Field	Option	Description
<From:>	Output	Upload from CompactFlash card.
<To:>	Output	Upload to application program memory.
<Program:>	Choicelist	List of program files stored on the CompactFlash card.
<Version:>	Output	Version of the program file chosen.

Next step

CONT (F1) uploads the selected application program.

25.2

System Languages

Description

System language uploads are possible from the CompactFlash card to the instrument. These files are stored in the \SYSTEM directory of the active memory device and use an extension that is individual to each language.

Access

Select **Main Menu: Tools...\Upload System Files...\System Languages**.

TOOLS

Upload System Languages

12:17
TOOLS
Upload System Languages
From : CF Card
To : Instrument
Language : GERMAN
Version : v2.00

CONT (F1)

To upload a system language and return to the screen from where this screen was accessed.

CONT DEL Q2 a ↑

DEL (F4)

To delete a language from the System RAM.

Description of fields

Field	Option	Description
<From:>	Output	Upload from CompactFlash card.
<To:>	Output	Upload to the instrument.

Field	Option	Description
<Language:>	Choicelist	List of language files stored on the CompactFlash card.
<Version:>	Output	Version of the language file.

Next step

CONT (F1) uploads the selected language.



It is not possible to have more than three language files stored on the instrument. English is always available as the default language and cannot be deleted.

25.3

Instrument Firmware

Description

Firmware uploads are possible from the CompactFlash card to the instrument, Smart-Antenna or RX1200. These files are stored in the \SYSTEM directory of the active memory device and use the extension *.fw.



Firmware can be uploaded from LGO on a PC directly through a serial interface to the CompactFlash card in the instrument and from there to the instrument or the RX1200.



SmartAntenna must be connected to the instrument when uploading SmartAntenna firmware. Uploading SmartAntenna firmware takes some time.

Access

Select **Main Menu: Tools...\Upload System Files...\Instrument Firmware**.

TOOLS

Upload System Firmware

18:34
TOOLS
Upload System Firmware

From : CF Card
To : Instrument

Firmware : TPS1200.FW
Version : v2.00

CONT (F1)

To upload firmware and return to the screen from where this screen was accessed.

CONT Q2 a ↑

Description of fields

Field	Option	Description
<From:>	Output	Upload from CompactFlash card.
<To:>	Output	Upload to the instrument, SmartAntenna or the RX1200.
<Firmware:>	Choicelist	List of firmware files stored on the CompactFlash card. Firmware for SmartAntenna is a separate file independant from the instrument firmware. For the RX1200 firmware files, available languages are included in the firmware.
<Version:>	Output	Version of the firmware file.

Next step

CONT (F1) to upload firmware.

26.1

Overview

Description

The calculator can be used to perform the following arithmetic operations such as

- addition, subtraction, multiplication and division
- statistics
- trigonometry, hyperbolic trigonometry and calculations with Pi
- polar, rectangular and angle conversions
- powers, logs, roots and exponential functions.

Operating modes

The calculator has two operating modes - RPN mode and Standard mode. The arithmetic operations available are identical, the difference lies in the way information is entered, stored and displayed on the screen.

Type	Description
RPN	Reverse Polish Notation This operating mode was developed as a way of writing mathematical expressions without using parenthesis and brackets. Many scientific calculators, for example Hewlett Packard calculators, are implemented with this operating mode. Values are entered and kept in a working stack.
Standard	This operating mode is based on the principles of conventional pocket calculators. There is no stacking of values.

Access

Select **Main Menu: Tools...\Calculator**.

OR

Press a hot key configured to access the screen **TOOLS XX Calculator**. Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

OR

Press **CALC** in any screen when editing an input field for numeric characters, such as **<Azimuth:>** in **COGO Traverse Input**. Refer to "26.4.4 Calling and Closing the Calculator from an Input Field for Numeric Characters".

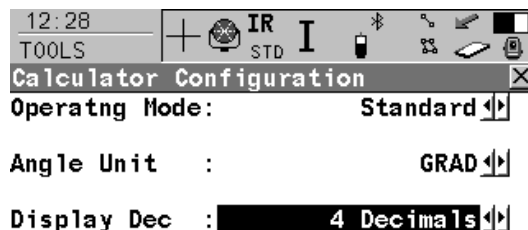
26.3

Configuring the Calculator

Access step-by-step

Step	Description
1.	Refer to "26.2 Accessing the Calculator" to access TOOLS XX Calculator .
2.	SHIFT CONF (F2) to access TOOLS Calculator Configuration .

TOOLS Calculator Configura- tion



CONT (F1)

To accept changes and return to the screen from where this screen was accessed.

Description of fields

Field	Option	Description
<Operatng Mode:>	RPN	The principle of, for example, Hewlett Packard calculators. Refer to "26.1 Overview" for more information. Refer to "26.4.1 RPN Mode" for a working example.

Field	Option	Description
	Standard	The principle of conventional pocket calculators. Refer to "26.1 Overview" for more information. Refer to "26.4.2 Standard Mode" for a working example.
<Angle Unit:>	DEG RAD GRAD	The unit used for trigonometric functions in the calculator. The selection here is independent from the angle setting in CONFIGURE Units & Formats . Degrees Radians Gon
<Display Dec:>	From 0 Decimals to 10 Decimals	The number of decimal places shown in TOOLS Calculator .

Next step

CONT (F1) confirms the selections made and returns to the screen from where **TOOLS Calculator Configuration** was accessed.

26.4

26.4.1

Using the Calculator

RPN Mode

Requirements

<Operating Mode: RPN> in **TOOLS Calculator Configuration**.

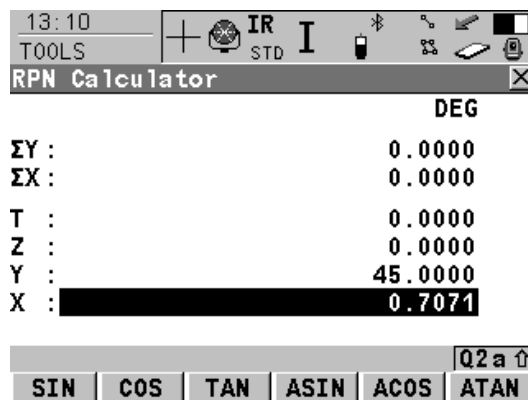
Access

Refer to "26.2 Accessing the Calculator" to access **TOOLS RPN Calculator**.

TOOLS

RPN Calculator

Refer to paragraph "Working example" for information about the operating principle.



The function keys **F1-F6** are allocated seven times. Using $\blacktriangle$ or $\blacktriangledown$ the various allocations can be accessed. Refer to "26.4.3 Description of Softkeys" for information about the function keys.

Description of fields

Field	Option	Description
First field on the screen	Output DEG RAD GRAD	The unit used for trigonometric functions in the calculator as configured in TOOLS Calculator Configuration . Degrees Radians Gon
<ΣY:>	Output	The result of the sum or difference of values in <Y:> using Σ+ (F1) and Σ- (F2) .
<ΣX:>	Output	The result of the sum or difference of values in <X:> using Σ+ (F1) and Σ- (F2) .
<T:>	Output	Third stack. After an operation, the value from <Z:> is written here.
<Z:>	Output	Second stack. After an operation, the value from <Y:> is written here.
<Y:>	Output	First stack. After an operation, the value from <X:> is written here.
<X:>	User input	The value for the next operation.

Next step

SHIFT DONE (F4) returns to **TPS1200+/TS30/TM30 Main Menu**.

Working example

Task: Calculate $(3 + 5) / (7 + 6)$.

Step	Description
1.	Type in 3.
2.	ENTER
3.	Type in 5.
4.	ENTER
	<Y: 3>, <X: 5>
5.	+ (F1)
	<X: 8>
6.	Type in 7.
7.	ENTER
	<Y: 8>, <X: 7>
8.	Type in 6.
9.	ENTER
	<Z: 8>, <Y: 7>, <X: 6>
10.	+ (F1)
	<Y: 8>, <X: 13>
11.	/ (F4)
	<X: 0.61538>

26.4.2

Standard Mode

Requirements

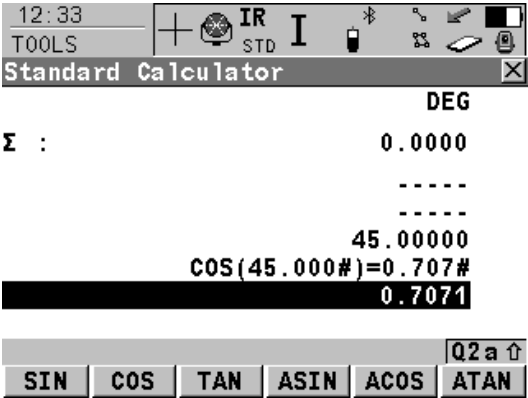
<Operatng Mode: Standard> in **TOOLS Calculator Configuration**.

Access

Refer to "26.2 Accessing the Calculator" to access **TOOLS Standard Calculator**.

TOOLS
Standard Calculator

Refer to paragraph "Working example" for information about the operating principle.



The function keys **F1-F6** are allocated seven times. Using  or  the various allocations can be accessed. Refer to "26.4.3 Description of Softkeys" for information about the function keys.

Description of fields

Field	Option	Description
First field on the screen	Output	The unit used for trigonometric functions in the calculator as configured in TOOLS Calculator Configuration .
	DEG	Degrees

Field	Option	Description
	RAD GRAD	Radians Gon
<Σ:>	Output	The result of the sum or difference of values in the last field on the screen using Σ+ (F1) and Σ- (F2) .
Third to sixth field on the screen	Output	Previously entered value OR Latest operation including result # indicates that the value is cut after the third decimal.
Last field on the screen	User input	The value for next operation or result from latest operation.

Next step

SHIFT DONE (F4) returns to **TPS1200+/TS30/TM30 Main Menu**.

Working example

Task: Calculate $(3 + 5) / (7 + 6)$.

Step	Description
1.	Type in 3.
2.	ENTER
3.	+ (F1)
4.	Type in 5.
5.	ENTER

Step	Description
	Last field on the screen displays 8.00000 .
6.	 such that STO (F1) is visible.
7.	STO (F1)
8.	 such that + (F1) is visible.
9.	Type in 7.
10.	ENTER
11.	+ (F1)
12.	Type in 6.
13.	ENTER
	Last field on the screen displays 13.00000 .
	Remember 13.00000 .
14.	 such that REC (F2) is visible.
15.	REC (F2) to recall 8.00000.
16.	ENTER
17.	 such that / (F4) is visible.
18.	/ (F4)
19.	Type in 13.
20.	ENTER
	Last field on the screen displays 0.61538 .

26.4.3

Description of Softkeys

Overview of softkeys

The softkeys shown and described are those of **<Operating Mode: RPN>**. Most of the softkeys are identical and their functionality is similar to that for **<Operating Mode: Standard>**.

The function keys **F1-F6** are allocated seven times with softkeys. Using  or  the various allocations can be accessed.



DEG

ΣY :	0.0000
ΣX :	0.0000
T :	0.0000
Z :	0.0000
Y :	45.0000
X :	0.7071

					Q2 a ↑
+	-	*	/	+/-	CLR X
Σ+	Σ-	MEAN	SDEV		CLR Y
SIN	COS	TAN	ASIN	ACOS	ATAN
°DMS	°DEC	PI		D->R	R->D
POLAR	RECT	SQRT	X^2	1/X	Y^X
LOG	10^X	LN	e^X		Y^X
STO	RCL	X<>Y	LASTX		CLEAR
HELP	CONF		DONE		QUIT

Description of softkeys

First level



+ (F1)

To add $\langle X \rangle$ and $\langle Y \rangle$.

- (F2)

To subtract $\langle X \rangle$ from $\langle Y \rangle$.

*** (F3)**

To multiply $\langle X \rangle$ by $\langle Y \rangle$.

/ (F4)

To divide $\langle Y \rangle$ by $\langle X \rangle$.

+/- (F5)

To change between positive and negative algebraic sign for $\langle X \rangle$.

CLR X (F6)

To clear $\langle X \rangle$.

 to access the **Second level**



Σ+ (F1)

To add $\langle X \rangle$ to $\langle \Sigma X \rangle$ and $\langle Y \rangle$ to $\langle \Sigma Y \rangle$.

Σ- (F2)

To subtract $\langle X \rangle$ from $\langle \Sigma X \rangle$ and $\langle Y \rangle$ from $\langle \Sigma Y \rangle$.

MEAN (F3)

To calculate the mean $\langle \Sigma X \rangle$.

SDEV (F4)

To calculate the standard deviation for $\langle \Sigma X \rangle$.

CLR Σ (F6)

To clear $\langle \Sigma X \rangle$ and $\langle \Sigma Y \rangle$.

▼ to access the **Third level**



SIN (F1)

To calculate sine of <X>.

COS(F2)

To calculate cosine of <X>.

TAN (F3)

To calculate tangent of <X>.

ASIN (F4)

To calculate arcsine of <X>.

ACOS (F5)

To calculate arccosine of <X>.

ATAN (F6)

To calculate arctangent of <X>.

▼ to access the **Fourth level**



°DMS (F1)

To convert decimal degrees into dd.mm.ss.

°DEC(F2)

To convert dd.mm.ss into decimal degrees.

PI (F3)

To insert <X: 3.1415926536>. The number of decimals depends on the selection for <Display Dec:> in **TOOLS Calculator Configuration**.

D -> R (F5)

To convert degrees into radians.

R -> D (F6)

To convert radians into degrees.

▼ to access the **Fifth level**

POLAR	RECT	SQRT	X^2	1/X	Y^X

POLAR (F1)

Conversion of rectangular coordinates into polar coordinates. The y coordinate must be visible in <Y:> and the x coordinate in <X:> when pressing this key. The angle is displayed in <Y:> and the distance in <X:>.

RECT(F2)

Conversion of polar coordinates into rectangular coordinates. The angle must be visible in <Y:> and the distance in <X:> when pressing this key. The y coordinate is displayed in <Y:>, the x coordinate in <X:>.

SQRT (F3)

To calculate $\sqrt{\text{<X:>}}$.

X^2 (F4)

To calculate <X:>^2 .

1/X (F5)

To inverse <X:>.

Y^X (F6)

To calculate $\text{<Y:>}^{\text{<X:>}}$.

▼ to access the **Sixth level**

LOG	10^X	LN	e^X		Y^X

LOG (F1)

To calculate the $\log_{10} \text{<X:>}$.

10^X(F2)

To calculate $10^{\text{<X:>}}$.

LN (F3)

To calculate the $\log_e \text{<X:>}$.

e^X (F4)

To calculate $e^{<X>}$.

Y^X (F6)

To calculate $<Y>^{<X>}$.

▼ to access the **Seventh level**

STO **RCL** **X<>Y** **LASTX** **CLEAR**

STO (F1)

To store $<X>$ to the memory. Up to ten values can be stored.

RCL (F2)

To recall a value for $<X>$ from the memory. Up to ten values can be recalled.

X<>Y (F3)

To swap the values for $<X>$ and $<Y>$.

LASTX (F4)

To recall the last $<X>$ before recent calculation.

CLEAR (F6)

To delete everything.

SHIFT to access the second level of function keys

HELP **CONF** **DONE** **QUIT**

SHIFT CONF (F2)

To configure the calculator.

SHIFT DONE (F4)

To return to **TPS1200+/TS30/TM30 Main Menu**.

26.4.4

Calling and Closing the Calculator from an Input Field for Numeric Characters



Call and close calculator step-by-step

COGO traverse calculation is used as example.

Step	Description	Refer to chapter
1.	Select Main Menu: Programs...\COGO to access the screen COGO COGO Begin .	
2.	COGO COGO Begin Check the settings.	
3.	CONT (F1) to access COGO COGO Menu .	
4.	COGO COGO Menu Highlight Traverse .	
5.	CONT (F1) to access COGO Traverse Input .	
6.	COGO Traverse Input Highlight <Azimuth:> .	
7.	ENTER	
8.	CALC (F5) to access TOOLS XX Calculator .	
	If a value had already been typed in for <Azimuth:> , this value is taken over into the input field in TOOLS XX Calculator .	
9.	TOOLS XX Calculator	

Step	Description	Refer to chapter
	Perform the calculations.	26.4.1, 26.4.2
10.	SHIFT DONE (F4) to return to COGO Traverse Input .	
	The calculated value is taken over for <Azimuth:> .	

Description

Allows ASCII files on the memory device to be viewed. The ASCII file can have up to 500 KB. Refer to "Appendix C Directory Structure of the Memory Device" for more information on the contents of folders on the memory device.



The \DBX directory cannot be accessed to view files.

Access

Select **Main Menu: Tools...\File Viewer**.

TOOLS**Device\Directory**

13:33		
TOOLS	+ IR STD I	
CF-Card		
File Name	Data Time	
..		
Code	21.11.05	12:11
Config	17.11.05	17:08
Convert	17.11.05	17:08
Data	21.11.05	13:25
DBX	21.11.05	13:29
Gps	17.11.05	17:08
Gsi	17.11.05	17:08
		Q2 a ↑
CONT	DIR	VIEW DEL MORE INTL

CONT (F1)

To access the highlighted directory or to view the highlighted file.

DIR (F2)

Available for a directory or .. being highlighted. To access the highlighted directory or to move up one directory.

VIEW (F3)

Available for a file being highlighted. To view the highlighted file. Accesses **TOOLS View File: File Name**. Refer to "TOOLS View File: File Name".

DEL (F4)

Available for a file being highlighted. To delete the highlighted file.

MORE (F5)

To display information about the size of a directory or file.

CFCRD (F6) or INTL (F6)

Available for instruments with internal memory. To change between viewing jobs stored on the CompactFlash card or internal memory.

Description of columns

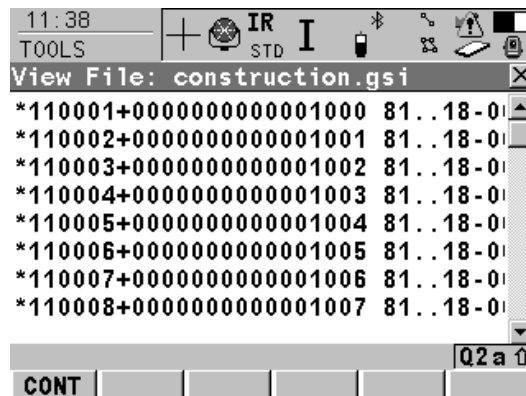
Column	Description
First	Directories and files are displayed if available. The file extension is shown for files. \ at the beginning of a line indicates a directory. .. is displayed at the top of the list if a directory has been accessed.
Second	Date of the directory or file.
Third	Time of the directory or file.

Next step

IF	THEN
the screen is to be quit	ESC to return to TPS1200+/TS30/TM30 Main Menu .
a directory is to be accessed	highlight the directory and DIR (F2) .
a file is to be viewed	highlight the file and VIEW (F3) . Refer to "TOOLS View File: File Name".

TOOLS

View File: File Name



CONT (F1)

To return to the screen from where this screen was accessed.

Keys

Keys	Function
	Moves up.
	Moves down.
	Moves right.
	Moves left.

Next step

CONT (F1) returns to the screen from where **TOOLS View File: File Name** was accessed.

Description

- A licence key can be used to activate application programs and protected options and can be used to define the expiry date of the software maintenance. Refer to "31.4 STATUS: System Information" to find out how to check the expiry date of the software maintenance.
- A licence key file can be uploaded to the instrument. To upload a licence key file the file should be located on the \SYSTEM directory of the CompactFlash card. Licence key files use the naming convention L_123456.key, where 123456 is the instrument serial number.
- Licence keys can also be typed in manually in **Main Menu: Tools...\Licence Keys** or the first time the application program is started.

Access

Select **Main Menu: Tools...\Licence Keys**.
OR
Select an application program not yet activated.

TOOLS

Enter Licence Key



Method : Manual Entry of Key
Key : 4h16f9phweowrb

CONT (F1)

To accept changes and return to
TPS1200+/TS30/TM30 Main Menu or
continue with application program.



SHIFT DEL (F4)

To delete all licence keys on the instrument.

Description of fields

Field	Option	Description
<Method:>		The method used to input the licence key to activate the application program or the protected options or the software maintenance.
	Upload Key File	The licence key file is uploaded from the Compact-Flash card. The licence key file must be stored in the \SYSTEM directory on the CompactFlash card.
	Manual Entry of Key	Allows the licence key to be typed in manually.

Field	Option	Description
<Key:>	User input	Available for <Method: Manual Entry of Key>. The licence key required to activate an application program. Entry is not case sensitive.

Next step

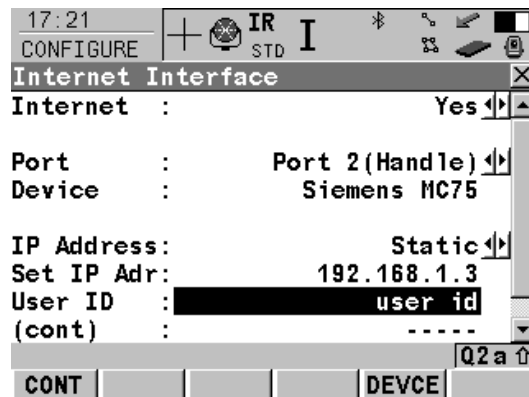
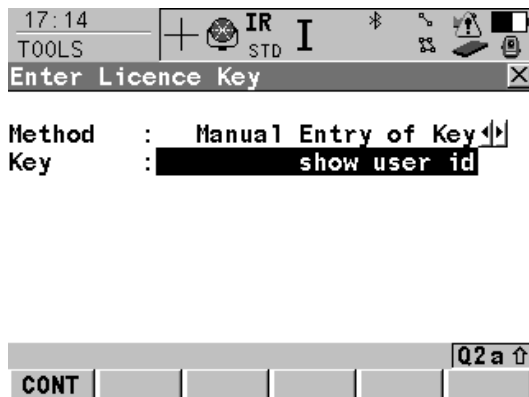
CONT (F1) returns to **TPS1200+/TS30/TM30 Main Menu** or continues with selected application program.

Showing/Hiding the User ID for the Internet Interface

Showing The User ID

1) Type "show user id" (not case sensitive) and press **CONT (F1)** to continue.

2) The user Id will then always be displayed.



Hiding the User ID

- 1) Type "hide user id" (not case sensitive) and press **CONT (F1)** to continue. 2) The user Id will then always be hidden.

17:13					17:22				
TOOLS					CONFIGURE				
IR STD I					IR STD I				
Enter Licence Key					Internet Interface				
Method : Manual Entry of Key					Internet : Yes				
Key : hide user id					Port : Port 2(Handle)				
					Device : Siemens MC75				
					IP Address: Static				
					Set IP Adr: 192.168.1.3				
					User ID : *****				
					(cont) : -----				
Q2 a ↑					Q2 a ↑				
CONT					CONT DEVICE				

29.1

Overview

Description

Leica instruments are manufactured, assembled and adjusted to the best possible quality. Quick temperature changes, shock or stress can cause deviations and influence the instrument accuracy.

It is therefore recommended to check and adjust the instrument from time to time. This can be done in the field by running through specific measurement procedures. The procedures are guided and have to be followed carefully and precisely as described in the following chapters. Some other instrument errors and mechanical parts can be adjusted mechanically.

Electronic adjustment

The following instrument errors can be checked & adjusted electronically:

l, t	Compensator longitudinal and transversal index errors
i	Vertical index error, related to the standing axis
c	Hz collimation error, also called line of sight error
a	Tilting axis error
ATR	ATR zero point error for Hz and V - option

Every angle measured in the daily work is corrected automatically if the compensator and the Hz-corrections are activated in the instrument configuration. Select **Main Menu:**

Config...\Instrument Settings...\Compensator to check the settings.

The results from check and adjust are displayed as errors but used with the opposite sign as corrections when applied to measurements.

Mechanical adjustment

Refer to the Leica TPS1200+ User Manual/TS30/TM30 User Manual for details.

Precise measurements

To get precise measurements in the daily work, it is important:

- To check and adjust the instrument from time to time.
- To take high precision measurements during the check and adjust procedures.
- To measure targets in two faces. Some of the instrument errors are eliminated by averaging the angles from both faces.
- To follow the four advices below.



During the manufacturing process, the instrument errors are carefully determined and set to zero. As mentioned above, these errors can change and it is highly recommended to re-determine them in the following situations:

- Before the first use
- Before every high precision survey
- After rough or long transportations
- After long working periods
- After long storage periods
- If the temperature difference between current environment and the temperature at the last calibration is more than 20°C

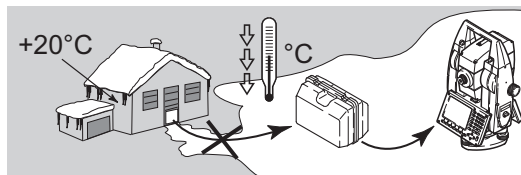


Before determining the instrument errors, the instrument has to be levelled up using the electronic level. **SHIFT F12** to access **STATUS Level & Laser Plummet**, Refer to "31.7 STATUS: Level & Laser Plummet".

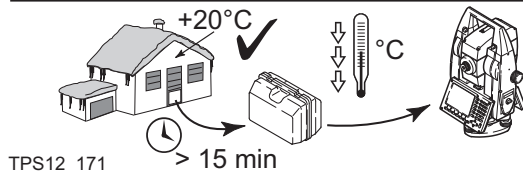
The tribrach, the tripod and the underground should be very stable and secure from vibrations or other disturbances.



The instrument should be protected from direct sunlight in order to avoid thermal warming in general and especially on one side of the instrument housing. It is also recommended to avoid strong heat shimmer and air turbulences. The best conditions can be found usually early in the morning and with overcast sky.



Before starting to work, the instrument has to become acclimatised to the ambient temperature. Approximately two minutes per °C temperature difference from storage to working environment but at least 15 min should be taken into account.



TPS12_171

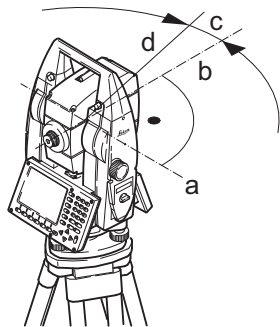
29.2

Details on Instrument Errors

General

Instrument errors occur, if the standing axis, the tilting axis and the line of sight are not precisely perpendicular to each other.

Hz collimation error (c)

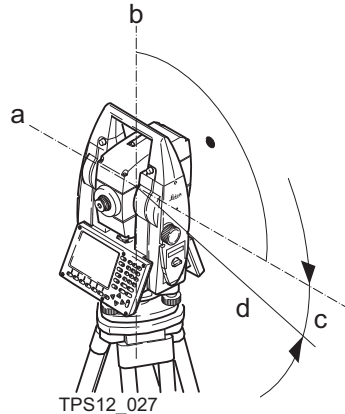


TPS12_026

- a) Tilting axis
- b) Line perpendicular to tilting axis
- c) Hz collimation error (c), also called line of sight error
- d) Line of sight

The Hz collimation error (c) is also called line of sight error. It is caused by the deviation between the optical line of sight, which means the direction in which the crosshairs points and the line perpendicular to the tilting axis. This error affects all Hz readings and increases with steep sightings.

Tilting axis error (a)

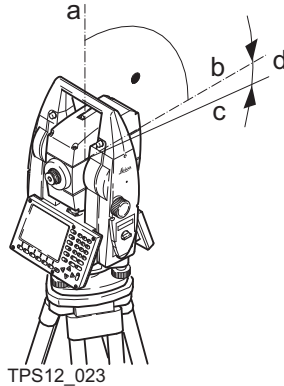


- a) Axis perpendicular to the vertical axis
- b) Mechanical vertical axis of the instrument, also called standing axis
- c) Tilting axis error
- d) Tilting axis

The tilting axis error (a) is caused by the deviation between the mechanical tilting axis and the line perpendicular to the vertical axis.

This error affects Hz angles. The affection is 0 in the horizon and increases with steep sights. To determine this error, it is necessary to point to a target located significantly below or above the horizontal plane. To avoid influences from the Hz collimation error (c), this has to be determined prior to the tilting axis error.

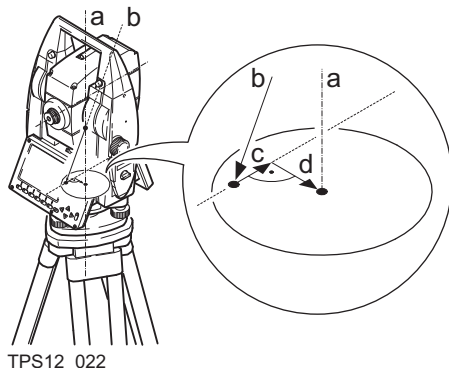
Vertical index error (i)



- a) Mechanical vertical axis of the instrument, also called standing axis
- b) Axis perpendicular to the vertical axis
- c) $V = 90^\circ$ reading in a specific face
- d) Vertical index error

A vertical index error (i) exists, if the 0° mark of the vertical circle reading doesn't coincide with the mechanical vertical axis of the instrument, also called standing axis.
The V index error (i) is a constant error that affects all vertical angle readings.

Compensator index errors (l, t)



- a) Mechanical vertical axis of the instrument, also called standing axis
- b) Plumb line
- c) Longitudinal component (l) of the compensator index error
- d) Transversal component (t) of the compensator index error

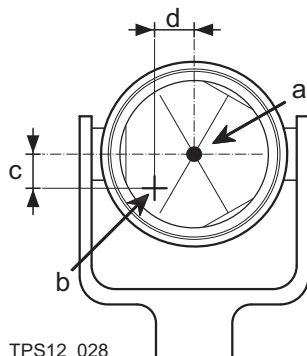
The compensator index errors (l, t) occur, if the vertical axis of the instrument and the plumb-line are parallel but the zero points of the compensator and the circular level do not coincide. The calibration procedure electronically adjusts the zero point of the compensator.

The plane of the dual axis compensator of the TPS1200+/TS30/TM30 is defined by a longitudinal component in direction of the telescope and a transversal component perpendicular to the telescope.

The longitudinal compensator index error (l) has a similar effect as the vertical index error and affects all vertical angle readings.

The transversal compensator index error (t) is similar to the tilting axis error. The effect of this error to the Hz angle readings is 0 at the horizon and increases with steep sightings.

ATR collimation errors



- a) Centre of prism
- b) Crosshairs
- c) V component of ATR collimation error
- d) Hz component of ATR collimation error

The ATR collimation error is the angular divergence between the line of sight, which means the direction in which the crosshairs points, and the ATR CCD camera axis, which detects the centre of the prism. Hz and V angles are corrected by the Hz and V components of the ATR calibration errors to measure exactly to the centre of the prism.



Note, that even after adjustment of the ATR, the crosshairs might not be positioned exactly on the centre of the prism after an ATR search. This is a normal effect. To speed up the ATR search, the telescope is not positioned exactly on the centre of the prism. The small rest deviations, the ATR offsets, are measured individually for each measurement and corrected electronically. This means that the Hz- and V- angles are corrected twice: first by the determined ATR errors for Hz and V and then by the individual small deviations of the current pointing, the ATR offsets.

**Summary of errors to be
adjusted electronically**

Instrument error	Effects Hz	Effects V	Elimination with two face measurement	Automatically corrected with proper adjust- ment
c - Hz collimation error	✓	-	✓	✓
a - Tilting axis error	✓	-	✓	✓
l - Compensator index error	-	✓	✓	✓
t - Compensator index error	✓	-	✓	✓
i - V-Index error	-	✓	✓	✓
ATR Collimation error	✓	✓	-	✓

29.3

Accessing Check & Adjust Menu

Access

Select **Main Menu: Tools...\Check & Adjust...**

OR

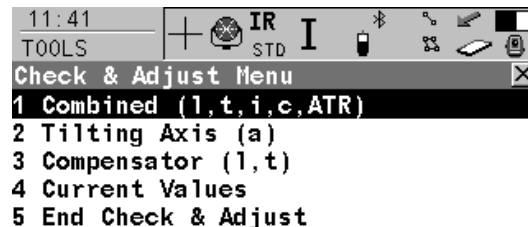
Press a hot key configured to access the screen **TOOLS Check & Adjust Menu**. Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

TOOLS

Check & Adjust Menu



CONT (F1)

To select the highlighted option and to continue with the subsequent screen.

CONF (F2)

To access the **TOOLS Configuration** screen. Refer to "29.4 Configure Check & Adjust".



Description of the Check & Adjust functions

Function	Description	Refer to chapter
Combined (l,t,i,c,ATR)	To determine the l, t, i, c and ATR instrument errors.	29.5
Tilting Axis (a)	To determine the tilting axis (a) error.	29.6
Compensator (l,t)	To determine the compensator (l, t) errors.	29.7
Current Values	To view the current instrument errors	29.8
End Check & Adjust	To exit the TOOLS Check & Adjust Menu .	

Next step

IF the task is to	THEN
determine the instrument errors	select one of the three available check and adjust procedures: Combined (l, t, i, c, ATR) , Tilting Axis (a) or Compensator (l, t) .
adjust the circular level	Refer to "29.9 Adjusting the Circular Level of the Instrument and Tribrach".
inspect the laser plummet	Refer to "29.11 Inspecting the Laser Plummet of the Instrument".
adjust the tripod	Refer to "29.12 Servicing the Tripod".
to end check and adjust	select End Check & Adjust .

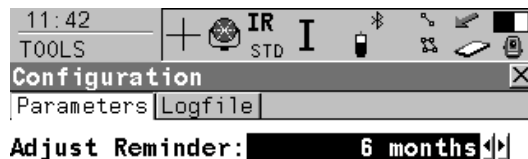
29.4

Configure Check & Adjust

Access step-by-step

Step	Description
1.	Refer to "29.3 Accessing Check & Adjust Menu" to access TOOLS Check & Adjust Menu .
2.	CONF (F2) to access TOOLS Configuration .

TOOLS Configuration, Parameters page



CONT (F1)

To accept the settings and to return to the screen **TOOLS Check & Adjust Menu**

PAGE (F6)

To change to another page on this screen.



Description of fields

Field	Option	Description
<Adjust Reminder:>	2 weeks, 1 month, 3 months, 6 months, 12 months or Never	A reminder message is displayed each time the instrument is turned on if one or more adjustment values were determined longer ago than the time specified with this parameter. This helps to redetermine the instrument errors on a regular basis. A reminder message to readjust the instrument is never displayed. This setting is not recommended.

Next step

PAGE (F6) changes to the **Logfile** page.

TOOLS

Configuration, Logfile page

Description of fields

Field	Option	Description
<Write Logfile:>	Yes or No	To generate a logfile when the application program is exited. A logfile is a file to which data from an application program is written to. It is generated using the selected <Format File:> .
<File Name:>	Choicelist	Available for <Write Logfile: Yes> . The name of the file to which the data should be written. A logfile is stored in the \DATA directory of the active memory device. The data is always appended to the file.

Field	Option	Description
		Opening the choicelist accesses XX Logfiles where a name for a new logfile can be created and an existing logfile can be selected or deleted.
<Format File:>	Choicelist	Available for <Write Logfile: Yes>. A format file defines which and how data is written to a logfile. Format files are created using LGO. A format file must first be transferred from the CompactFlash card to the System RAM before it can be selected. Refer to "24 Tools...\Transfer Objects..." for information on how to transfer a format file. Opening the choicelist accesses XX Format Files where an existing format file can be selected or deleted.

Next step

PAGE (F6) changes back to the **Parameters** page.

29.5

Combined Adjustment (I, t, i, c and ATR)

Access step-by-step

Step	Description
1.	Refer to "29.3 Accessing Check & Adjust Menu" to access TOOLS Check & Adjust Menu .
2.	In TOOLS Check & Adjust Menu highlight Combined (I,t,i,c,ATR) .
3.	CONT (F1) to access TOOLS Combined I .

Description

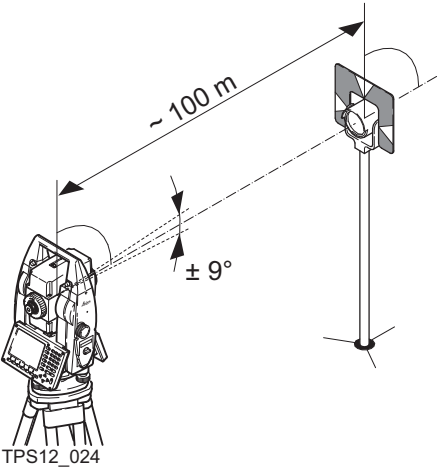
The combined adjustment procedure determines the following instrument errors in one process:

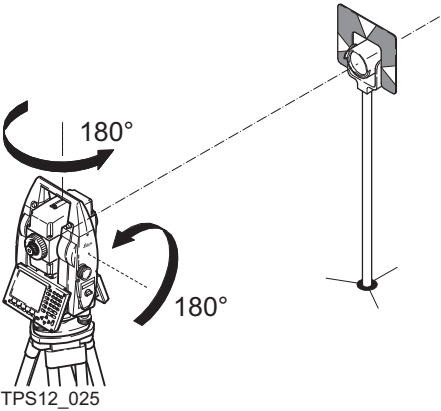
I, t	Compensator longitudinal and transversal index errors
i	Vertical index error, related to the standing axis
c	Hz collimation error, also called line of sight error
ATR Hz	ATR zero point error for Hz angle - option
ATR V	ATR zero point error for V angle - option

Combined procedure step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
	Before determining the instrument errors, the instrument has to be: • levelled up using the electronic level • protected from direct sunlight • acclimatised to the ambient temperature, approximately two minutes per °C difference compared to the storage place. • Refer to "29.1 Overview" paragraph "Precise measurements" for more details.	
1.	TOOLS Check & Adjust Menu Select the option Combined (I,t,i,c,ATR)	
2.	TOOLS Combined I <ATR Adjust: On> Includes the determination of the ATR, Hz and V adjustment values if an ATR is available.  It is recommended to use a clean Leica circular prism as target, for example a GPR1. Do not use a 360° prism. <ATR Adjust: Off> ATR Hz and V adjustment value determination is not included. A prism is not necessarily required to run the procedure.	

Step	Description	Refer to chapter
3.	 Aim the telescope accurately at a target at a distance of about 100 m. The target must be positioned within $\pm 9^\circ/\pm 10$ gon of the horizontal plane ☞ The procedure can be started in any telescope face. ☞ The fine pointing has to be performed manually in both faces. TPS12_024	

Step	Description	Refer to chapter
4.	MEAS (F1) to measure and to continue to the next screen.  Motorised instruments change automatically to the other face. TPS12_025 Non-motorised TPS1200+ instruments guide to the other face using the TOOLS Telescope Positioning screen.	32
5.	TOOLS Combined II MEAS (F1) to measure the same target in the other face and to calculate the instrument errors.	
	If one or more errors are bigger than the predefined limits, the procedure has to be repeated. All measurements of the current run are rejected and are not averaged with the results from previous runs.	
6.	TOOLS Adjustment Accuracy	

Step	Description	Refer to chapter
	<No. of Meas:> Shows the number of runs executed. One run consists of a measurement in face I and face II. All other fields display the standard deviations of the determined adjustment errors. The standard deviations can be calculated from the second run onwards.	
	It is recommended to measure at least two runs.	
7.	MEAS (F5) if more runs have to be added. Continue with step 2. OR CONT (F1) to accept the measurements and to access TOOLS Adjustment Results. No more runs can be added later.	

TOOLS Adjustment Results

11:43		+  IR		  	
TOOLS		STD I		  	
Adjustment Results 					
Component	New [g]	Use			
l Comp	0.0000	Yes			
t Comp	0.0000	Yes			
i V-index	-0.0000	Yes			
c Hz-col	-0.0000	Yes			
ATR Hz	0.0118	Yes			
ATR V	0.0118	Yes			
					Q2 a 
CONT	REDO		USE	MORE	

CONT (F1)

To accept and store the new determined instrument errors, where **Yes** is set in the Use column. Writes to or appends to an existing logfile, if the logfile recording has been enabled. Refer to "29.4 Configure Check & Adjust".

USE (F4)

To set **Yes** or **No** in the **Use** column for the highlighted set.

MORE (F5)

To view additional information about the current used old instrument errors.

REDO (F2)

To reject all results and to repeat the complete check and adjust procedure. Refer to step 2. of paragraph "Combined procedure step-by-step".

Description of columns and fields

Column	Option	Description
New [g]	-----	Shows the new determined and averaged instrument errors. The unit is displayed in [].
Use	Yes	Stores the new adjustment error.
	No	Keeps the currently used error active on the instrument and rejects the new one.
Old [g]	-----	Shows the old adjustment errors, which are currently valid on the instrument. The unit is displayed in [].

Next step

IF the results are	THEN
to be stored	CONT (F1) overwrites the old adjustment errors with the new ones, if Yes is set in the Use column.

IF the results are	THEN
to be determined again	REDO (F2) rejects all new determined adjustment values and repeats the whole procedure. Refer to step 2. of paragraph "Combined procedure step-by-step".

29.6

Tilting Axis Adjustment (a)

Access step-by-step

Step	Description
1.	Refer to "29.3 Accessing Check & Adjust Menu" to access TOOLS Check & Adjust Menu .
2.	In TOOLS Check & Adjust Menu highlight Tilting Axis (a) .
3.	CONT (F1) to access TOOLS Tilting-Axis Adjustment I .

Description

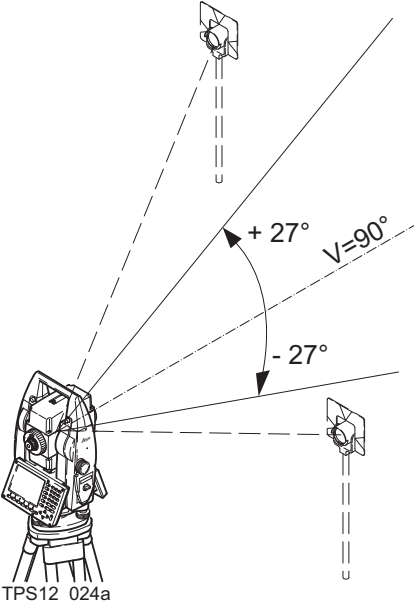
This procedure determines the following instrument error:

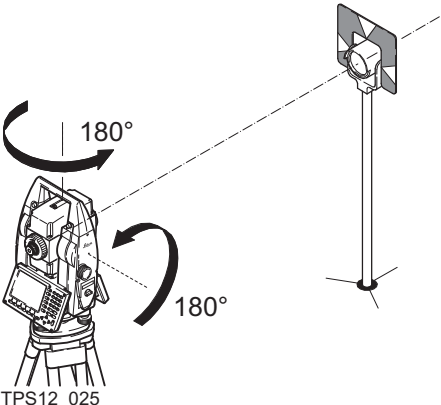
a Tilting axis error

Tilting axis adjustment step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

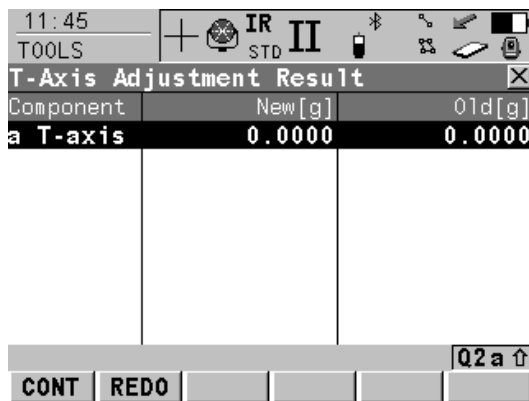
Step	Description	Refer to chapter
	Before determining the tilting axis error, the instrument has to be: • levelled up using the electronic level • protected from direct sunlight • acclimatised to the ambient temperature, approximately two minutes per °C difference compared to the storage place. • The Hz collimation error has to be determined before.	29.1, 29.5
1.	TOOLS Check & Adjust Menu Select the option: Tilting Axis (a)	

Step	Description	Refer to chapter
2.	TOOLS Tilting-Axis Adjustment I  Aim the telescope accurately at a target at a distance of about 100 m. For distances less than 100 m make sure to precisely point to the target. The target must be positioned within at least 27°/30 gon above or beneath the horizontal plane. ☞ The procedure can be started in any telescope face. ☞ The fine pointing has to be performed manually in both faces. TPS12_024a	

Step	Description	Refer to chapter
3.	MEAS (F1) to measure and to continue to the next screen.  Motorised instruments change automatically to the other face. Non-motorised TPS1200+ instruments guide to the other face using the TOOLS Telescope Positioning screen.	32
4.	TOOLS Tilting Axis Adjustment II MEAS (F1) to measure the same target in the other face and to calculate the tilting axis error.	
	If the error is bigger than the predefined limit, the procedure has to be repeated. The measurements of the current run are then rejected and not averaged with the results from previous runs.	
5.	TOOLS T-Axis Adjustment Accuracy	

Step	Description	Refer to chapter
	<No. of Meas:> Shows the number of runs executed. One run consists of a measurement in face I and face II. <σ a T-axis:> shows the standard deviation of the determined tilting axis error. The standard deviation can be calculated from the second run onwards.	
	It is recommended to measure at least 2 runs.	
6.	MEAS (F5) if more runs have to be added. Continue with step 2. OR CONT (F1) to accept the measurements and to access TOOLS T-Axis Adjustment Result. No more runs can be added later.	

TOOLS T-Axis Adjustment Result



CONT (F1)

To accept and record the new determined tilting axis error. Writes to or appends to an existing logfile, if the logfile recording has been enabled. Refer to "29.4 Configure Check & Adjust".

REDO (F2)

To reject the result and to repeat the complete check and adjust procedure. Refer to step 2. of paragraph "Tilting axis adjustment step-by-step".

Description of columns and fields

Column	Option	Description
New [g]	-----	Shows the new determined and averaged tilting axis error. The unit is displayed in [].
Old [g]	-----	Shows the old instrument error, which is currently valid on the instrument. The unit is displayed in [].

Next step

IF the result is	THEN
to be stored	CONT (F1) overwrites the old tilting axis error with the new one.
to be determined again	REDO (F2) rejects the new determined tilting axis error and repeats the whole procedure. Refer to step 2. of paragraph "Tilting axis adjustment step-by-step".

29.7

Compensator Adjustment (I, t)

Access step-by-step

Step	Description
1.	Refer to "29.3 Accessing Check & Adjust Menu" to access TOOLS Check & Adjust Menu .
2.	In TOOLS Check & Adjust Menu highlight Compensator (I,t) .
3.	CONT (F1) to access TOOLS Compensator Adjustment .

Description

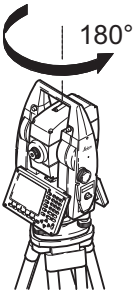
The compensator adjustment procedure determines the following instrument errors:

- I Compensator longitudinal index error
- t Compensator transversal index error

Compensator index adjustment step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
	Before determining the compensator index errors, the instrument has to be: • levelled up using the electronic level • protected from direct sunlight • acclimatised to the ambient temperature, approximately two minutes per °C difference compared to the storage place.	29.1
1.	TOOLS Check & Adjust Menu	

Step	Description	Refer to chapter
	Select the option: Compensator (I, t)	
2.	TOOLS Compensator Adjustment MEAS (F1) to measure the first face. No target has to be aimed at. Motorised instruments change to the other face and release a measurement automatically.  Non-motorised TPS1200+ instruments guide to the other face using the TOOLS Telescope Positioning screen. MEAS (F1) to release the measurement in the other face. TPS12_025a	
	If one or more errors are bigger than the predefined limits, the procedure has to be repeated. All measurements of the current run are rejected and are not averaged with the results from previous runs.	
3.	TOOLS Comp Adjustment Accuracy <No. of Meas:> Shows the number of runs executed. One run consists of a measurement in face I and face II. <σ I Comp:> and <σ t Comp:> show the standard deviations of the determined adjustment errors. The standard deviations can be calculated from the second run onwards.	
	It is recommended to measure at least two runs.	

Step	Description	Refer to chapter
4.	MEAS (F5) if more runs have to be added. Continue with step 2. OR CONT (F1) to accept the measurements and to access TOOLS Comp Adjustment Results . No more runs can be added later.	

TOOLS Comp Adjustment Results

11:48	IR			Bluetooth			Wi-Fi			USB			Battery						
TOOLS	STD			I															
Comp Adjustment Results															X				
Component					New [g]					Old [g]									
1 Comp					0.0000					0.0000									
t Comp					0.0000					0.0000									
Q2 a ↑																			
CONT				REDO															

CONT (F1)

To accept and record the new determined instrument errors. Writes to or appends to an existing logfile, if the logfile recording has been enabled. Refer to "29.4 Configure Check & Adjust".

REDO (F2)

To reject all results and to repeat the complete check and adjust procedure. Refer to step 2. of paragraph "Compensator index adjustment step-by-step".

Description of columns and fields

Column	Option	Description
New [g]	-----	Shows the new determined and averaged instrument errors. The unit is displayed in [g].

Column	Option	Description
Old [g]	-----	Shows the old instrument errors, which are currently valid on the instrument. The unit is displayed in [].

Next step

IF the results are	THEN
to be stored	CONT (F1) overwrites the old instrument errors with the new ones.
to be determined again	REDO (F2) rejects the new determined instrument errors and repeats the whole procedure. Refer to step 2. of paragraph "Compensator index adjustment step-by-step".

Access

Step	Description
1.	Refer to "29.3 Accessing Check & Adjust Menu" to access TOOLS Check & Adjust Menu .
2.	In TOOLS Check & Adjust Menu highlight Current Values .
3.	CONT (F1) to access TOOLS Current Values .

TOOLS
Current Values

11:46		
TOOLS		
Current Values		
Component	Current[g]	Date
1 Comp	0.0000	04.11.03
t Comp	0.0000	04.11.03
i V-index	0.0000	23.11.05
c Hz-col	0.0000	23.11.05
a T-axis	0.0000	23.11.05
ATR Hz	0.0000	23.11.05
ATR V	0.0000	23.11.05
		Q2 a ↑
CONT		MORE

CONT (F1)

To return to the **TOOLS Check & Adjust Menu** screen. Refer to "29.3 Accessing Check & Adjust Menu".

MORE (F5)

To display information about the date of the determination, the standard deviation of the errors and the temperature during the determination.

Next step

CONT (F1) returns to **TOOLS Check & Adjust Menu** screen. Refer to "29.3 Accessing Check & Adjust Menu".

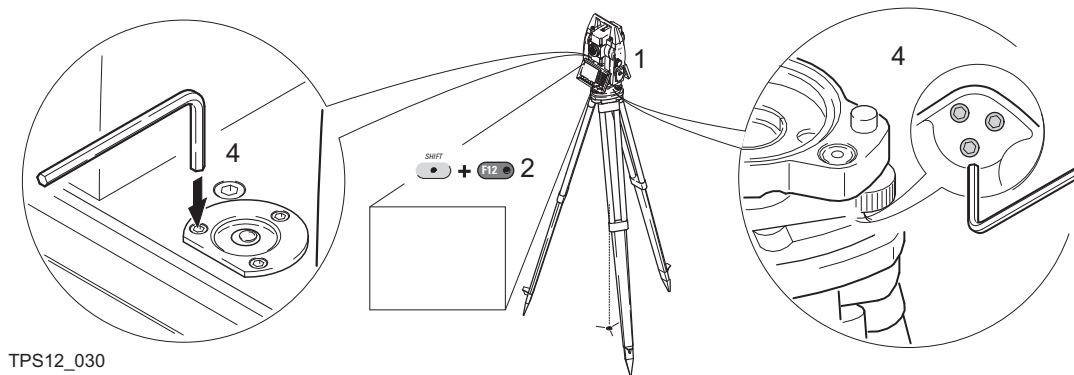


Note that the temperature of the environment around the instrument may differ from the temperature shown on the screen as it is the internal temperature of the instrument.

29.9

Adjusting the Circular Level of the Instrument and Tribrach

Adjusting the circular level step-by-step



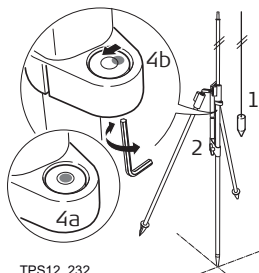
TPS12_030

Step	Description
1.	Place and secure the instrument into the tribrach and onto a tripod.
2.	Using the tribrach footscrews, level the instrument with the electronic level. SHIFT F12 to access STATUS Level & Laser Plummet .
3.	Check the position of the circular level on the instrument and tribrach.
4.	a) If both circular levels are centered, no adjustments are necessary
	b) If one or both circular levels are not centered, adjust as follows:
	Instrument: If it extends beyond the circle, use the supplied allen key to centre it with the adjustment screws. Turn the instrument by 200 gon (180°). Repeat the adjustment procedure if the circular level does not stay centered.

Step	Description
	Tribrach: If it extends beyond the circle, use the supplied allen key to centre it with the adjustment screws.
	After the adjustments, all adjusting screws should have the same tightening tension and no adjusting screw shall be loose.

29.10

Adjusting the circular level step-by-step



Step	Description
1.	Suspend a plumb line.
2.	Using a pole bipod, align the prism pole parallel to the plumb line.
3.	Check the position of the circular level on the prism pole.
4.	a) If the circular level is centered, no adjustment is necessary.
	b) If the circular level is not centered, use an allen key to centre it with the adjustment screws.
	After the adjustments, all adjusting screws should have the same tightening tension and no adjusting screw shall be loose.

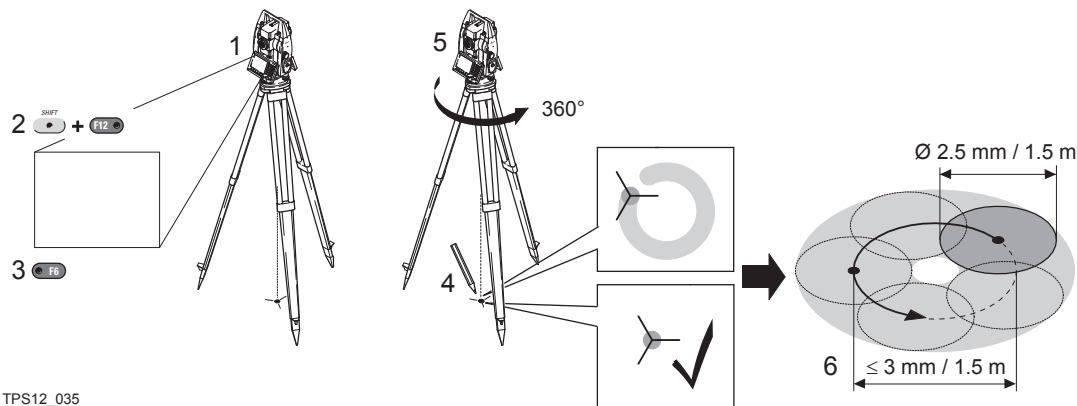
29.11



Inspecting the laser plummet step-by-step

Inspecting the Laser Plummet of the Instrument

The laser plummet is located in the vertical axis of the instrument. Under normal conditions of use, the laser plummet does not need adjusting. If an adjustment is necessary due to external influences, the instrument has to be returned to any Leica Geosystems authorized service workshop.



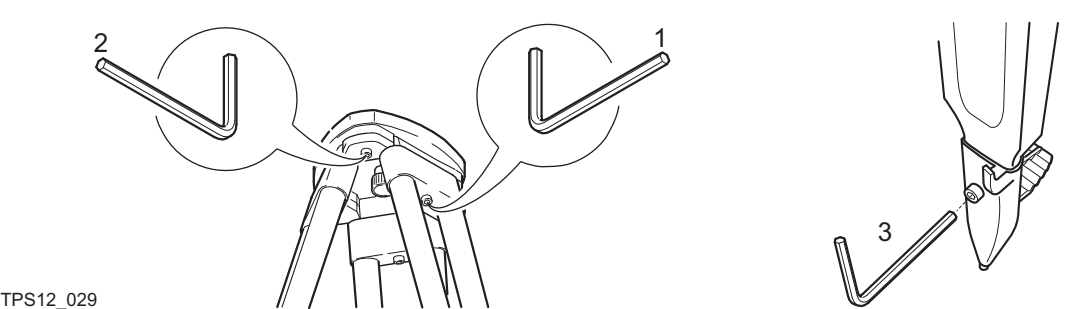
TPS12_035

The following table explains the most common settings.

Step	Description
1.	Place and secure the instrument into the tribrach and onto a tripod.
2.	Using the tribrach footscrews, level the instrument with the electronic level. SHIFT F12 to access STATUS Level & Laser Plummet .

Step	Description
3.	PAGE (F6) to access the Laser Plummet page. Switch on the laser plummet. Inspection of the laser plummet should be carried out on a bright, smooth and horizontal surface, like a sheet of paper.
4.	Mark the centre of the red dot on the ground.
5.	Turn the instrument through 360° slowly, carefully observing the movement of the red laser dot.
	The maximum diameter of the circular movement described by the centre of the laser point should not exceed 3 mm at a distance of 1.5 m.
6.	If the centre of the laser dot describes a perceptible circular movement or moves more than 3 mm away from the point which was first marked, an adjustment may be required. Inform your nearest Leica Geosystems authorized service workshop. Depending on brightness and surface, the diameter of the laser dot can vary. At 1.5 m it is about 2.5 mm.

Servicing the tripod
step-by-step



TPS12_029

The following table explains the most common settings.

Step	Description
	The connections between metal and timber components must always be firm and tight.
1.	Tighten the leg cap screws moderately, with the supplied allen key.
2.	Tighten the articulated joints on the tripod head just enough to keep the tripod legs open when lifting the tripod off the ground.
3.	Tighten the allen screws of the tripod legs.

Description

This is to transfer jobs, codelists and other System1200 related files on the CompactFlash Card or internal memory with a standard and simple FTP server.
FTP protocol is used to transfer between System1200, which runs Leica SmartWorx and has an internet device connected, and the ftp server. The zip/unzip functionality is included.

Supported files

The following list shows the supported file extensions that will automatically move to the corresponding directory after downloading.

Supported file	File extension	Directory
Almanac file	Almanac.sys	DATA/GPS
Antenna file from GPS1200+	List.ant	GPS
Application program files	*.a*	SYSTEM
ASCII files for import/export to/from job	*.txt	DATA
Coordinate system file from GPS1200+	Trfset.dat	DBX
CSCS field files	*.csc	DATA/GPS/CSCS
DXF files for import/export to/from job	*.dxf	DATA
Firmware files	*.fw	SYSTEM
Format files	*.frt	CONVERT
Geoid field files	*.gem	DATA/GPS/GEOID
GSI files	*.gsi	GSI
GSM/Modem station list from GPS1200+	*.fil	GPS

Supported file	File extension	Directory
Language files	*.s*	SYSTEM
Licence file	*.key	SYSTEM
Logfiles created from application programs	*.log	DATA
TPS configuration files	*.xfg	CONFIG
System files	System.ram	SYSTEM
Custom ASCII file (LEICA Geo Office Export)	*.cst	DATA
Comma separated variables, text file format (ASCII)	*.csv	DATA



Internet interface should be configured and connected prior to using this function.

Access

Select **Main Menu: Tools...\Field to Office**.

TOOLS

Field to Office -> Config

Description of fields

Field	Option	Description
<IP Address:>	User input	In order to get access to the Internet, an IP address is required. This IP address identifies the receiver in the Internet. IP address format IPv6, for example 2001:0db8:85a3:08d3:1319:8a2e:0370:7334, is NOT supported.
<Host:>	User input	In order to get access to the Internet, a host name is required. This host name identifies the receiver in the Internet. For RX1250 receivers only.

Field	Option	Description
<TCP/IP Port:>	User input	Port to be used. Any number between 0 and 65535 is valid.
<User ID:>	User input	The User ID allows connection to the ftp site. If no value is typed in, then the instrument logs into the FTP server anonymously.
<Password:>	User input	The password to get access to the ftp site.

Next step

IF the task is to	THEN
connect to the FTP server entered	CONEC (F1) . Once the connection to the FTP server is established, TOOLS Field to Office: Transfer, Field page is displayed. Refer to "TOOLS Field to Office: Transfer, Field page".
to exit the screen	SHIFT QUIT (F6) .

TOOLS

Field to Office:

Transfer,
Field page

The files and folders on the CompactFlash Card or internal memory of the instrument are displayed including their size.

To get into the folders, highlight the folder and **ENTER**.



UPLD (F1)

To copy the file or folder to its corresponding directory on the ftp server. Files or folders bigger than 100 KB are zipped before sending.

UNZIP (F2)

To unzip a file in the download directory. Available if a zip file is highlighted.

IMPRT (F3)

To move a file from the \Download folder to the appropriate directory folder based on it's file extension type.

Available in the \Download folder when a file is highlighted. Unavailable for unrecognised files in the \Download folder. These must stay in the \Download folder.

INTRN (F5)

To change between the CompactFlash Card and the internal memory.

SHIFT QUIT (F6)

To return to **TPS1200+/TS30/TM30 Main Menu** and disconnect automatically from the FTP server.

Next step

PAGE (F6) changes to the **FTP** page.

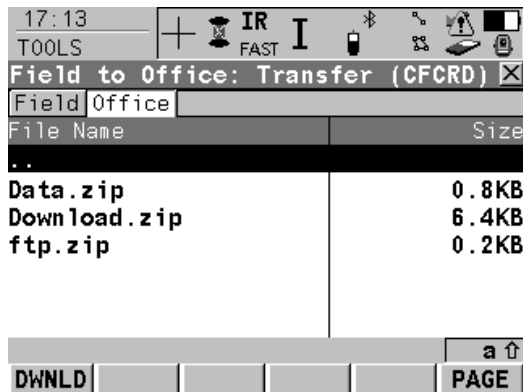
TOOLS

Field to Office: Transfer, Office page

The files located on the FTP server are displayed.

Whenever switching to this page, a refresh action is done or it reconnects to the server if the connection to the server was disconnected.

The most important keys are explained.



File Name	Size
..	
Data.zip	0.8KB
Download.zip	6.4KB
ftp.zip	0.2KB

DWNLD a ↑ PAGE

DWNLD (F1)

To download the highlighted file or folder list on the FTP server to the local download folder. Downloaded files are moved automatically to the corresponding directories if recognised by the system. If not, they are stored in the download folder. Zipped files are unzipped before storing in the download folder.

SHIFT RFRSH (F5)

To refresh the FTP directory.

Next step

SHIFT QUIT (F6) returns to **TPS1200+/TS30/TM30 Main Menu**.

31.1

STATUS Functions

Description

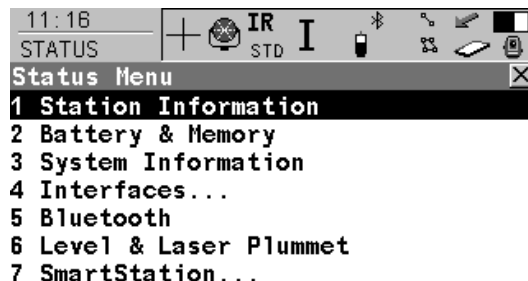
The STATUS functions help using the instrument by showing the state of many instrument functions. All fields are output fields. Unavailable information is indicated by -----.

Access

Press **USER** and then **STAT (F3)**. Refer to "2.2 USER Key" for information on the **USER** key.

STATUS

Status Menu



CONT (F1)

To select the highlighted option and to continue with the subsequent screen.



Description of the STATUS functions

STATUS function	Description	Refer to chapter
Station Information	Information related to the current station set on the instrument.	31.2
Battery & Memory	Information related to use and status of battery and memory.	31.3
System Information	Information related to the instrument hardware and firmware.	31.4
Interfaces...	Information related to the configuration and use of interfaces, port and devices.	31.5
Bluetooth	Information related to the configuration and use of Bluetooth interfaces.	31.7
Level & Laser Plummet	Information related to electronic level and laser plummet.	31.8
SmartStation...	Information related to the active survey and Smart-Station firmware.	31.8

31.2

STATUS: Station Information

Access

Select **STATUS: Station Information**.

Refer to "31.1 STATUS Functions" on how to access the STATUS menu.

OR

Press a hot key configured to access the screen **STATUS Station Information**.

Refer to "2.1 Hot Keys" for information on hot keys.

STATUS

Station Information

18:28
STATUS

Station Information

Station ID : 5
Instrument Ht: 1.500 m
Easting : 75.609 m
Northing : 63.557 m
Height : 100.000 m
Temperature : 12.0 °C
Pressure : 1013.3 mbar
Atmos ppm : -0.0

CONT Q2 a ↑

CONT (F1)

To exit **STATUS Station Information**.

Description of fields

Field	Description
<Station ID:>	Station ID of the current station set-up.
<Instrument Ht:>	Instrument height of the current station set-up.

Field	Description
<Easting:>	Easting value of the instrument position.
<Northing:>	Northing value of the instrument position.
<Height:>, <Local Ell Ht:> or <Ortho Ht:>	If no coordinate system is selected the orthometric height <Height:> of the instrument position is displayed. For a selected coordinate system, orthometric or ellipsoidal height can be displayed.
<Temperature:>	Temperature set on the instrument.
<Pressure:>	Pressure set on the instrument.
<Atmos ppm:>	Atmospheric ppm set on the instrument.

Next step

CONT (F1) to exit **STATUS Station Information**.

Access

Select **STATUS: Battery & Memory**.

Refer to "31.1 STATUS Functions" on how to access the STATUS menu.

OR

Press a hot key configured to access the screen **STATUS Battery & Memory**.

Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

OR

Tap the battery icon. Refer to the TPS1200+/TS30/TM30 System Field Manual for information on icons.

OR

Tap the CompactFlash card/internal memory icon.

Refer to the TPS1200+/TS30/TM30 System Field Manual for information on icons.

STATUS

Battery & Memory, Battery page



Battery Int : not attached
Battery Ext : 100 %

CONT (F1)

To exit **STATUS Battery & Memory**.



PAGE (F6)

To change to another page on this screen.

Description of fields

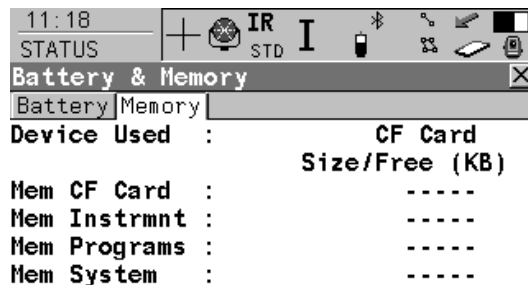
Field	Description
Any field	The percentage of remaining power capacity for all batteries are displayed numerically. Batteries not in use are shown in grey. For internal and external battery being attached at the same time the internal battery is used until it is empty and then the external battery is used.

Next step

PAGE (F6) changes to the **Memory** page.

STATUS Battery & Memory, Memory page

If no information for a field is available, for example no CompactFlash card is inserted, then ----- is displayed.



CONT (F1)

To exit **STATUS Battery & Memory**.



PAGE (F6)

To change to another page on this screen.

Description of fields

Field	Description
<Device Used:>	The memory device in use.
<Mem CF Card:>	The total/free memory for data storage on the CompactFlash card.
<Mem Instrmnt:>	The total/free memory for data storage on the internal memory. A grey field and grey ----- indicate an unavailable internal memory.
<Mem Programs:>	The total/free system memory used for application programs.

Field	Description
<Mem System:>	The total/free system memory. The system memory stores • instrument related files such as system settings. • survey related files such as codelists and configuration sets.

Next step

CONT (F1) to exit **STATUS Battery & Memory**.

Access

Select **STATUS: System Information**.

Refer to "31.1 STATUS Functions" on how to access the STATUS menu.

OR

Press a hot key configured to access the screen **STATUS System Information**.

Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

STATUS
System Information,
Instrument page

Shows the type of instrument, the serial number, the equipment number, the ID of the instrument, the currently active system language and the availability of additional instrument hardware options such as ATR, PowerSearch or if the ability to track GPS L5, GLONASS, Galileo and Compass have been activated by a licence key.

Next step

PAGE (F6) changes to the **Firmware** page.

STATUS
System Information,
Firmware page

Shows the versions of all system firmware.

Description of fields

Field	Description
<Firmware:>	Firmware version of the onboard software.
<Maintenance End:>	Expiry date of the software maintenance.
<Build User Iface:>	Build version of the onboard software.

Field	Description
<Build Processb.:>	Build version of the processor board.
<Telescope Fw:>	Firmware version of the telescope.
<Boot:>	Firmware version of the boot software.
<API:>	Firmware version for the application program interface.
<EF Interface:>	Firmware version for the electric front interface.
<Keyboard/Display:>	Firmware version for the graphical user interface.
<Build Sensorb.:>	For TS30/TM30. Build version of the sensor board.

Next step

PAGE (F6) changes to the **Application** page.

Shows the versions of all uploaded application programs.

Next step

CONT (F1) exits **STATUS System Information**.

STATUS
System Information,
Application page

Description

STATUS Interfaces gives an overview of all interfaces with the port and the devices currently assigned.

Access

Select **STATUS: Interfaces....**

Refer to "31.1 STATUS Functions" on how to access the STATUS menu.

OR

Press a hot key configured to access the screen **STATUS Interfaces**.

Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

STATUS
Interfaces

The screen gives an overview of all interfaces with the currently assigned port and device. Unavailable information is indicated by -----.

The image shows a handheld device screen with a status bar at the top. The status bar includes the time '16:43', the word 'STATUS', and several icons: a plus sign, a camera with a cross, 'IR STD', a Bluetooth symbol, a magnifying glass, a battery level indicator, and a signal strength indicator. Below the status bar is a title bar that says 'Interfaces' with a close button (X) on the right. The main content area is a table with three columns: 'Interface', 'Port', and 'Device'. The table lists several interfaces: 'GSI Output', 'GeoCOM Mode', 'RCS Mode', 'Export Job', 'GPS RTK', and 'Internet', each with a '-' in the Port column and a '-' in the Device column. Below these is a row for 'SmartStation2' with an empty Port column and 'ATX1230' in the Device column. At the bottom of the screen is a navigation bar with four buttons: 'CONT', 'IFACE', 'DEVICE', and 'Q2 a' with an upward arrow.

CONT (F1)

To exit **STATUS Interfaces**.

IFACE (F3)

Available for **GPS RTK** or **Internet** being highlighted. To view information related to real-time data or the internet connection. For real-time refer to "31.8.2 Real-Time Status".

DEVICE (F5)

Available for **GPS RTK** or **Internet** being highlighted. To view the status of the attached device. Refer to "31.8.2 Real-Time Status" paragraph "STATUS Real-Time Input, Device page".

Next step

CONT (F1) exits **STATUS Interfaces**.

Description

This screen shows

- Bluetooth ports available and configured.
- the device attached and connected to each Bluetooth port.
- the ID address of each device.

Access

Select **STATUS: Bluetooth**.
Refer to "31.1 STATUS Functions" on how to access the STATUS menu.
OR
Tap the Bluetooth icon.
Refer to the TPS1200+/TS30/TM30 System Field Manual for information on icons.

STATUS
Bluetooth

The way information is displayed indicates the configuration status of the Bluetooth port and the connection status of the device.

Information displayed	Bluetooth port configured	Device connected
in black	✓	✓
in grey	✓	-
as ----	-	-

Next step
CONT (F1) exits **STATUS Bluetooth**.

Description

The electronic level is shown and can be centred.

Access

Select **STATUS: Level & Laser Plummet**.

Refer to "31.1 STATUS Functions" on how to access the STATUS menu.

OR

Press **SHIFT F12**.

OR

Press a hot key configured to access the screen **STATUS Level & Laser Plummet**.

Refer to "2.1 Hot Keys" for information on hot keys.

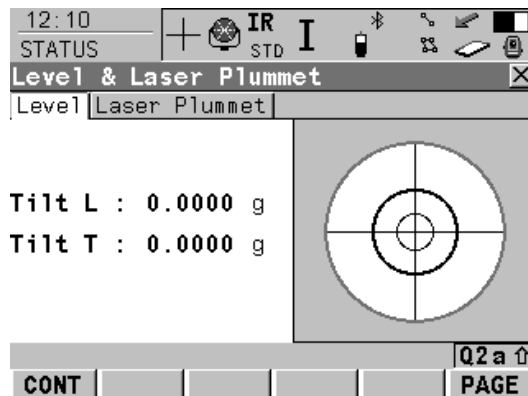
OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.



The level moves linear with the inclination values **<Tilt L:>** and **<Tilt T:>**. On the screen closest to the circular level, the electronic level moves down if the value in **<Tilt L:>** gets bigger and vice versa. If the value for **<Tilt T:>** gets bigger the level moves left and vice versa.

STATUS
Level & Laser Plummet,
Level page



CONT (F1)

To exit **STATUS Level & Laser Plummet**.

PAGE (F6)

To change to another page on this screen.

Description of fields

Field	Description
<Tilt L:>	Longitudinal tilt of the vertical axis.
<Tilt T:>	Transversal tilt of the vertical axis.

Next step

PAGE (F6) changes to the **Laser Plummet** page.

STATUS
Level & Laser Plummet,
Laser Plummet page

Description of fields

Field	Option	Description
<Laser Plummet:>	On or Off	To turn the laser plummet on or off. Is always set on when accessing this screen. Changing this setting turns the laser plummet on or off immediately.
<Intensity:>	From 0 % to 100 %	The percentage of the intensity of the laser plummet is displayed numerically and graphically. The minimum value is 10%. Changing this value with the right and left arrow keys changes the intensity of the laser plummet immediately.

Next step

CONT (F1) exits STATUS Level & Laser Plummet.

31.8

31.8.1

STATUS: SmartStation

Satellite Status

Description

This screen shows information related to the satellites ordered by the elevation angle.

Access

Select **STATUS: SmartStation...\Satellite Status**.

Refer to "31.1 STATUS Functions" on how to access the STATUS menu.

OR

Press a hot key configured to access the screen **STATUS Satellites**.

Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

OR

Tap the number of visible satellites icon.

Refer to the TPS1200+/TS30/TM30 System Field Manual for information on icons.

OR

Tap the contributing satellites icon.

Refer to the TPS1200+/TS30/TM30 System Field Manual for information on icons.

STATUS

Satellites: Rover, GPS page

17:11					
STATUS					
Satellites : Rover					
GPS	GLO	GAL	Skyplot	Almanac	
Sat	Elev	Azmth	S/N L1	S/N L2	
G23	↓ 75	60	50	43	
G24	↓ 69	211	50	41	
G13	↑ 66	232	51	41	
G04	↑ 48	299	49	39	
G20	↓ 43	95	49	38	
G02	↑ 18	315	44	33	
G17	↓ 15	233	44	35	
					a ↑
CONT		REF	HEALTH	MORE	PAGE

CONT (F1)

To exit **STATUS Satellites**.

ROV / REF (F3)

To change between the signal to noise ratio values of rover and reference.

Available for **<R-Time Mode: Rover>** configured in **CONFIGURE Real-Time Mode**.

HEALTH (F4)

To view the numbers of satellites categorised in good, bad and unavailable.

MORE (F5)

To display information about the signal to noise ratio values for GPS satellites (if **<GPS L5: Yes>** is configured in **CONFIGURE Satellite Settings**) and Galileo satellites. Not available on the **GLO** page, **Skyplot** page or **Almanac** page.

PAGE (F6)

To change to another page on this screen.

Description of columns

Column	Description
Sat	The P seudo R andom N oise number (GPS), the Slot number (GLONASS) or the S pace V ehicle number (Galileo) of the satellites.

Column	Description
Elev	The elevation angle in degrees. The arrows indicate if the satellite is rising or falling.
Azmth	The azimuth of the satellite.
S/N 1, S/N 2 and S/N 5	The signal to noise ratio on L1, L2 and L5 for GPS, on L1 and L2 for GLONASS and on E1, E5a, E5b and Alt-Boc for Galileo. The number is shown in brackets if the signal is currently not being used in the position calculations.

Next step

PAGE (F6) changes to the **GLO** page for **<GLONASS: Yes>** configured in **CONFIGURE Satellite Settings**. Refer to paragraph "STATUS Satellites: Rover, GLO page".

STATUS
Satellites: Rover,
GLO page

The information about the GLONASS satellites shown on this page is identical with the information shown on **STATUS Satellites: Rover, GPS** page. Refer to paragraph "STATUS Satellites: Rover, GPS page".

Next step

PAGE (F6) changes to the **GAL** page for **<GALILEO: Yes>** configured in **CONFIGURE Satellite Settings**. Refer to paragraph "STATUS Satellites: Rover, GAL page".

STATUS
Satellites: Rover,
GAL page

The information about the Galileo satellites shown on this page is identical with the information shown on **STATUS Satellites: Rover, GPS** page. Refer to paragraph "STATUS Satellites: Rover, GPS page".

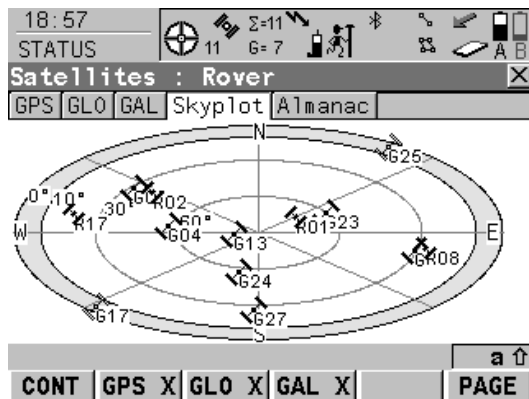
Next step

PAGE (F6) changes to the **Skyplot** page. Refer to paragraph "STATUS Satellites: Rover, GPS page".

STATUS

Satellites: Rover, Skyplot page

The skyplot shows satellite information in a graphical way. Satellites below the **<Cut Off Angle>** configured in **CONFIGURE Satellite Settings** are marked grey. The part of the skyplot between the 0° elevation and the cut-off angle is marked grey.



CONT (F1)

To exit **STATUS Satellites**.

GPS X / GPS ü (F2)

To hide or show the GPS satellites (shown by the prefix G).

GLO X / GLO ü (F3)

To hide or show the GLONASS satellites (shown by the prefix R). Available when

<GLONASS: Yes> is configured in **CONFIGURE Satellite Settings**.

GAL X / GAL ✓ (F4)

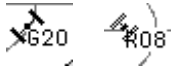
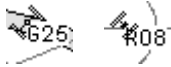
To hide or show the Galileo satellites (shown by the prefix E).

Available when **<Galileo: Yes>** is configured in **CONFIGURE Satellite Settings**.

PAGE (F6)

To change to another page on this screen.

Description of symbols

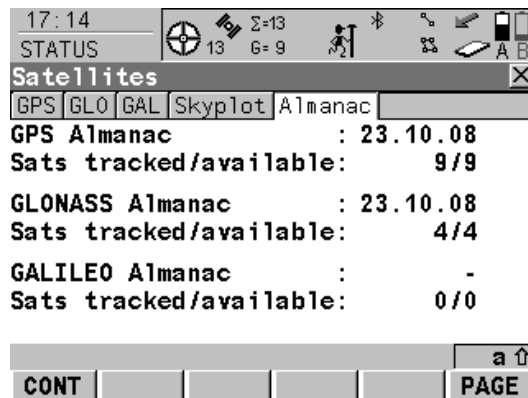
Symbol	Description
	Satellites above the <Cut Off Angle:> configured in CONFIGURE Satellite Settings .
	Satellites below the <Cut Off Angle:> configured in CONFIGURE Satellite Settings .

Next step

PAGE (F6) changes to the **Almanac** page. Refer to paragraph "STATUS Satellites: Rover, Almanac page".

STATUS
Satellites: Rover,
Almanac page

The almanac page shows the date of the used almanacs, the number of satellites tracked as shown on the skyplot and the number of all satellites available above the cut off elevation mask as shown on the skyplot.



CONT (F1)

To exit **STATUS Satellites**.

PAGE (F6)

To change to another page on this screen.

Next step

CONT (F1) exits **STATUS Satellites**.

31.8.2

Real-Time Status

Description

This screen shows information related to real-time data, for example the data link and the device used to receive real-time data.

Access

This screen is accessible for **<R-Time Mode: Rover>** in **CONFIGURE Real-Time Mode**.

Select **STATUS: SmartStation...\Real-Time Status**.

OR

Press a hot key configured to access the screen **STATUS Real-Time Input**.

Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

OR

Tap the real-time device and real-time status icon.

Refer to the TPS1200+/TS30/TM30 System Field Manual for information on icons.

STATUS Real-Time Input, General page

09:32

STATUS

G= 7

R= 3

Real-Time Input

General | Device | Reference

R-Time Data : Leica
GPS Used L1/L2 : 07/07
GLO Used L1/L2 : 03/03

RTK Data Link Messages
Last Received : 1.0 sec
In Last Minute : 100 %
Ref Network : None

CONT

DATA

PAGE

A ↑

CONT (F1)

To exit **STATUS Real-Time Input**.

DATA (F4)

To view the data being received. Depending on **<R-Time Data:>**, the shown data differ. Refer to paragraph "STATUS Real-Time Input Data".

PAGE (F6)

To change to another page on this screen.

Description of fields

Field	Description
<R-Time Data:>	The received real-time data format message type.
<GPS used L1/L2/L5:>	The number of satellites on L1, L2 and L5 (when <GPS L5: Yes> configured in CONFIGURE Satellite Settings) being used in the current position solution.
<GLO used L1/L2:>	The number of satellites on L1 and L2 being used in the current position solution. Available when <GLONASS: Yes> is configured in CONFIGURE Satellite Settings .
<GAL Used E1/E5a:>	Available for Galileo receivers when <GALILEO: Yes> is configured in CONFIGURE Satellite Settings . The number of satellites on E1 and E5a being used in the current position solution.

Field	Description
<GAL Used E5b/ABOC:>	Available for Galileo receivers when <GALILEO: Yes> is configured in CONFIGURE Satellite Settings . The number of satellites on E5b and Alt-BOC being used in the current position solution.
<Last Received:>	Seconds since the last message from the reference was received.
<In Last Minute:>	The percentage of real-time data received from the reference compared with the data received from the SmartAntenna within the last minute. This indicates how well the datalink is working.
<Ref Network:>	The type of reference network in use.

Next step

PAGE (F6) changes to the **Device** page. Refer to paragraph "STATUS Real-Time Input, Device page".

STATUS

Real-Time Input, Device page

The content of this page differs for each type of device in use.

11:49
STATUS
Real-Time Input
General | Device | Reference
Name : -----
Type : GSM
Port : Port 2 (Handle)
Firmware : -----
Operator : -----
Status : Detection
Bluetooth: Connection Down
CONT PAGE

CONT (F1)

To exit **STATUS Real-Time Input**.

PAGE (F6)

To change to another page on this screen.

For all devices available

Description of fields

Field	Description
<Name:>	The name of the device.

For RS232

Description of fields

Field	Description
<Type:>	The type of device.

Field	Description
<Port:>	The port to which the device is connected.
<Bluetooth:>	Available if device is connected via bluetooth. Indicates the state of the connection.

For digital cellular phones and modems

Description of fields

Field	Description
<Type:>	The type of device.
<Port:>	The port to which the device is connected.
<Firmware:>	The software version of the attached digital cellular phone.
<Operator:>	The name of the network operator in which the digital cellular phone is operating.
<Status:>	The actual mode of the digital cellular phone. The options are Unknown , Detection and Registered .
<Bluetooth:>	Available if device is connected via bluetooth. Indicates the state of the connection.
<Signal:>	Indication of received signal strength of the digital cellular phone network.

For radios

Description of fields

Field	Description
<Port:>	The port to which the device is connected.
<Type:>	The type of device.
<Channel:>	The radio channel.
<Bluetooth:>	Available if device is connected via bluetooth. Indicates the state of the connection.

Next step

PAGE (F6) changes to the **Reference** page. Refer to paragraph "STATUS Real-Time Input, Reference page; STATUS Real-Time Input, Ref (VRS) page".

STATUS
Real-Time Input,
Reference page;
STATUS
Real-Time Input,
Ref (VRS) page

The name of the page changes depending on the type of reference being used.

Reference page: Reference is a real reference station.

Ref (VRS) page Reference is a virtual reference station.

Description of fields

Field	Description
<Ref Stn ID:>	An identification for a reference station. The ID is converted into a compact format to be send out with real-time data in all real-time data formats. It is different from the point ID of the reference station.

Field	Description
<Antenna Ht:>	- For <R-Time Data: Leica>, <R-Time Data: Leica 4G>, <R-Time Data: RTCM v3.1> or <R-Time Data: RTCM X v2> with <RTCM Version: 2.3>: The antenna height at the reference from the marker to the MRP. - For <R-Time Data: CMR/CMR+> and <R-Time Data: RTCM 18, 19 v2> or <R-Time Data: RTCM 18, 19 v2> with <RTCM Version: 2.2> The antenna height at the reference from the marker to the phase center. - For all other <R-Time Data:>: ----- is displayed because the data format does not include information about the antenna height.
<Coords of:>	The coordinates for the reference station which are transferred depend on the active real-time data format. - For real-time messages which include antenna height and antenna type: Marker. - For real-time messages which do not include antenna Information: Phase Centre of L1.

Next step

IF	THEN
other coordinate types are to be viewed	COORD (F2). Local coordinates are available when a local coordinate system is active.
this screen is to be quit	CONT (F1) exits STATUS Real-Time Input .

STATUS Real-Time Input Data

The following provides additional information on the satellite data received via real-time message. Information of those satellites is displayed, which are used on both reference and rover.

Access

DATA (F4) on **STATUS Real-Time Input, General** page.

11:51		L1= 7	
STATUS		7 L2= 7	
Real-Time Input Data			
Sat PRN	:	G05	
Sat Time	:	11:52:00	
Phase L1	:	114113499.922 cyc	
Phase L2	:	88919664.778 cyc	
Code L1	:	21715062.949 m	
Code L2	:	21715069.669 m	
		Q2 a ↑	
CONT	SAT-	SAT+	

CONT (F1)

To return to **STATUS Real-Time Input**.

SAT- (F2)

To display information about the satellite with the next smaller PRN.

SAT+ (F3)

To display information about the satellite with the next larger PRN.

Description of fields

The data being received from the satellites and the layout of the screen depend on the active real-time data format.

Field	Description
<Sat PRN:>	The PRN number (GPS), the Slot number (GLONASS) or the Spave Vehicle number (Galileo) of the satellites shown with the prefix G (GPS), R (GLONASS) or E (Galileo).
<Sat Time:>	The GPS time of the satellite.
<Phase L1:>, <Phase L2:>, <Phase L5:> <Phase L1:>, <Phase L2:> <Phase E1:>, <Phase E5a:>, <Phase E5b:>, <Phase ABOC:> <Msg 18 L1:>, <Msg 18 L2:> <Msg 20 L1:>, <Msg 20 L2:>	The number of phase cycles from the antenna to the GPS satellite on L1, L2 and L5. The number of phase cycles from the antenna to the GLONASS satellite on L1 and L2. The number of phase cycles from the antenna to the Galileo satellite on E1, E5a, E5b and Alt-BOC. The uncorrected carrier phases for L1 and L2. The carrier phase corrections for L1 and L2.
<Code L1:>, <Code L2:>, <Code L5:> <Code L1:>, <Code L2:>	The pseudorange from the antenna to the GPS satellite for L1, L2 and L5. The pseudorange from the antenna to the GLONASS satellite on L1 and L2.

Field	Description
<Code E1:>, <Code E5a:>, <Code E5b:>, <Code ABOC:>	The pseudorange from the antenna to the Galileo satellite on E1, E5a, E5b and Alt-BOC.
<Msg 19 L1:>, <Msg 19 L2:>	The uncorrected pseudoranges for L1 and L2.
<Msg 21 L1:>, <Msg 21 L2:>	The pseudorange corrections for L1 and L2.
<PRC:>	Pseudorange corrections.
<RRC:>	Rate of change of the corrections.
<IODE:>	Issue Of Data Ephemeris. The identification number of the ephemeris for a satellite.

Next step

CONT (F1) returns to the screen from where **STATUS Real-Time Input Data** was accessed.

31.8.3

Current Position

Description

This screen shows information related to the current SmartStation position. For real-time rover configurations the baseline vector is also shown. MapView shows the current position in a graphical format.

Access

Select **STATUS: SmartStation... \Current Position**.

Refer to "31.1 STATUS Functions" on how to access the STATUS menu.

OR

Press a hot key configured to access the screen **STATUS Position**.

Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

OR

Tap the position status icon.

Refer to the TPS1200+/TS30/TM30 System Field Manual for information on icons.

STATUS Position, Position page

11:54

STATUS

Position

Position | Baseline | Map

Local Time : 11:54:56.0
 Pos Latency : 0.00 sec
 WGS84 Lat : 47°24'32.25471" N
 WGS84 Long : 9°37'02.87295" E
 Height : 482.386 m
 Pos Quality : 0.007 m
 Ht Quality : 0.010 m

Q2 a ↑

CONT PAGE

CONT (F1)

To exit **STATUS Position**.

COORD (F2)

To see other coordinate types. Local coordinates are available when a local coordinate system is active.

PAGE (F6)

To change to another page on this screen.

SHIFT ELL H (F2) and SHIFT ORTH (F2)

Available for local coordinates. To change between the ellipsoidal and the orthometric height.

Description of fields

Field	Description
<Pos Latency:>	The latency of the computed position. Latency is mainly due to time required for data transfer and computation of position.
Pos Quality and Ht Quality	Available for phase fixed and code only solutions. The 2D coordinate and height quality of the computed position. Refer to "6.3.1 Terminology" for information on coordinate quality.
HDOP and VDOP	Available for navigated solutions.

Next step

IF	THEN
the receiver is a real-time rover	PAGE (F6) changes to the Baseline page. Refer to paragraph "STATUS Position, Baseline page".
the receiver is not configured for real-time	CONT (F1) exits STATUS Position .

**STATUS
Position,
Baseline page**

Information on the baseline vector is displayed.

Next step

CONT (F1) exits **STATUS Position**.

31.9

Logging Status

Description

This screen shows information related to logging of raw observations.

Access

Select **STATUS: Survey...\Logging Status**.

Refer to "31.1 STATUS Functions" on how to access the STATUS menu.

OR

Press a hot key configured to access the screen **STATUS Logging**.

Refer to "2.1 Hot Keys" for information on hot keys.

OR

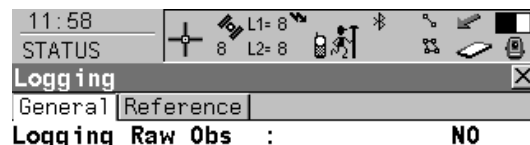
Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

OR

Tap the logging information icon.

Refer to the TPS1200+/TS30/TM30 System Field Manual for information on icons.

STATUS Logging, General page



11:58

STATUS

Logging

General Reference

Logging Raw Obs : NO

All Static Obs : 0

Recorded DB-X Pts: 444

CONT (F1)

To exit STATUS Logging.



CONT PAGE

PAGE (F6)

To change to another page on this screen.

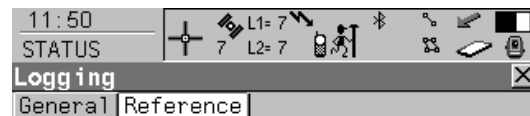
Description of fields

Field	Description
<Logging Raw Obs:>	YES or NO.
<All Static Obs:>	The number of static epochs recorded in the current job.
<Recorded DB-X Pts:>	The number of manually occupied points and auto points stored in the job.

Next step

PAGE (F6) changes to the **Reference** page.

STATUS
Logging,
Reference page



Log Static Obs : ----- sec

CONT (F1)

To exit **STATUS Logging**.

PAGE (F6)

To change to another page on this screen.



Description of fields

Field	Description
<Log Static Obs:>	The logging rate at the reference. This information is shown if the real-time message format supports this information and raw observations are being logged at the reference.

Next step

CONT (F1) exits **STATUS Logging**.

Access

Select **STATUS: SmartAntenna System Info**.
Refer to "31.1 STATUS Functions" on how to access the STATUS menu.
OR
Press a hot key configured to access the screen **STATUS SmartAntenna Information**.
Refer to "2.1 Hot Keys" for information on hot keys.
OR
Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

STATUS
SmartAntenna Informa-
tion

Shows the versions of all system firmware.

Description of fields

Field	Description
<Type:>	The type of antenna.
<Meas Engine:>	The firmware version for the measurement engine.
<Meas Eng Boot:>	The firmware version of the boot software for the measurement engine.

Next step
CONT (F1) exits **STATUS SmartAntenna Information**.

Description

Motorised instruments turn to a target point or change face automatically. On non motorised instruments the **XX Telescope Positioning** screen assists in manual aiming. This screen helps reducing the possibility for errors in target point identification. The horizontal and vertical angle differences between the current telescope position and the target position are displayed. The telescope needs to be turned until the displayed values are zero.

Access

Press **SHIFT USER**, highlight **<Change Face>** and press **ENTER**.

OR

Press a hot key configured to access the screen **XX Telescope Positioning**. Refer to "2.1 Hot Keys".

OR

Press **ALL (F1)** or **POSIT (F5)** in some application programs, where telescope positioning to a certain point is needed.

XX Telescope Positioning



Hz- and V-positioning.
Set directions to zero.

Δ Hz : -199.0020 g
Δ V : 52.9998 g

OK (F4)

To confirm angles and return to the screen this screen was accessed from.



ABORT (F6)

To abort the telescope positioning.

Description of fields

Field	Option	Description
<ΔHz:>	Output	The difference between the horizontal angle of the current telescope position and of the telescope position to aim at is displayed.
<ΔV:>	Output	The difference between the vertical angle of the current telescope position and of the telescope position to aim at is displayed.

Next step

OK (F4) to confirm the current telescope position and return to the screen **XX Telescope Positioning** was accessed from.

33.1

EDM

Description

Electronic Distance Measurement **EDM** is the sensor used for distance measurements. There are three different **<EDM Type:>** and five, for TM30 six, different **<EDM Mode:>** the instrument can work in. These terms are described below. Refer to "17.1 EDM & ATR Settings" and to "3 Quick Settings - SHIFT USER" for more information.

EDM types

EDM Type	Description
IR	<EDM Type: Reflector (IR)> allows to measure the distance to a prism or reflector tape with the visible red laser. The last used options for <Reflector:>, <Add. Constant:>, <Reflector Ht:> and <EDM Mode:> are applied. For <Automation: ATR> or <Automation: LOCK>, <EDM Type: Reflector (IR)> is automatically set.  It is important to select the currently used <Reflector:> from the list to gain correct results.
RL	Available for instruments equipped with reflectorless EDM. <EDM Type: Reflctrless (RL)> allows to measure distances to objects without a reflector with the visible red laser. The last used option for <EDM Mode:> is applied, <Reflector: Reflectorless> and <Reflector Ht: 0.000> are set. <Automation: None> is set.

EDM Type	Description
LO	Available for instruments equipped with reflectorless EDM. <EDM Type: Long Range (LO)> allows to measure very long distances to prisms. The last used option for <EDM Mode:> and <Reflector:> are applied, <Automation: None> is set.

EDM modes

EDM Mode	Description
Standard	Pressing ALL (F1) or DIST (F2) a single measurement is performed with focus on accuracy and not on time.
Fast	Pressing ALL (F1) or DIST (F2) a single measurement is performed with focus on time, accuracy not as high as for <EDM Mode: Standard> .
Tracking	Pressing ALL (F1) or DIST (F2) continuous measurements are performed with focus on fast measurements. Press REC (F3) to store the measurements.  STOP (F1) to stop tracking.
Average	Pressing ALL (F1) or DIST (F2) with <Avg Max #Dist: n> n measurements are performed with <EDM Mode: Standard> . During measurements the current average and standard deviation are displayed.

EDM Mode	Description
SynchroTrack	Available only for <EDM Type: Reflector (IR)>. This is the measurement mode for the interpolation of angle measurements in IR LOCK Tracking mode. Pressing ALL (F1) or DIST (F2) a linear interpolation between the previous and following angle measurement is performed, based upon the timestamp of the EDM measurement. Using this interpolation procedure, a higher accuracy for all dynamic applications, for example machine guidance, is possible.
Precise	Available for TM30 and only for <EDM Type: Reflector (IR)>. Pressing ALL (F1) or DIST (F2) a single measurement is performed with focus on highest precision measurement.

33.2

33.2.1

Prism Search Methods

ATR

Description

Automatic Target Recognition ATR is the sensor which recognises and measures the position of a prism by means of a CCD array. A laser beam is transmitted and the reflected beam is received by the built in CCD array. The position of the reflected spot with respect to the centre of the CCD is computed. These ATR offsets are used to correct the horizontal and vertical angles. The ATR offsets are also used to control the motors which turn the instrument to centre the crosshairs to the prism. In order to minimise the time for measuring, the crosshairs are not moved to the exact centre of the prism. The ATR offset can be up to 500 cc depending on selected **<EDM Mode:>**. The ATR measures the ATR offsets between the crosshairs and prism centre and corrects the Hz and V angles accordingly. Therefore the Hz and V angles are measured to the prism-centre, even if the crosshairs are not aimed precisely at the centre of the prism.

Motorised instruments can be equipped with ATR. For **<Automation: ATR>** the instrument can find a static prism and measure a distance once **ALL (F1)** or **DIST (F2)** is pressed. The instrument does not follow a moving prism.

Refer to "17.1 EDM & ATR Settings" and to "3 Quick Settings - SHIFT USER" for more information.

Field of view

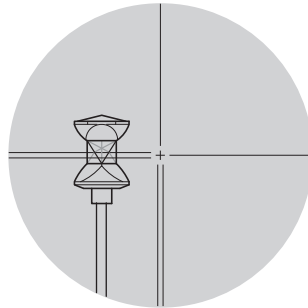
The telescope field of view is the region seen when looking through the telescope. The ATR field of view is the region seen by the ATR. Both are identical on TPS1200+/TS30 instruments.

For TM30 instruments, the telescope field of view and the ATR field of view vary.

Next step

IF the reflector is	THEN
in the field of view	Refer to paragraph "ATR measurement" for more information.
not in the field of view	Refer to paragraph "ATR search" for more information.

ATR measurement



TPS12_080

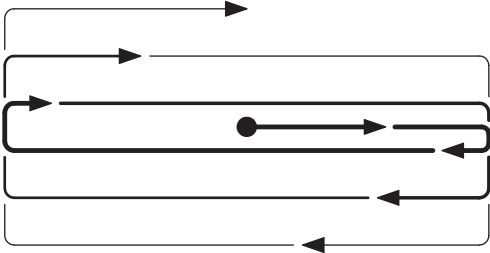
If the reflector is in the field of view and **<Automation: ATR>** the crosshairs are automatically positioned to the reflector when, for example **ALL (F1)** or **DIST (F2)** is pressed. No ATR search is started.



The displayed values are always related to the centre of the prism after **ALL (F1)** or **DIST (F2)** is pressed. For **ALL (F1)** these values are displayed only shortly after the key press.

The crosshairs of the telescope may not fully coincide with the centre of the prism when viewed through the telescope. The remaining ATR offsets for the horizontal and vertical angles are measured by the ATR sensor and applied to the measured and displayed angles.

ATR search



TPS12_042

If the reflector is not in the field of view when **ALL (F1)** or **DIST (F2)** is pressed, an ATR search is started. For the ATR search the ATR window is scanned line by line starting at the current telescope position.

- If the
- prism was not found: **RETRY (F5)** can be pressed to search for the reflector in an increased area.
 - prism was found: The ATR measurement is performed to position the telescope to the centre of the prism.

ATR window

The ATR window is a relative window based on the current telescope position. The horizontal and vertical extent can be defined. Pressing **ALL (F1)**, **DIST (F2)** or **L.GO (F5)** starts an ATR search in the ATR window.

Dynamic ATR window

For **<Search with: ATR>** after loss of lock and prediction the prism is searched for with ATR in a dynamic ATR window. This window covers a horizontal region from the position of loss of lock to the current telescope position and the same extent on the other side. The vertical dimension of the dynamic window is one third of the horizontal expansion. Refer to "33.3 Follow Moving Prisms - LOCK" for information on LOCK.

Automation modes

Automation	Description
None	Points are measured with <Automation: None> . ATR search and/or ATR measurement are not performed.

Automation	Description
ATR	<Automation: ATR> is set. The ATR sensor is used for measurements to static reflectors. If needed an ATR measurement or ATR search is performed after pressing ALL (F1) or DIST (F2) . The accuracy of ATR measurements depends on the set <EDM Mode:> .
LOCK	<Automation: LOCK> is set. The ATR sensor is used to follow moving prisms and to find prisms after loss of lock. Depending on <EDM Mode:> single or continuous measurements are performed pressing ALL (F1) or DIST (F2) . Unavailable for Smart-Station/TM30/TS30+SmartAntenna.

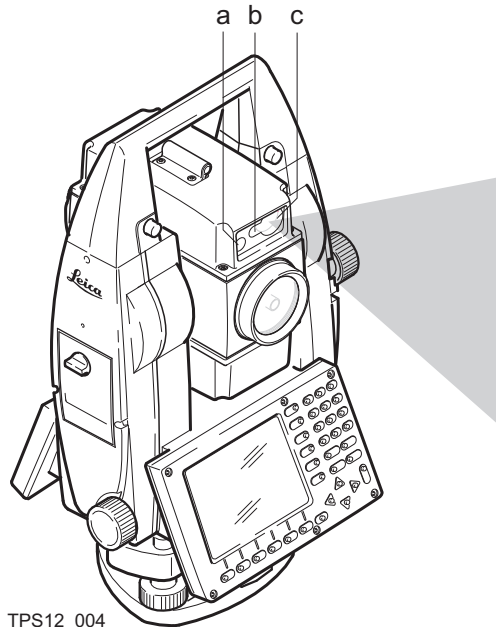
33.2.2

PowerSearch

Description

The PowerSearch module allows an automatic prism detection within a short period of time. In the **QUICK SET Change Settings to:** screen the PowerSearch function can be started by pressing **PS (F6)**.

Functionality



The PowerSearch sensor consists of a transmitter (a) and a receiver (b). Both are installed in the telescope.

When PowerSearch is activated, the instrument starts to rotate around its standing axis. The transmitter emits a vertical laser swath. If the laser swath detects a prism, the rotation of the instrument is stopped. Afterwards a ATR measurement in vertical direction is performed.

- a) EGL
- b) Transmitter
- c) Receiver



If a PS window is defined and active, PowerSearch is executed within the defined limits.

360° search

For **<PS Window: Off>** and **PS (F6)** the prism is searched for with PowerSearch in the 360° window. The default search with PowerSearch consists of a short swing in anti-clockwise direction followed by a complete 360° turn in clockwise direction. If a prism is detected the movement is stopped and an ATR search is performed.

PS window

The PS window can be defined individually. It is specified by absolute angles and does not change its position. The PS window can be set in the **CONFIGURE Search Windows, PS Window** page by aiming at two opposite points of the PS window. For **<PS Window: On>** and **PS (F6)** a prism is searched for with PowerSearch in the PS window. Refer to "17.2 Search Windows" for more information on setting the PS window.

Dynamic PS window

For **<PS Window: Off>**, **<Search with: PowerSearch>**, loss of lock and after prediction the prism is searched for in a dynamic PS window. This window covers a region at the position after prediction of horizontal 100 gon by vertical 40 gon. Refer to "33.3 Follow Moving Prisms - LOCK" for information on LOCK.

Direction of search

The direction which the instrument turns during the search routine can be define via hot key. Refer to "2.1 Hot Keys". The setting for the hot key has no influence to the Quick Settings, the automatic PowerSearch after loss of lock and the predefined search window.

Description

LOCK enables instruments equipped with ATR to follow a moving prism. The ATR sensor is active. When **<Automation: LOCK>** and a distance measurement is initiated with **DIST (F2)** or **L.GO (F5)** is pressed, an ATR search is executed. The instrument locks onto the prism and follows its movements. ATR offsets are continuously applied to the angle measurements. When the instrument loses lock to the reflector, a search is executed with either PS or ATR depending on settings.

LOCK is unavailable for SmartStation/TM30/TS30+SmartAntenna.

Refer to "17 Config...\Instrument Settings..." and to "3 Quick Settings - SHIFT USER" for more information.



If the speed of the reflector is too fast, the target may be lost. Make sure that the speed does not exceed the figure given in the technical data.

Enable lock

<Automation: LOCK>. The instrument is not yet locked onto the reflector and the ATR sensor is not active. Pressing **ALL (F1)**, **DIST (F2)**, **L.GO (F5)** or **CONT (F1)** in **QUICK SET Orientation With Compass**, **QUICK SET Positioning Hz/V**, **QUICK SET Move by Joystick** or **QUICK SET Check Recorded Pt/Backsight Pt** the ATR is used to find the reflector. Pressing **PS (F6)** PowerSearch is used to find the prism. When the reflector is found, the instrument locks onto the reflector. The instrument follows the moving reflector. The ATR sensor is active.

As long as the instrument is locked on, ATR offsets are continuously applied to the angle measurements. If the instrument loses lock to the prism the instrument may search for the prism with ATR or PS.

Loss of lock

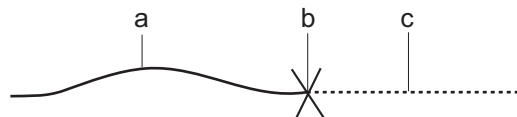
When the instrument is locked onto a reflector, lock may be lost if the movement of the reflector is too fast for the instrument to follow or the reflector is hidden behind an object. After lock is lost, the prediction is used to find the prism again. Refer to paragraph "Prediction" for more information.

The ATR sensor is still active.



Whenever the prism is moved in the field of view of the telescope the instrument locks automatically to the prism.

Prediction



TPS12_079

- a) Moving reflector locked onto by the instrument
- b) Loss of lock
- c) Prediction

As long as the prism is being tracked by the instrument a mathematical filter continuously calculates the average speed and direction of the prism. If the line of sight between instrument and prism is disturbed, the instrument keeps on moving using these calculated values. This behaviour is called prediction. The prediction time can be configured. During prediction the LOCK icon is displayed. If the prism comes into the field of view of the ATR it automatically locks on again.

Prism search after prediction

After prediction, the prism is searched for depending on the settings in the **CONFIGURE Automatic Prism Search** and **CONFIGURE Search Windows, PS Window** screens.

- **<Search with: No Search>**. If prism moved in field of view, prism is not searched for until **ALL (F1)**, **DIST (F2)**, **L.GO (F5)**, **CONT (F1)** or **PS (F6)** is pressed.
- **<Search with: ATR>**. prism is searched for in the dynamic ATR window with ATR.
- **<Search with: PowerSearch>** and **<PS Window: On>**: prism is searched for in the PS window with PowerSearch.
- **<Search with: PowerSearch>** and **<PS Window: Off>**: prism is searched for in the dynamic PowerSearch window.

Relock

Independent of **<Search with:>** the instrument can relock onto the prism. Refer to paragraph "Enable lock" for information on how to enable lock.

Description

When **<Use Interface: Yes>** in **CONFIGURE RCS Mode** the instrument can be controlled by RX1200 via radio. The ATR sensor does not necessarily have to be active when working in RCS mode. The RX1200 is used to remote control the instrument. No data can be stored on the RX1200. The screen and content displayed on the RX1200 are a copy of the remote controlled instrument. Refer to "20.3 RCS Mode" for information on configuration of interfaces.

The keyboard design of the RX1200 is different from the TPS1200+/TS30/TM30 keyboard. The functionality of the keys is the same. All functions and programs of the TPS1200+/TS30/TM30 are available on the RX1200.

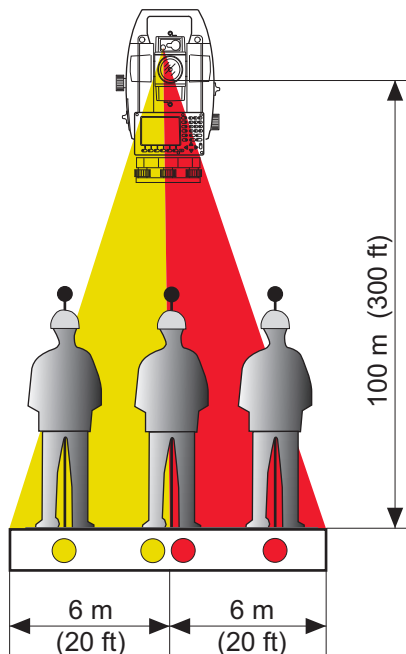
The communication between the TPS1200+/TS30/TM30 and the RX1200 is established via radio modems. One radio modem has to be connected to the TPS1200+/TS30/TM30 serial port. The RX1250T/RX1250Tc has an integrated radio, no additional connections are needed.

Refer to RX1200 User Manual for further information on the RX1200 and refer to "3 Quick Settings - SHIFT USER" for additional information.

Description

The **E**mitting **G**uide **L**ight, EGL, consists of two differently coloured flashing lights in the telescope housing of the TPS1200+/TS30. The EGL is used for guidance into the line of sight. If the left light is seen, the prism should be moved right and vice versa. If both flashing lights can be seen, the prism is in the line of sight of the instrument.

Functionality



TPS12_006

The EGL can be used

- to help guiding the reflector into the telescope line of sight when the instrument is remotely controlled and **<Automation: LOCK>**.
- to stake out points

The instrument emits two differently colored flashing cones of light. At a target distance of 100 m the cones have a width of 6 m. Between the two cones of light a sector with a width of 30 mm is created where both guide lights are visible simultaneously. In this position the prism is in the line of sight of the instrument.

Using the EGL step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Set <Automation: LOCK> and press COMPS (F1) or Hz/V (F2) or JSTCK (F3) on the QUICK SET Change Settings to: screen OR Set <EGL: On> on the CONFIGURE Lights, Display, Beeps, Text, Lights page.	3.2 18.5
2.	Align instrument line of sight and prism, where both flashing EGL lights can be seen simultaneously.	
3.	CONT (F1) to lock onto the prism.	
4.	If the instrument has locked onto the prism the EGL is turned off automatically.	
	If the EGL was turned on in the CONFIGURE Lights, Display, Beeps, Text, Lights page, it has to be turned off by setting <EGL: Off> .	



The EGL is turned off automatically once the instrument has locked onto a prism.

Description

There are several different illumination types built into the instrument that all fulfill different functions. Some are to support measurements, for example the visible red laser pointer. Others, such as the screen illumination, are for more convenient work with the instrument. These different types of illumination are described below.

Laser plummet

The laser plummet allows setting up the instrument over a marked point. The laser beam is emitted from the bottom of the instrument, pointing to the ground. When the instrument is levelled and the laser beam points exactly at the ground point, the instrument is set up correctly.

The laser plummet can be turned on and off. It is turned on automatically when opening the **STATUS Level and Laser Plummet** screen and turned off when leaving the screen.

Visible red laser pointer

The visible red laser pointer is used for reflectorless measurements. The visible red laser pointer is arranged coaxially with the line of sight of the telescope and emitted through the objective. If the instrument is well adjusted, the visible red laser beam coincides with the line of sight.



The direction of the beam should be inspected before precise distance measurements are executed, since an excessive deviation of the laser beam from the line of sight can cause inaccurate results.

GUS74 Laser Guide

The GUS74 Laser Guide is an option for TPS1200+ instruments. It is built into a special telescope compartment and emits a visible red laser beam to visualise the line of sight over long ranges. The GUS74 Laser Guide is used for special applications such as tunneling. Refer to GUS74 Laser Guide Manual for detailed information.

Screen/key illumination The screen and key illumination allows a more convenient working with the instrument when the lighting conditions are not ideal. They can be turned on in the **CONFIGURE Lights, Displays, Beeps, Text, Lights** page. To access this screen press **SHIFT F11** in any application program. Changes to the setting become effective instantly. Refer to "18.5 Lights, Display, Beeps, Text" for more information on screen and key illumination settings.

34.1

Overview

Description

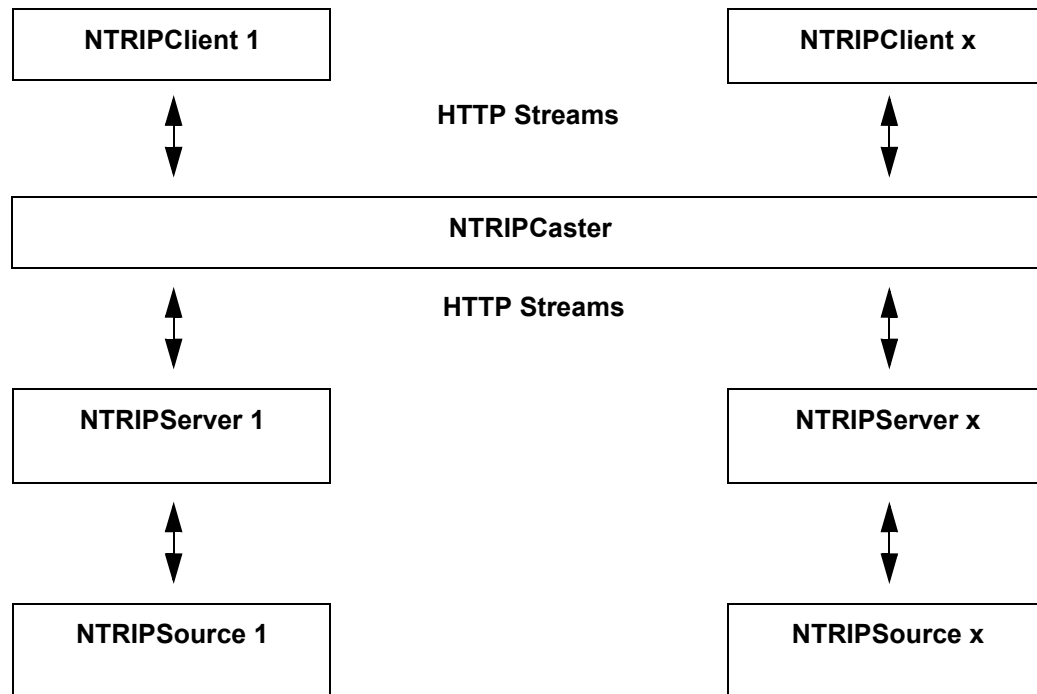
Networked Transport of RTCM via Internet Protocol

- is a protocol streaming real-time corrections over the Internet.
- is a generic protocol based on the Hypertext Transfer Protocol HTTP/1.1.
- is used to send differential correction data or other kinds of streaming data to stationary or mobile users over the Internet, allowing simultaneous PC, laptop, PDA, or receiver connections to a broadcasting host.
- supports wireless Internet access through mobile IP networks like digital cellular phones or modems.

System components

NTRIP consists of three system components:

- NTRIPClients
- NTRIPServers
- NTRIPCaster



NTRIPClient

The NTRIPClient receives data streams. This could be, for example a real-time rover receiving real-time corrections.

In order to receive real-time corrections, the NTRIPClient must first send

- a user ID
- a password
- an identification name, the so-called MountPoint, from which real-time corrections are to be received

to the NTRIPCaster.

NTRIPServer

The NTRIPServer transfers data streams.

In order to send real-time corrections, the NTRIPServer must first send

- a password
- an identification name, the so-called MountPoint, where the real-time corrections come from

to the NTRIPCaster.

Before sending real-time corrections to the NTRIPCaster for the first time, a registration form must be completed. This is available from the NTRIPCaster administration centre. Refer to the Internet.

NTRIPSource

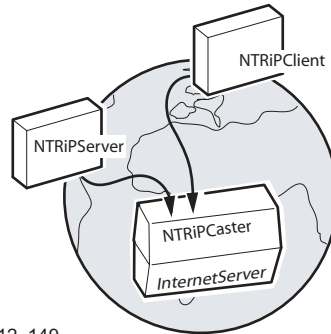
The NTRIPSource generates data streams. This could be, for example a GRX1200+ configured as reference sending out real-time corrections.

NTRIPCaster

The NTRIPCaster

- is an Internet server handling various data streams to and from the NTRIPServers and NTRIPClients.
 - checks the requests from NTRIPClients and NTRIPServers to see if they are registered to receive or provide real-time corrections.
 - decides whether there is streaming data to be sent or to be received.
-

Graphic



GPS12_149

NTRIP and it's role in the Internet

34.2

34.2.1

Requirements

Configuring SmartStation for Using NTRIP Service

Configuring an Access to the Internet

- SmartStation must be used.
- Firmware v2 or higher must be loaded on the TPS1200+/TS30/TM30 instrument.
- Firmware v1.42 or higher must be loaded on the RX1200.



To access to the Internet with SmartStation, **General Packed Radio System** devices will normally be used. GPRS is a telecommunication standard for transmitting data packages using the Internet Protocol (IP).

Configure access to Internet step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to "19.2.2 Accessing CONFIGURE Interfaces" to access CONFIGURE Interfaces .	
2.	In CONFIGURE Interfaces highlight Internet .	
3.	EDIT (F3) to access CONFIGURE Internet Interface .	
4.	CONFIGURE Internet Interface <Internet: Yes:> <IP Address: Dynamic>	20.6

Step	Description	Refer to chapter
	<User ID:> Some providers ask for a user ID to allow connecting to the Internet via GPRS. Contact your provider if a user ID needs to be used. <Password:> Some providers ask for a password to allow connecting to the Internet via GPRS. Contact your provider if a password needs to be used.	
5.	DEVICE (F5) to access CONFIGURE GPRS Internet Device .	
6.	CONFIGURE GSM/Modem Devices Highlight the GPRS device to be used.	
	NEW (F2) to create a new device.	19.4.3
7.	CONT (F1) to return to CONFIGURE Internet Interface .	
8.	CONT (F1) to return to CONFIGURE Interfaces .	
9.	CTRL (F4) to access CONFIGURE XX Connection .	
10.	CONFIGURE XX Connection Type in relevant information.	21.6
	CODES (F3) Available for digital cellular phones of GSM technology. To enter the Personal Identification Number of the SIM card. If the PIN is locked for any reason, for example the wrong PIN was entered, input the Personal UnblockKey code for access to the PIN.	
11.	CONT (F1) to return to TPS1200+/TS30/TM30 Main Menu .	

Step	Description	Refer to chapter
	The instrument is now online to the Internet. The Internet online status icon is displayed. But because GPRS is being used, no charges are yet made since no data transfer from the Internet has yet taken place.	
12.	USER	
13.	STAT (F3) to access STATUS Status Menu .	
14.	Highlight Interfaces....	
15.	ENTER to access STATUS Interfaces .	
16.	STATUS Interfaces Highlight Internet .	
17.	IFACE (F3) to access STATUS Internet .	
18.	STATUS Internet This screen shows • if the receiver is online on the Internet. • for how long the receiver is online. • the technology of data transfer. • the amount of data received or sent since the receiver is online.	
19.	CONT (F1) to return to STATUS Interfaces .	
20.	CONT (F1) to return to TPS1200+/TS30/TM30 Main Menu .	

34.2.2

Configuring to Connect to a Server

Requirements

The configurations from the previous chapter must have been completed. Refer to "34.2.1 Configuring an Access to the Internet".

Configure connect to a server step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Select Main Menu: Config...\Interfaces....	
2.	CONFIGURE Interfaces Highlight GPS RTK .	
3.	EDIT (F3) to access CONFIGURE Real-Time Mode .	
4.	CONFIGURE Real-Time Mode <R-Time Mode: Rover> <R-Time Data:> Select the type of data to be received from the Internet. <Port: NETx>	22.1
5.	CONT (F1) to return to CONFIGURE Interfaces .	
6.	Highlight GPS RTK .	
7.	CTRL (F4) to access CONFIGURE Set NET Port .	
8.	CONFIGURE Set NET Port <User: Client>	

Step	Description	Refer to chapter
	<Server:> The server to be accessed in the Internet. Opening the choicelist accesses CONFIGURE Server to Connect where new servers can be created and existing servers can be selected or edited. <IP Address:> The stored IP address of the selected <Server:> to be accessed in the Internet. <TCP/IP Port:> The stored port of the selected Internet <Server:> through which the data is provided. Each server has several ports for various services. <Auto CONEC: Yes> Allows for automatic connection between the SmartStation and the Internet when a point is occupied during a survey. Ending the point occupation also ends the Internet connection.	21.10
9.	CONT (F1) to return to CONFIGURE Interfaces .	
	Once SmartStation is connected to the server a message is displayed in the message line.	
10.	CONT (F1) to return to TPS1200+/TS30/TM30 Main Menu .	
11.	USER	
12.	STAT (F3) to access STATUS Status Menu .	
13.	Highlight Interfaces....	
14.	ENTER to access STATUS Interfaces .	
15.	STATUS Interfaces	

Step	Description	Refer to chapter
	Highlight GPS RTK .	
16.	DEVCE (F5) to access STATUS Device: Ethernet .	
17.	STATUS Device: Ethernet Check the Internet online status.	
18.	CONT (F1) to return to STATUS Interfaces .	
19.	CONT (F1) to return to TPS1200+/TS30/TM30 Main Menu .	

34.2.3

Using the NTRIP Service with SmartStation

Requirements

The configurations from the previous chapter must have been completed. Refer to "34.2.2 Configuring to Connect to a Server".

Use NTRIP service step-by-step

Step	Description
1.	Select Main Menu: Config...\Interfaces....
2.	In CONFIGURE Interfaces highlight GPS RTK .
3.	EDIT (F3) to access CONFIGURE Real-Time Mode .
4.	CONFIGURE Real-Time Mode <Port: NETx> must be selected.
5.	ROVER (F2) to access CONFIGURE Additional Rover Options .
6.	PAGE (F6) to access CONFIGURE Additional Rover Options, NTRIP page.
7.	CONFIGURE Additional Rover Options, NTRIP page
8.	<Use NTRIP: Yes> <User ID:> A user ID is required to receive data from to the NTRIPCaster. Contact the NTRIP administrator for information. <Password:> A password is required to receive data from the NTRIPCaster. Contact the NTRIP administrator for information.
9.	SRCE (F5) to access CONFIGURE NTRIP Source-Table .
10.	CONFIGURE NTRIP Source-Table All MountPoints are listed. MountPoints are the NTRIP servers sending out real-time data. This screen consists of two columns:

Step	Description
	- First column MountPoint: The abbreviations for the MountPoints. - Second column Identifier: The city where the MountPoint is located.
11.	Highlight a MountPoint about which more information is required. This information helps to configure the receiver to use the selected MountPoint as a reference.
12.	INFO (F3) to access CONFIGURE MountPoint: XX .
13.	CONFIGURE MountPoint: XX, General page <Format:> The real-time data format sent out by the MountPoint. <FormatDet:> Details about <Format:>, for example the RTCM message types including update rates in seconds displayed in brackets. <Authentic:> The type of password protection required for the authorisation to the NTRIPServer. <Authentic: None> if no password is required. <Authentic: Basic> if the password need not be encrypted. <Authentic: Digest> if the password must be encrypted. <NMEA:> Indicates if the MountPoint must receive GGA NMEA data from the rover in order to compute VRS information. <Charges:> Indicates if charges are currently made for the connection. <Carrier:> The type of carrier message sent out. <System:> The type of satellite system supported by the MountPoint.
14.	PAGE (F6) to access CONFIGURE MountPoint: XX, Location page.
15.	CONFIGURE MountPoint: XX, Location page

Step	Description
	Detailed information about the location of the MountPoint is displayed.
16.	PAGE (F6) to access CONFIGURE MountPoint: XX, Miscell page.
17.	CONFIGURE MountPoint: XX, Miscell page <Generator:> The hard- or software generating the data stream. <Compress:> The name of the compression / encryption algorithm. <Info:> Miscellaneous information if available.
	PREV (F2) to display information about the previous MountPoint in the list.
	NEXT (F3) to display information about the next MountPoint in the list.
18.	CONT (F1) to return to CONFIGURE NTRIP Source-Table .
19.	CONT (F1) to return to CONFIGURE Additional Rover Options .
	SHIFT CONEC (F3) and SHIFT DISCO (F3) are now available in GPS mode to connect to and disconnect from the NTRIPServer.

35.1

Overview

Description

MapView is an interactive display feature embedded in the firmware but used by all application programs as well as data management. MapView provides a graphical display of the survey elements which allows for a better overall understanding of how the data being used and measured relates to each other.

Depending on the application program and where in the application program MapView is accessed from, different modes, and their associated functionality, are available.

The displayed data in all modes of MapView can be shifted by using both the arrow keys and the touchscreen.

MapView modes

MapView is available in three modes:

Map mode:

- Part of data management.
- Is also available within some application programs, for example, the Reference Line application program.
- Can be used to view, select and edit points, lines and areas.
- Available as the **Map** page in data management and some application programs.

Plot mode:

- Is available to view results in various application programs. For example, COGO application program.
- Available as the **Plot** page in some application programs.

Survey mode:

- Part of the Survey application program.
- Is available within some application programs, for example, Stakeout application program.

- Can be used to select lines and areas.
- Same as Map mode but also shows the positions of the instrument and the reflector.
- Provides special functionality when staking out points.
- Available as the Map page in Survey and some application programs.

Modes within application programs

It is possible to access different MapView modes from the same application program. For example, **REFLINE Choose Reference Line, Map** page accesses MapView in map mode, whereas, **REFLINE XX Stakeout, Map** page accesses MapView in survey mode.

Displayable data

The data displayed in MapView is defined by the application program through which it was accessed, filters set in **MANAGE Sorts & Filters**, and the selections made in **XX MapView Configuration**.

Description

The MapView interactive display feature is provided as a page within all application programs and data management. It is accessed through the application program itself. Depending on the application program and from where in the application program MapView is accessed, different MapView modes are available.

Access step-by-step**Example access for map mode:**

Step	Description
1.	Select Main Menu: Manage...\Data. OR Press a hot key configured to access the screen MANAGE Data: Job Name. Refer to "2.1 Hot Keys" for information on hot keys. OR Press USER. Refer to "2.2 USER Key" for information on the USER key. OR From a choicelist in some screens for example in application programs.
2.	PAGE (F6) until MANAGE Data: Job Name, Map page is active.

Example access for plot mode:

Step	Description
1.	Press PROG . Highlight COGO. CONT (F1) . Refer to "36.2 Accessing the Programs Menu" for information on the PROG key.

Step	Description
	OR Press a hot key configured to access the screen COGO COGO Begin. Refer to "2.1 Hot Keys" for information on hot keys. OR Press USER. Refer to "2.2 USER Key" for information on the USER key.
2.	CONT (F1) to access COGO COGO Menu .
3.	COGO COGO Menu Highlight Intersections.
4.	CONT (F1) to access COGO Intersection Input .
5.	COGO Intersection Input Choose a method and enter appropriate data.
6.	CALC (F1) to access COGO XX Results .
7.	PAGE (F6) until COGO XX Results, Plot page is active.

Example access for survey mode:

Step	Description
1.	Select Main Menu: Survey. OR Press a hot key configured to access the screen SURVEY Survey Begin. Refer to "2.1 Hot Keys" for information on hot keys.



Step	Description
	OR Press USER . Refer to "2.2 USER Key" for information on the USER key. OR Press PROG . Highlight Survey . CONT (F1) . Refer to "36.2 Accessing the Programs Menu" for information on the PROG key.
2.	CONT (F1) to access SURVEY Survey: Job Name .
3.	PAGE (F6) until SURVEY Survey: Job Name, Map page is active.

MapView can be open multiple times, for example as **SURVEY Survey: Job Name, Map** page accessed from **TPS1200+/TS30/TM30 Main Menu** and as **MANAGE Data: Job Name, Map** page accessed using the **USER** key.

35.3

Configuring MapView

Description

Allows options to be set which are used as default options within MapView. These settings are stored within the configuration set and apply to all **Map** and **Plot** pages, regardless of how MapView is accessed.



Any changes made in **XX MapView Configuration** affect the appearance of MapView in all application programs, not just the active application program.

Access step-by-step

Step	Description
1.	Refer to "35.2 Accessing MapView" to access MapView in map, plot or survey mode.
2.	SHIFT CONF (F2) to access XX MapView Configuration .

XX
MapView Configuration,
Points page

12:48

MANAGE

IR

STD

I

MapView Configuration

Points | Lines & Areas | Display

Show Points : Yes

Display with Point Symbol

Point ID : Yes

Point Code : No

Point Height : No

Point CQ : No

Q2 a

CONT SYMBL PAGE

- CONT (F1)**
To confirm the selections and to return to the screen from where this screen was accessed.
- SYMBL (F3)**
To view all point symbols and their descriptions.
- PAGE (F6)**
To change to another page on this screen.

Description of fields

Field	Option	Description
<Show Points:>	Yes or No	Determines if points are displayed in MapView.
<Point ID:>	Yes or No	Available for <Show Points: Yes>. Determines if the ID of a point is displayed.
<Point Code:>	Yes or No	Available for <Show Points: Yes>. Determines if the code of a point is displayed.
<Point Height:>	Yes or No	Available for <Show Points: Yes>. Determines if the height of a point is displayed.
<Point CQ:>	Yes or No	Available for <Show Points: Yes>. Determines if the coordinate quality of a point is displayed.

Displayable point information

 200
 Tree
 435.000
 0.000

- a) <Point ID:>
- b) <Point Code:>
- c) <Point Height:>
- d) <Point CQ:>

Next step

PAGE (F6) changes to the **Lines&Areas** page. Refer to paragraph "XX MapView Configuration, Lines&Areas page".

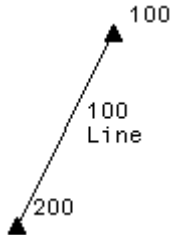
XX
MapView Configuration,
Lines&Areas page

Description of fields

Field	Option	Description
<Show Lines:>	Yes or No	Determines if lines are displayed in MapView.
<Show Line ID:>	Yes or No	Available for <Show Lines: Yes>. Determines if the ID of a line is displayed.
<Show Line Code:>	Yes or No	Available for <Show Lines: Yes>. Determines if the code of a line is displayed.
<Show Areas:>	Yes or No	Determines if areas are displayed in MapView.
<Show Area ID:>	Yes or No	Available for <Show Areas: Yes>. Determines if the ID of an area is displayed.
<Show Area Code:>	Yes or No	Available for <Show Areas: Yes>. Determines if the code of an area is displayed.

Displayable line/area
information

A line is shown as example.



- a) <Show Line ID:>
- b) <Show Line Code:>

Next step

PAGE (F6) changes to the **Display** page. Refer to paragraph "XX MapView Configuration, Display page".

XX MapView Configuration, Display page

Description of fields

Field	Option	Description
<Show Pt Info:>	When <200 Pts or As Configured	Determines if point information is shown or not. For <Show Pt Info: When <200 Pts> point information is not shown when more than 200 points are displayed. For <Show Pt Info: As Configured> the point information, as configured in XX MapView Configuration, Points page, is shown regardless of the number of points being displayed.
<Datum View:>	WGS 1984 or Local	Determines the datum in which the points are viewed.  When both GPS and TPS data is being used, it is possible that some data will not be displayed.
<Rotate 180°:>	Yes or No	Available for <Datum View: Local> . To rotate the map by 180°. The north arrow is not rotated and still orientated towards the top of the screen.
<Toolbar:>	On or Off	Determines if the toolbar of touch icons are displayed. Refer to "35.4.3 Toolbar".
<Curr Pos Info:>		Determines if a certain information related to the current position is displayed in the lower left corner of the map (only visible in survey mode).

Field	Option	Description
	<None>	No information is displayed in the map.
	Point ID	Point ID of the current position.
	Code	Code of the current position.
	Attrib 01	User defined attribute.
	Attrib 02	User defined attribute.
	Attrib 03	User defined attribute.
	Attrib 04	User defined attribute.
	Attrib 05	User defined attribute.
	Quality 3D	Current 3D coordinate quality of the computed position.
The following fields are relevant for Survey Mode:		
<Show Path:>	Yes or No	Displays the path of the reflector as a dashed line.
<Center To:>	Choicelist	To centre the map on the reflector or the instrument.
	Reflector	To centre the map on the reflector. For EDM mode standard, fast or average, the map will centre onto the last measured point. For EDM mode tracking or synchrotrack, the map will centre onto the current reflector position. These behaviours are true for all automation settings
	Total Station	To centre the map on the instrument.

Next step

CONT (F1) confirms the selections and returns to where **XX MapView Configuration** was accessed.

35.4

35.4.1

MapView Components

Softkeys

Description

Standard functionality is provided by a number of softkeys within MapView. These softkeys are available regardless of the mode in which MapView was accessed and always perform the same functions.

Standard softkeys

The softkeys described below are standard on all MapView screens. For descriptions of mode specific softkeys see appropriate chapters.

Softkey	Description
ZOOM+ (F4)	To zoom into the map.  Pressing ESC stops the zooming process. All keys become active again.
ZOOM- (F5)	To zoom out of the map.  Pressing ESC stops the zooming process. All keys become active again.
PAGE (F6)	To change to another page on this screen.
SHIFT CONF (F2)	To configure MapView. Accesses XX MapView Configuration . Refer to "35.3 Configuring MapView".
SHIFT FIT (F3)	To fit all displayable data into the screen area. Refer to "35.4.3 Toolbar" for more information.

Touch screen functions

Some softkey functionality can be replaced by touch screen functions.

Softkey	Touch equivalent
PAGE (F6)	Tap on a page tab.
SHIFT FIT (F3)	Tap on fit touch icon. Refer to "35.4.3 Toolbar".

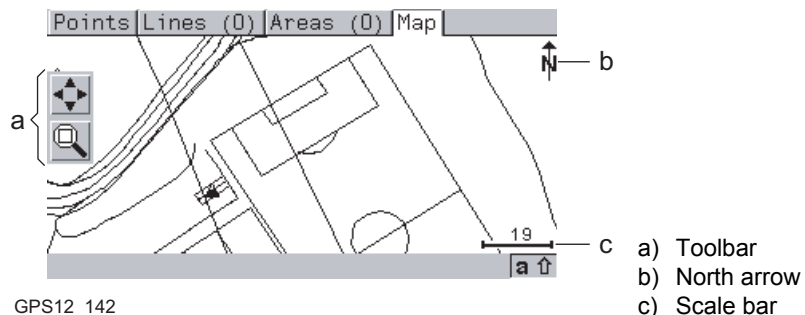
35.4.2

Screen Area

Description

The MapView screen area is very similar in all cases. The positions of the scale bar, the North arrow and the toolbar, if visible, do not change.

Standard screen



Reflector

Reflectors are displayed on the **Map** page. The reflector path is shown as dashed line.

Symbol	Description
	Measured position.

Instrument station

Symbol	Description
	Position of the instrument station.

Scale bar

Symbol	Description
	Scale of the current screen. The minimum is 0.5 m. There is no maximum for the zoom but the scale cannot display values greater than 99000 m. In this case the value displayed will be >99000 m.

North arrow

Symbol	Description
	North arrow. North is always orientated towards the top of the screen.

Toolbar

Symbol	Description
	Touch icon toolbar. Refer to "35.4.3 Toolbar" for more information about the functionality of the touch icons in the toolbar.

Point with focus

Symbol	Description
	The point that has the focus.

35.4.3

Toolbar

Description

Touch icons are available in a toolbar, if **<Toolbar: On>** in **XX MapView Configuration, Display** page. The toolbar is always located on the left hand side of the screen. Some of the functions performed by the touch icons can also be replicated using a softkey in the same mode as when the touch icon appears. The softkey equivalent to each touch icon, if one exists, are indicated below.

Touch icons in the toolbar

Touch icon	Softkey	Description
	SHIFT FIT (F3)	Available as a touch icon in map mode. The fit touch icon fits all displayable data, according to filters and the map configuration, into the screen area, using the largest possible scale.
	-	The windowing touch icon zooms to a specified area window. An area window can be drawn by tapping on the top left and the bottom right corner of the area. This causes the screen to zoom to the selected area.
	-	Available in survey mode. This touch icon displays the current direction as dashed line. A location on the Map page can then be tapped and the instrument turns to this direction. If <Automation: ATR> the instrument does an ATR search. If <Automation: LOCK> the instrument tries to lock on to a reflector.

35.4.4

Point Symbols

Points

When **<Show Points: Yes>** in **XX MapView Configuration**, points are displayed, in all modes, according to their class.

Symbol	Description
	3D control point is a point of class CTRL with horizontal and vertical coordinate components.
	2D control point is a point of class CTRL with horizontal coordinate components.
	Adjusted point is a point of class ADJ .
	Reference point is a point of class REF .
	Average point is a point of class AVGE .
	Measured point is a point of class MEAS .
	Single Point Position uploaded from LGO.
	Navigated point is a point of class NAV .
	Estimated point is a point of class EST .
	Calculated COGO point is a point of class MEAS or CTRL depending on the COGO calculation method.



Points of class **NONE** or points of class **CTRL/MEAS** with a height only component cannot be displayed in MapView.



A list of the point types available, and their description, is available by pressing **SYMBL (F3)** in **XX MapView Configuration, Points** page. Refer to "35.3 Configuring MapView".

35.5

35.5.1

Map Mode

MapView in Map Mode

Description

The map mode of MapView is available as the **Map** page in data management and some application programs. It can be used to display, select and edit points, lines and areas.

Access

Refer to "35.2 Accessing MapView" paragraph "Example access for map mode:".

OR

From a choicelist in some screens, for example, in application programs, which access data management.

OR

As a part of an application program, for example, COGO.

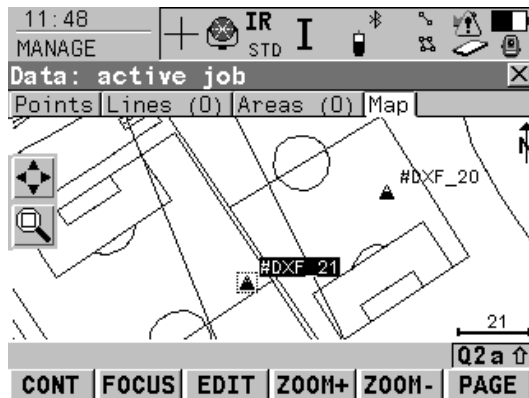


The **MANAGE Data: Job Name, Map** page is used as the example below. The functions described are the same for all **Map** pages in map mode.

MANAGE

Data: Job Name,
Map page

The softkeys described below are specific to MapView in map mode. Refer to "35.4.1 Softkeys" for descriptions of the standard softkeys.



FOCUS (F2) or DONE (F2)

To activate the focus tool and select a point without using the touch screen. Refer to "35.5.2 Selecting Points, Lines and Areas".

EDIT (F3)

To edit the highlighted point's parameters. Accesses **MANAGE Edit Point: Point ID**.

SHIFT CENTR (F4)

To centre the screen around the point with the current focus, or the focus tool if **DONE (F2)** is visible.

SHIFT FILTR (F5)

Available for **FOCUS (F2)**. To change the filter settings. Accesses **MANAGE Sorts & Filters**.

Touch screen functions

Key	Touch equivalent
FOCUS (F2)	Tap on a point.

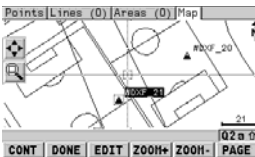
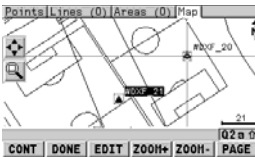
35.5.2

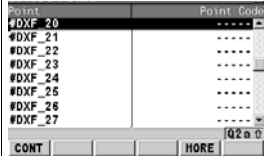
Selecting Points, Lines and Areas

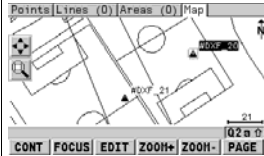
Description

Selecting a point, line or area in the map mode of MapView is possible using both the softkeys and the touch screen. The functionality of all screens and field are similar for the selecting of a point, line or area. The step-by-step instructions for selecting a point using the softkeys can be applied for lines and areas.

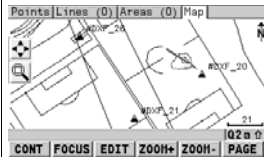
Select a point using the softkeys step-by-step

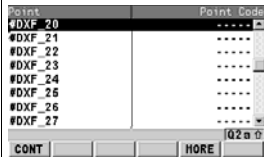
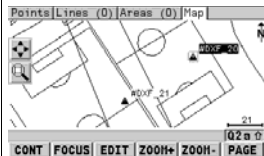
Step	Description	Display
1.	Refer to "35.5.1 MapView in Map Mode" to access MANAGE Data: Job Name, Map page.	
	If no point field is highlighted on the previous page when the Map page is accessed, then any point that is selected will be assigned to the first point field on the previous page, the second point to the second point field, etc. If a point field is highlighted when the Map page is accessed then the point selected will be assigned to that field.	
2.	FOCUS (F2) to activate the focus tool. The focus tool is made up of a square placed at the centre of dashed cross-hairs. The focus tool always starts at the centre of the screen area.	
3.	Use the arrow keys to navigate the focus tool to the point to select. A point is available for selection when the square is centred around the point symbol.	

Step	Description	Display
	When there are multiple points within the same area and the precise selection is unclear, pressing ENTER will access XX Select Point .	
4.	Press ENTER to select the point. The point parameter text, as defined in XX Map View Configuration, Points page, is highlighted.	
5.	Have multiple points been selected? - If yes, continue with step 6. - If no, continue with step 8.	
6.	XX Select Point Point ID The ID of the points within range of the point selection. Point Code The code of the points within range of the point selection. Select the desired point.	
	MORE (F5) to display information about the point code, the 3D coordinate quality and class, the time the point was stored and the date the point was stored.	
7.	CONT (F1) returns to MANAGE Data: Job Name, Map page with the focus on the selected point.	

Step	Description	Display
8.	DONE (F2) exits the focus tool.	

Selecting a point using the touch screen step-by-step

Step	Description	Display
1.	Refer to "35.5.1 MapView in Map Mode" to access MANAGE Data: Job Name, Map page.	
	If no point field is highlighted on the previous page when the Map page is accessed, then any point that is selected will be assigned to the first point field on the previous page, the second point to the second point field, etc. If a point field is highlighted when the Map page is accessed then the point selected will be assigned to that field.	
2.	Tap on the point to be selected.	
	When there are multiple points within the same area and the precise selection is unclear, tapping on the point will access XX Select Point .	

Step	Description	Display
3.	Have multiple points been selected? - If yes, continue with step 4. - If no, continue with step 6.	
4.	XX Select Point Point ID The ID of the points within range of the point selection. Point Code The code of the points within range of the point selection. Select the desired point.	
	MORE (F5) to display information about the point code, the 3D coordinate quality and class, the time the point was stored and the date the point was stored.	
5.	CONT (F1) returns to MANAGE Data: Job Name, Map page with the focus on the selected point.	
6.	A square is centred on the selected point and the point parameter text, as defined in XX MapView Configuration, Points page, is highlighted.	

35.6

Plot Mode - MapView Screen Area

Description

The plot mode of MapView is available as the **Plot** page in an application program and can be used to view the results of the application program. Results are shown in black, all other information, that is displayable, is shown in grey.

Access

Refer to "35.2 Accessing MapView" paragraph "Example access for plot mode:". OR

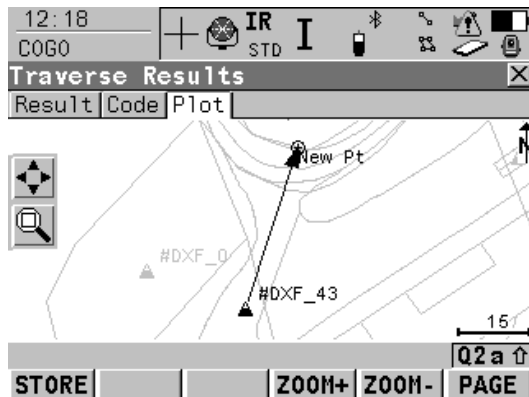
As a part of an application program, for example, COGO.



The **COGO XX Results, Plot** page is used as the example below. The functions described are the same for all **Plot** pages.

COGO XX Results, Plot page

The softkeys described below are specific to MapView in plot mode. Refer to "35.4.1 Softkeys" for descriptions of the standard softkeys.



SHIFT FACE (F1) and SHIFT PLAN (F1)

Available in **REFPLANE XX Reference Plane, Plot** page. To change between the face and the plane view of the plane.

SHIFT FIT R (F4)

To fit the results in the screen area.

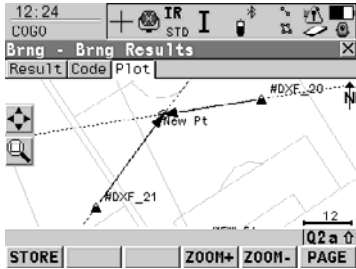
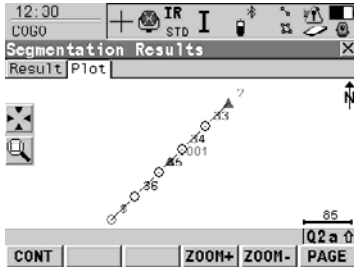
SHIFT RFRSH (F5)

To refresh the screen.

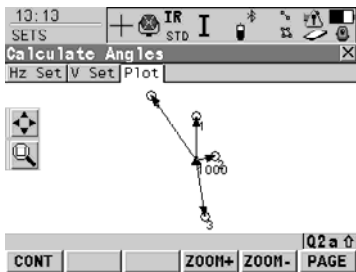
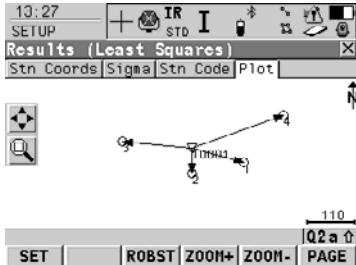
Touch screen functions

Key	Touch Equivalent
SHIFT FIT R (F4)	Tap on fit results touch icon. Refer to "35.4.3 Toolbar".

Example of results displayed in MapView on Plot page

Application	Display	Description
COGO Intersection, Bearing - Bearing		Intersecting lines with known bearings from known points.
COGO line calculation, Segmentation		Points defining the line and those created on the line

Application	Display	Description
COGO Shift, Rotate & Scale		Original points in grey, calculated COGO points in black
Reference Line, Edit Reference Line		Reference line or arc
Reference Plane, Edit Reference Plane		A dashed rectangle indicates the face view of the plane.

Application	Display	Description
Sets of Angles, Calculating Angles		Directions from station to sets of angle points
Setup		Directions to resection points.

35.7

35.7.1

Survey Mode

MapView in Survey Mode

Description

The survey mode of MapView is available as the Map page in Survey and is used to display the position of the instrument station during a survey. It can also be used to select lines and areas. It is also used by the Stakeout, Reference Line and Reference Plane application programs to assist in the staking out/measuring of points.

Refer to "35.7.2 MapView in Staking Out Survey Mode" for more information about using MapView when staking out points.

Access



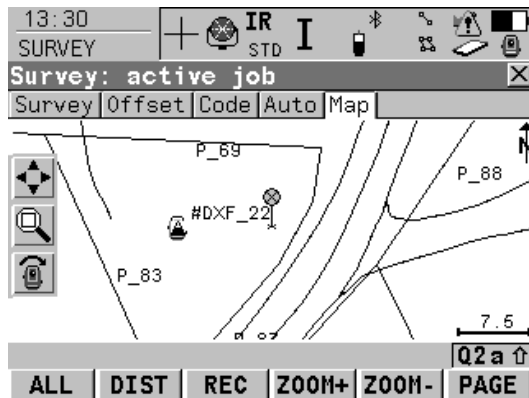
Refer to "35.2 Accessing MapView" paragraph "Example access for survey mode:".

The **SURVEY Survey: Job Name, Map** page is used as the example below. The functions described are the same for all **Map** pages in survey mode.

SURVEY

Survey: Job Name, Map page

The softkeys described below are specific to MapView in survey mode. Refer to "35.4.1 Softkeys" for descriptions of the standard softkeys.



SHIFT FACE (F1) and SHIFT PLAN (F1)

Available in **REFPLANE Measure Point on Plane, Map** page. To change between the face and the plane view of the plane.

SHIFT CENTR (F4)

To centre the screen around the point with the current focus or the focus tool, if **FOCUS (F2)** is active.

SHIFT RFRSH (F5)

To refresh the screen.

Touch screen functions

Key	Touch equivalent
SHIFT CENTR (F4)	Tap on centre touch icon. Refer to "35.4.3 Toolbar".

Description

When staking out a point in Stakeout or Reference Line application programs, the **Map** page is available. The MapView survey mode is provided for this operation, with some differences.

- With the RX1200 active points can be selected, using the touch screen, as points to be staked.
- An arrow indicating the direction from the current position to the point to be staked is provided.
- A box provides information such as the distance to the stakeout point and the CUT/FILL value so the point to be staked can be found.

Data displayed

For Stakeout application program.

- From **<Job:>** and **<Stakeout Job:>**, all point symbols are shown in green, point ID's in black and displayable lines and areas in a colour defined in **MANAGE New Line** or **MANAGE Edit Line**.
- If the survey is to be orientated to a reference line/arc, the line is displayed in black.

For Reference Line application program.

- From **<Job:>**, all point symbols are shown in green, point ID's and displayable lines and areas are shown in black.
- From **<Control Job:>**, all point ID's and point symbols are shown in grey, displayable lines and areas are shown in a colour defined in **MANAGE New Line** or **MANAGE Edit Line**.
- The point to be staked is displayed in black.
- The reference line/arc is displayed in black.



The **STAKEOUT XX Stakeout, Map** page is used as the example below. The functions described are the same for all **Map** pages available when staking out.

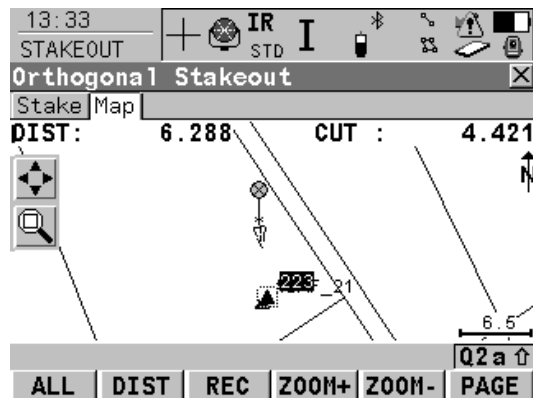
Access step-by-step

Example access for MapView in survey mode, Stakeout

Step	Description
1.	Select Main Menu: Programs...\Stakeout . OR Press PROG . Highlight Stakeout. CONT (F1) . OR Press a hot key configured to access the screen STAKEOUT Stakeout Begin . Refer to "2.1 Hot Keys" for information on hot keys. OR Press USER . Refer to "2.2 USER Key" for information on the USER key. OR Press STAKE (F5) from another application program, for example COGO.
2.	CONT (F1) to access STAKEOUT XX Stakeout .
3.	PAGE (F6) until STAKEOUT XX Stakeout, Map page is active.

STAKEOUT XX Stakeout, Map page

The softkeys described below are specific to MapView in survey mode, staking out. Refer to "35.4.1 Softkeys" for descriptions of the standard softkeys.



SHIFT CENTR (F4)

To centre the screen around the reflector.

Description of fields

Field	Option	Description
<DIST:>	Output	Horizontal distance from the current position to the point to be staked.
<CUT:>	Output	The negative height difference from the height of the current position to the height of the point to be staked.
<FILL:>	Output	The positive height difference from the height of the current position to the height of the point to be staked.

35.7.3

Selecting Lines and Areas

Description

Selecting a line or area in the survey mode of MapView is possible using the touch screen. The functionality of all screens and field are similar for the selecting of a line or area. The step-by-step instructions for selecting a line using the touchscreen can be applied for areas.

Selecting a line step-by-step

Step	Description
1.	Select Main Menu: Survey . OR Select Main Menu: Programs...\Survey . OR Press a hot key configured to access the screen SURVEY Survey Begin . Refer to "2.1 Hot Keys" for information on hot keys. OR Press USER . Refer to "2.2 USER Key" for information on the USER key. OR Press PROG . Highlight Survey. CONT (F1) . Refer to "36.2 Accessing the Programs Menu" for information on the PROG key.
2.	PAGE (F6) until SURVEY XX Survey, Map page is active.
3.	Tap on the line to be selected.  When there are multiple lines within the same area and the precise selection is unclear, tapping on the line will access XX Select Line .
4.	Have multiple lines been selected ?

Step	Description
	• If yes, continue with step 5. • If no, continue with step 7.
5.	XX Select Line Point ID The ID of the lines within range of the line selection. Point Code The code of the lines within range of the point selection. Select the desired line.
	MORE (F5) to display information about the line code, the start time, the end time, the length and the Open status of the line.
6.	CONT (F1) returns to SURVEY Data: Job Name, Map page.
7.	A message appears in the message line. • Line Line Name was opened (If the line was close before). • Line Line Name was closed (If the line was open before).

36.1

Overview

Description

Application programs are software packages supporting specific tasks. Available are:

- Survey (integrated into the instrument firmware and cannot be deleted)
- Setup (integrated into the instrument firmware and cannot be deleted)

- Alignment Tool Kit - refer to the separate manual
- COGO
- Determine Coordinate System
- DTM Stakeout
- DXF Export, DXF Import
- GPS Survey
- Hidden Point
- MGuide - refer to the separate manual
- Reference Line
- Reference Plane
- RoadRunner - this program could contain the following:
 - RoadRunner - refer to the separate manual
 - RoadRunner Tunnel - refer to the separate manual
 - RoadRunner Rail - refer to the separate manual

- Sets of Angles - this program could contain the following:
 - Sets of Angles
 - Monitoring
- Stakeout
- Survey Cross Section
- Traverse
- Volume Calculations

For an explanation of the application programs refer to the relevant chapters.

Loadable and non-loadable application programs

Loadable application programs:	• Can be loaded onto the instrument. • Can be deleted from the instrument.
Non-loadable application programs:	• Are always available on the instrument. • Survey and Setup are non-loadable application programs. To get updates for these programs, the system software has to be reloaded.

Licence key

Some loadable application programs are protected. They are activated through a specific licence key. This can either be typed in **Main Menu: Tools...\Licence Keys** or the first time the application program is started. Refer to "28 Tools...\Licence Keys" for information on how to type in or upload a licence key. A licence key is required for:

- DTM Stakeout
- DXF Export
- Reference Line
- Reference Plane
- RoadRunner
- Sets of Angles (includes Monitoring, which requires a separate licence key)
- Stakeout
- Volume Calculations

Customised application programs

Customised application programs can be developed locally using the GeoC++ development environment. Information on the GeoC++ development environment is available on request from the Leica Geosystems representative.
Customised application programs always run in the language they were developed in.

36.2

Accessing the Programs Menu

Description

The application programs menu contains all loaded application programs including Survey and Setup. They are listed in the order in which they were loaded. Selecting an option in the menu starts the application program assigned to the option. Configurations and measurements that can be performed depend on the application program.

The screen of the application programs menu is called **TPS1200+/TS30/TM30 Programs**.

Access to the application programs menu

Select **Main Menu: Programs....**

OR

Press **PROG**.

TPS1200+/TS30/TM30 Programs



CONT (F1)

To start the highlighted application program.

Next step

Select an option in the menu to open the application. Refer to the chapter on the individual application programs.



Four application programs can be open at one time. **XX Begin** is shown for the application program opened first, but not for the following application programs.

37.1

Overview

Description

COGO is an application program to perform **coordinate geometry** calculations such as

- coordinates of points.
- bearings between points.
- distances between points.

The calculations can be made from

- existing point data in the job, known distances or known azimuths.
- measured points.
- entered coordinates.

In contrast to remote point measurements within the Survey application program, COGO is more of a calculation program than a measuring program.



Changing coordinates of a point which has been previously used in COGO does not result in the point being recomputed.

COGO calculation methods

The COGO calculation methods are:

- Inverse.
- Traverse.
- Intersections.
- Line calculations.
- Arc calculations.
- Shift, Rotate & Scale (Manual)
- Shift, Rotate & Scale (Match Pts)
- Area Division

Distances and azimuths	Type of distances: The choices are • Ground • Grid • Ellipsoidal Type of azimuths: The azimuths are grid azimuths relative to the local grid.
Coding of COGO points	• Thematical coding is available in COGO XX Results after the COGO calculation. Thematical coding of COGO points is identical to coding measured points. Refer to "8 Coding" for information on coding. • For the COGO calculation shift, rotate & scale, the codes from the original points are taken over for the calculated COGO points.
Properties of COGO points	The properties stored with COGO points are: • Class: Either MEAS or CTRL depending on the COGO calculation method. • Sub class: COGO • Source: Arc Base Pt, Arc Centre Pt, Arc Offset Pt, Arc Segmt Pt, COGO Area Divsn., COGO Shift/Rtn, COGO Traverse, Intsct (Brg Brg), Intsct (Brg Dst), Intsct (Dst Dst), Intsct (4 Pts), Line Base Pt, Line Offset Pt or Line Segmt Pt depending on the COGO calculation method used • Instrument source: TPS

Access

Select **Main Menu: Programs...\COGO**.

OR

Press **PROG**. Highlight **COGO. CONT (F1)**. Refer to "36.2 Accessing the Programs Menu" for information on the **PROG** key.

OR

Press a hot key configured to access the screen **COGO COGO Begin**. Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.



The screens for each COGO calculation method can be accessed directly by pressing a configured hot key or **USER** where **COGO COGO Begin** is not accessed. The currently active configuration set and job are used.

COGO

COGO Begin

11:38
COGO

COGO Begin

Job : construction

Coord System : <None>

Codelist : <None>

Config Set : TCPR

Reflector : Leica Circ Prism

Add. Constant: 0.0 mm

Q2a ↑

CONT CONF SETUP CSYS

CONT (F1)

To accept changes and access the subsequent screen. The chosen settings become active.

CONF (F2)

To configure the COGO application program. Accesses **COGO Configuration**. Refer to "37.3 Configuring COGO".

SETUP (F3)

To set up station. Accesses **SETUP Station Setup**.

CSYS (F6)

To select a different coordinate system. Not available for **<Use Auto CrdSys: Yes>** configured in **CONFIGURE Additional Rover Settings**. Refer to "22.1.1 Configuration of Real-Time".

Description of fields

Field	Option	Description
<Job:>	Choicelist	The active job. All jobs from Main Menu: Manage...Jobs can be selected.
<Coord System:>	Output	The coordinate system currently attached to the selected <Job:>.

Field	Option	Description
<Codelist:>	Choicelist	No codes are stored in the selected <Job:>. All codelists from Main Menu: Manage...\Codelists can be selected.
	Output	Codes have already been stored in the selected <Job:>. If codes had been copied from a System RAM codelist, then the name of the codelist is displayed. If codes have not been copied from a System RAM codelist but typed in, then the name of the active job is displayed.
<Config Set:>	Choicelist	The active configuration set. All configuration sets from Main Menu: Manage...\Configuration Sets can be selected.
<Reflector:>	Choicelist	The active reflector. All reflectors from Main Menu: Manage...\Reflectors can be selected.
<Add. Constant:>	Output	The additive constant stored with the chosen reflector.

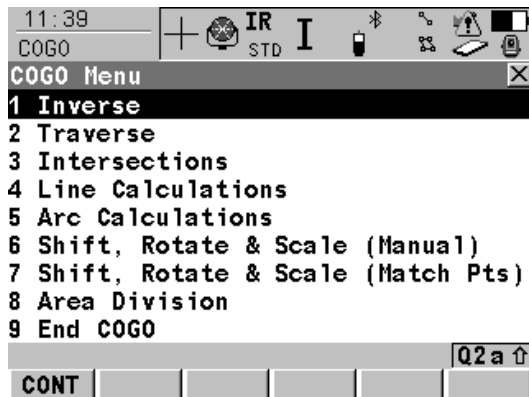
Next step

CONT (F1) accepts changes and accesses **COGO COGO Menu**.

COGO

COGO Menu

The COGO menu lists all COGO calculation methods and the option to end COGO.



CONT (F1)

To select the highlighted option and to continue with the subsequent screen.

SHIFT CONF (F2)

To configure the COGO application program. Accesses **COGO Configuration**. Refer to "37.3 Configuring COGO".

Description of the COGO menu options

COGO menu options	Description	Refer to chapter
Inverse	To calculate the direction, the distance and the 3D coordinate differences between: • two known points, • a known point and a given line, • a known point and a given arc. Points with full coordinate triplets, position only points and height only points can be used.	37.4

COGO menu options	Description	Refer to chapter
Traverse	To calculate the position of new points using - the azimuth/bearing and the distance from a known point. Offset optional. - the angle and the distance from a known point. Offset optional. Points with full coordinate triplets and position only points can be used.	37.5
Intersections	To calculate the position of an intersection point using - bearings from two known points. - a bearing and a distance from two known points. - distances from two known points. - four points. - two lines Points with full coordinate triplets and position only points can be used.	37.6
Line Calculations	To calculate the base point of the line using - two known points and an offset point. - a bearing and a distance from a known point and an offset point. To calculate the offset point of the line using	37.7

COGO menu options	Description	Refer to chapter
	• two known points that define the line, a distance along the line and an offset. • a distance along a bearing from a known point and offset. To calculate new points on a line using • two known points that define the line and either the segment length or the number of segments. • a bearing and distance from a known point that define the line and either the segment length or the number of segments.	
Arc Calculations	To calculate: • the arc centre. • the base point of the arc. • the offset point of the arc. • new points on an arc. The arc can be defined using • three points. • a radius to two known points. • a radius and two tangents, each of it defined by a point and the intersection point of the tangents.	37.8

COGO menu options	Description	Refer to chapter
	- the length of an arc and two tangents, each of it defined by a point and the intersection point of the tangents. - the length of a chord and two tangents, each of it defined by a point and the intersection point of the tangents. Known must be also, depending on the arc calculation method - an offset point. - either the segment length or the number of segments.	
Shift, Rotate & Scale (Manual)	To calculate the position of new points using - coordinates of known points - shifts. - rotation. - scale. Heights are not scaled. The values for shifts, rotation and/or scale are entered manually. Points with full coordinate triplets, position only points and height only points can be used.	37.9

COGO menu options	Description	Refer to chapter
Shift, Rotate & Scale (Match Pts)	To calculate the coordinates of new points using the shifts, rotation and scale computed from selected points. Points with full coordinate triplets, position only points and height only points can be used.	37.10
Area Division	To divide an area by a • defined line • percentage • size of a sub area.	37.11
End COGO	To end COGO and return to the screen from where COGO was accessed.	

Next step

IF	THEN
a COGO calculation method is to be started	highlight the relevant option and press CONT (F1) . Refer to the chapters stated above.
COGO is to be configured	SHIFT CONF (F2) . Refer to "37.3 Configuring COGO".
COGO is to be ended	highlight End COGO and CONT (F1) .

37.3

Configuring COGO

Access

Select **Main Menu: Programs...\COGO**. In **COGO COGO Begin** press **CONF (F2)** to access **COGO Configuration**.

OR

Press **PROG**. Highlight **COGO**. **CONT (F1)**. In **COGO COGO Begin** press **CONF (F2)** to access **COGO Configuration**.

OR

Press **SHIFT CONF (F2)** in **COGO COGO Menu**. Refer to "37.2 Accessing COGO".

OR

Press **SHIFT CONF (F2)** in **COGO XX**.

COGO Configuration, Parameters page

This screen consists of the **Parameters** page, **Residuals** page and the **Logfile** page. The explanations for the softkeys given below are valid for all pages.

18:18 COGO

Configuration

Parameters Residuals Logfile

Distance Type: Grid

Two Faces : No

Use Offsets : Yes

Store Pts As : MEAS

Est Pos Qlty : 0.300 m

Est Ht Qlty : 0.300 m

Q2 a

CONT PAGE

CONT (F1)

To accept changes and return to the screen from where this screen was accessed.

PAGE (F6)

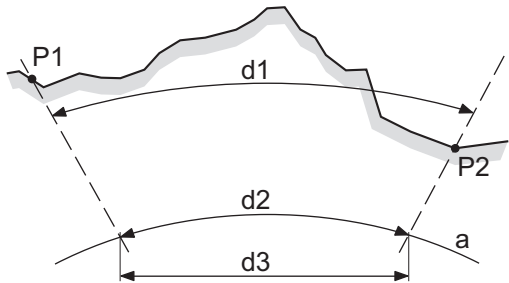
To change to another page on this screen.

SHIFT ABOUT (F5)

To display information about the program name, the version number, the date of the version, the copyright and the article number.

Description of fields

Field	Option	Description
<Distance Type:>	Grid	The type of distances and offsets to be accepted as input, shown as output and used in the calculation. Distances are calculated as the trigonometric distance between the position of two points. The distance field is <HDist-Grid:> .
	Ground	Distances are horizontal distances between two points at the mean elevation parallel to the ellipsoid of the active coordinate system. The distance field is <HDist-Grnd:> .
	Ellipsoid	The distances are reduced to the ellipsoid. They are calculated as the shortest distance between the two points on the ellipsoid. A scale factor is applied. The distance field is <HDist-Ell:> .  In the attached coordinate system, a projection, an ellipsoid and a transformation have to be defined to calculate grid, ground and ellipsoid coordinates.

Field	Option	Description
 a Ellipsoid Known P1 First known point P2 Second known point Unknown d1 Ground distance d2 Ellipsoid distance d3 Grid distance TPS12_170		
<Two Faces:>	Yes No	Defines if the instrument measures the second face automatically after storing the first. After storing a measurement with ALL (F1) or REC (F3) motorised instruments change face automatically, non-motorised instruments access COGO Telescope Positioning. The measurements of face I and face II are averaged on the base of face I. The averaged value is stored. No automatic measurement in two faces.
<Use Offsets:>	Yes or No	Activates the use of offsets in the COGO calculations. Input fields for the offsets are available in COGO XX .
<Store Pts As:>	MEAS or CTRL	To store the cogo point with point class MEAS or with point class CTRL.

Field	Option	Description
		Points stored with point class MEAS can be stored with the same point ID. The averaging functionality (configured under job management) can then be used to calculate an average for these points. Points stored with point class CTRL can only be stored with a unique point ID. A message is always displayed when a point is about to be stored with an already existing point ID. The user can then decide to either keep the existing point or overwrite the existing point.
<Est Pos Qlty:>	User input	The estimated value for the position quality assigned to all calculated COGO points which is used for the averaging calculation.
<Est Ht Qlty:>	User input	The estimated value for the height quality assigned to all calculated heights which is used for the averaging calculation.
When the Intersections method=TPS Obs-TPS Obs, the following fields apply:		
<Compute Ht:>	Output text Using Average Use Upper Height Use Lower Height	Defines the height being used. Using an average of the two observations. Using the upper height. Using the lower height.

**COGO
Configuration,
Residuals page**

Next step

PAGE (F6) changes to the **Residuals** page. Refer to paragraph "COGO Configuration, Residuals page".

This page applies to COGO Shift, Rotate & Scale (Match Pts).

Description of fields

Field	Option	Description
<Easting:>	User input	The limit above which Easting residuals will be flagged as possible outliers.
<Northing:>	User input	The limit above which Northing residuals will be flagged as possible outliers.
<Height:>	User input	The limit above which Height residuals will be flagged as possible outliers.
<Residual Distbtn:>	None 1/Distance^{xx} Multiquad-ratic	The method by which the residuals of the control points will be distributed throughout the transformation area. No distribution is made. Residuals remain with their associated points. Distributes the residuals according to the distance between each control point and the newly transformed point. Distributes the residuals using a multiquadratic interpolation approach.

Next step

PAGE (F6) changes to the **Logfile** page. Refer to paragraph "COGO Configuration, Logfile page".

Description of fields

Field	Option	Description
<Write Logfile:>	Yes or No	To generate a logfile when the application program is exited. A logfile is a file to which data from an application program is written to. It is generated using the selected <Format File:> .
<File Name:>	Choicelist	Available for <Write Logfile: Yes> . The name of the file to which the data should be written. A logfile is stored in the \DATA directory of the active memory device. The data is always appended to the file. Opening the choicelist accesses XX Logfiles where a name for a new logfile can be created and an existing logfile can be selected or deleted.
<Format File:>	Choicelist	Available for <Write Logfile: Yes> . A format file defines which and how data is written to a logfile. Format files are created using LGO. A format file must first be transferred from the CompactFlash card to the System RAM before it can be selected. Refer to "24 Tools...\Transfer Objects..." for information on how to transfer a format file.

Field	Option	Description
		Opening the choicelist accesses XX Format Files where an existing format file can be selected or deleted.

Next step

PAGE (F6) changes to the first page on this screen.



<Azimuth:> is used throughout this chapter. This should always be considered to also mean **<Bearing:>**.

37.4

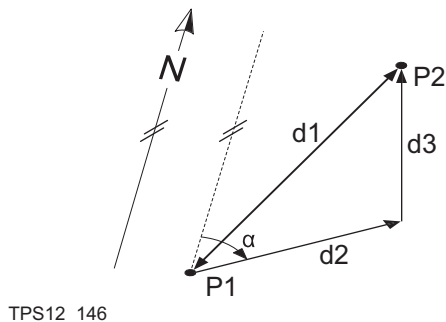
37.4.1

COGO Calculation - Inverse Method

Overview

Description

It is possible to compute an inverse result between point, line and arc elements:



Option 1: inverse between point - point

To compute an inverse between two known points.

Known elements:

P1 First known point (From)

P2 Second known point (To)

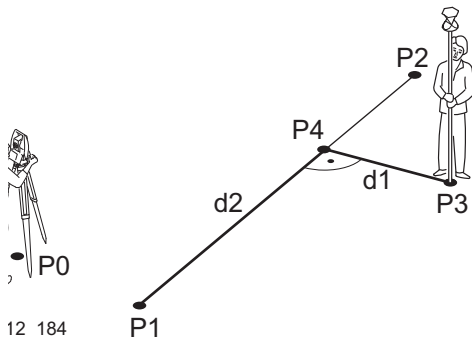
Unknown elements:

α Direction from P1 to P2

d1 Slope distance between P1 and P2

d2 Horizontal distance between P1 and P2

d3 Height difference between P1 and P2



Option 2: inverse between point - line

To compute an inverse between a known point and a given line (the inverse is computed as the perpendicular between the known point and the given line).

Known elements:

P0 Instrument station

P1 Starting point

P2 End point or the direction from P1 to P2

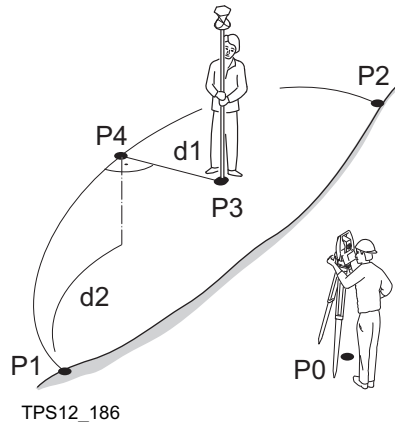
P3 Offset point

Unknown elements:

P4 Base point

d1 The perpendicular offset to the base point

d2 The distance along the line



Option 3: inverse between point - arc

To compute an inverse between a known point and a given arc (the inverse is computed as the perpendicular between the known point and the given arc).

Known elements:

P0 Instrument station

P1 Starting point

P2 End point

P3 Offset point

P4 Second point or arc radius or arc/chord length

Unknown elements:

P4 Base point

d1 The perpendicular offset to the base point

d2 The distance along the arc

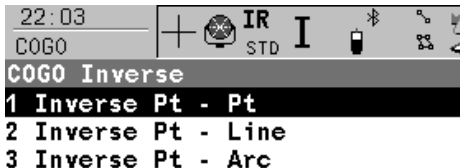
The coordinates of the points must be known. The points:

- may be taken from the active job.
- may be measured during the COGO calculation.
- may be entered manually.

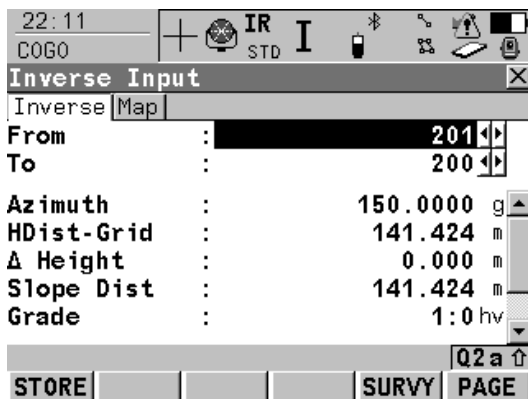
37.4.2

Inverse Between Two Known Points (Pt - Pt)

Starting step-by-step

Step	Description
1.	 11:39 COGO COGO Menu 1 Inverse
2.	 22:03 COGO COGO Inverse 1 Inverse Pt - Pt 2 Inverse Pt - Line 3 Inverse Pt - Arc

Calculating



22:11
COGO
Inverse Input
Inverse Map
From : 201
To : 200
Azimuth : 150.0000 g
HDist-Grid : 141.424 m
Δ Height : 0.000 m
Slope Dist : 141.424 m
Grade : 1:0 hv
STORE SURVY PAGE

STORE (F1)

To store the result.

SURVY (F5)

To measure a known point for the calculation.

SHIFT CONF (F2)

To configure the program.

PAGE (F6)

To change to another page on the screen.

Description of fields

Field	Option	Description
<From:> or <To:>	Choicelist	The point ID of the two known points. To type in coordinates for a known point open the choicelist. Press NEW (F2) to create a new point.
<Azimuth:>	Output	The direction from the first point to the second point.
<HDist-XX:>	Output	The horizontal distance between the two points.
< Δ Height:>	Output	The height difference between the two points.
<Slope Dist:>	Output	The slope distance between the two points.
<Grade:>	Output	The grade between the two points.
< Δ Easting:>	Output	The difference in Easting between the two points.
< Δ Northing:>	Output	The difference in Northing between the two points.

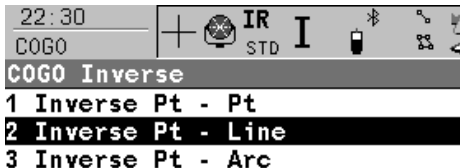
Storing the results step-by-step

Step	Description
1.	Press STORE (F1) to store the inverse result to the active job. There are no points stored to the database, only the inverse result.
2.	Inverse results can be exported from the job using a format file. The format file is created with Format Manager in LEICA Geo Office.

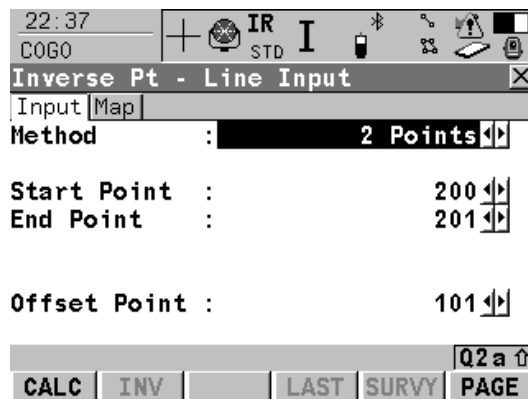
37.4.3

Inverse Between a Known Point and a Line (Pt - Line)

Starting step-by-step

Step	Description
1.	
2.	

Calculating



22:37
COGO

IR STD I

Inverse Pt - Line Input

Input Map

Method : **2 Points**

Start Point : 200

End Point : 201

Offset Point : 101

CALC INV LAST SURVY PAGE

CALC (F1)

To calculate the result.

INV (F2)

To calculate the inverse between two points.

LAST (F4)

To select the values for distance and offset from previous COGO inverse calculations.

SURVY (F5)

To measure a known point for the calculation.

SHIFT CONF (F2)

To configure the program.

SHIFT MODIF (F4)

To modify the original azimuth, distance or offset value.

PAGE (F6)

To change to another page on the screen.

Description of fields

Field	Option	Description
<Method:>		2 Points or Pt/Brg/Dist . The method for calculating the inverse result.
<Start Point:>	Choicelist	The point ID defining the start of the line.
<End Point:>	Choicelist	The point ID defining the end of the line.
<Azimuth:>	Output	The direction from the first point to the second point.
<HDist-XX:>	Output	The horizontal distance between the two points.
<Offset Point:>	Choicelist	The point ID defining an offset to the line.

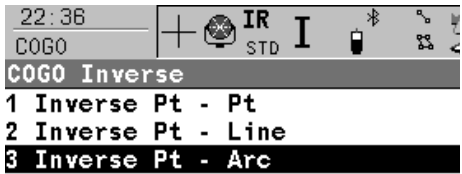
**Storing the results
step-by-step**

Step	Description
1.	Press CALC (F1) to calculate the inverse result and move to the results screen.
2.	Press STORE (F1) to store the inverse result to the active job. There are no points stored to the database, only the inverse result.
3.	Inverse results can be exported from the job using a format file. The format file is created with Format Manager in LEICA Geo Office.

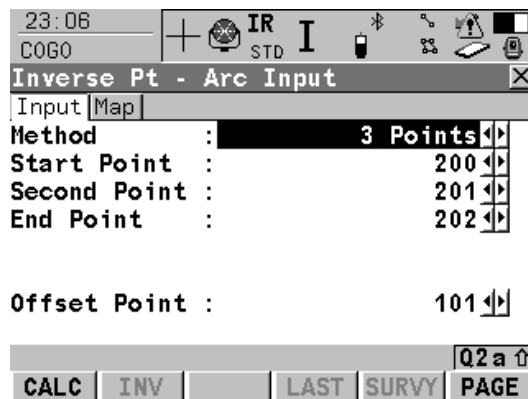
37.4.4

Inverse Between a Known Point and an Arc (Pt - Arc)

Starting step-by-step

Step	Description
1.	
2.	

Calculating



23:06
COGO

IR STD I

Inverse Pt - Arc Input

Input Map

Method : 3 Points

Start Point : 200

Second Point : 201

End Point : 202

Offset Point : 101

CALC INV LAST SURVY PAGE

CALC (F1)

To calculate the result.

INV (F2)

To calculate the inverse between two points.

LAST (F4)

To select the values for distance and offset from previous COGO Inverse calculations.

SURVY (F5)

To measure a known point for the calculation.

SHIFT CONF (F2)

To configure the program.

SHIFT MODIF (F4)

To modify the original azimuth, distance or offset value.

PAGE (F6)

To change to another page on the screen.

Description of fields

Field	Option	Description
<Method:>		3 Points or 2 Points/Radius or 2 Tgnts/Radius or 2 Tgnts/Arc Lngt or 2 Tgnts/Chrd Lngt . The method for calculating the inverse result.
<Start Point:>	Choicelist	The point ID defining the start of the arc.
<Second Point:>	Choicelist	The point ID defining a second point on the arc.
<End Point:>	Choicelist	The point ID defining the end of the arc.
<Arc Length:>	User Input	The arc length.
<Azimuth:>	Output	The direction from the first point to the second point.
<Chord length:>	User Input	The chord length of the arc.
<HDist-XX:>	Output	The horizontal distance between the two points.
<Offset Point:>	Choicelist	The point ID defining an offset to the arc.
<PI Point:>	Choicelist	The point ID defining the intersection of the tangents.
<Point 1:>	Choicelist	The point ID (with PI Point) defining the 1st tangent.
<Point 2:>	Choicelist	The point ID (with PI Point) defining the 2nd tangent.
<Radius:>	User Input	The radius of the arc.

Storing the results step-by-step

Step	Description
1.	Press CALC (F1) to calculate the inverse result and move to the results screen.
2.	Press STORE (F1) to store the inverse result to the active job. There are no points stored to the database, only the inverse result.
3.	Inverse results can be exported from the job using a format file. The format file is created with Format Manager in LEICA Geo Office.

37.5

37.5.1

Description

COGO Calculation - Traverse Method

Overview

Elements that must be known are

- the coordinates of one point.
- the direction from the known point to the COGO point.
- the distance from the known point to the COGO point.
- offsets, if required and configured.

The coordinates of the known point

- may be taken from the active job.
- may be measured during the COGO calculation.
- may be entered.

The direction from the known point to the COGO point can be an azimuth or an angle.

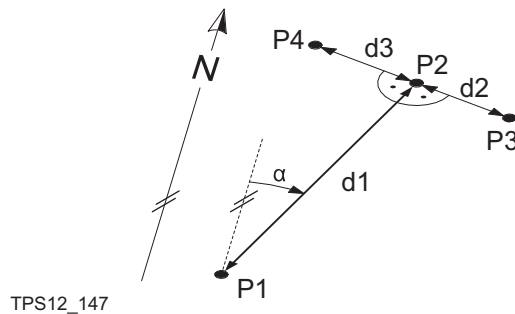
Points with full coordinate triplets and position only points can be used. Position only is calculated, height can be typed in.

A COGO traverse calculation can be calculated for

- a single point.
 - multiple points. Several single points are calculated in one sequence.
 - sideshots.
-

Diagram

COGO traverse calculation with offset for a single point



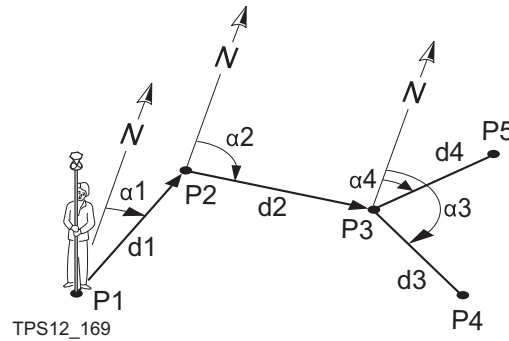
Known

- P1 Known point
- α Direction from P1 to P2
- d_1 Distance between P1 and P2
- d_2 Positive offset to the right
- d_3 Negative offset to the left

Unknown

- P2 COGO point without offset
- P3 COGO point with positive offset
- P4 COGO point with negative offset

COGO traverse calculation without offset for multiple points



Known

- P1 Known point
- α_1 Direction from P1 to P2
- α_2 Direction from P2 to P3
- α_3 Direction from P3 to P4
- α_4 Direction from P3 to P5
- d1 Distance between P1 and P2
- d2 Distance between P2 and P3
- d3 Distance between P3 and P4
- d4 Distance between P3 and P5

Unknown

- P2 First COGO point
- P3 Second COGO point
- P4 Third COGO point - sideshot
- P5 Fourth COGO point

37.5.2

COGO traverse calculation with azimuth/bearing step-by-step

Traverse with Azimuth/Bearing

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to "37.2 Accessing COGO" to access COGO Traverse Input .	
	COGO Traverse Input, Input page SHIFT CONF (F2) to configure the COGO application program.	37.3
2.	COGO Traverse Input, Input page <Method: Azimuth> <From:> The point ID of the known point for the COGO calculation. Select a point to be used.	
	SURVY (F5) when <From:> is highlighted. To measure a known point for the COGO calculation.	48.2
	For all point fields, the MapView interactive display on the Map page can be used to select the desired point.	35.5
	To type in coordinates for a known point open the choicelist when <From:> is highlighted. Press NEW (F2) to create a new point.	6.3.2
3.	COGO Traverse Input, Input page <Azimuth:> The direction from the known point to the COGO point. <HDist-XX:> The horizontal distance between the known point and the COGO point.	

Step	Description	Refer to chapter
	<Offset:> Available for <Use Offsets: Yes> in COGO Configuration, Parameters page. The offset of the COGO point from the line of direction. A positive offset is to the right, a negative offset is to the left. Type in the azimuth, the distance and the offset, if required.	
	The values for the azimuth, the distance and the offset can be calculated from two existing points. INV (F2) when <Azimuth:>, <HDist-XX:> or <Offset:> is highlighted. To perform a COGO inverse calculation.  Upon pressing STORE (F1) in COGO Inverse, the result from the COGO inverse calculation is copied to the field which was highlighted when INV (F2) was pressed.  For <Write Logfile: Yes> in COGO Configuration, Logfile page the result of the COGO inverse calculation is written to the logfile.	37.4
	The values for the azimuth, the distance and the offset can be selected from previous COGO inverse calculations. LAST (F4) when <Azimuth:>, <HDist-XX:> or <Offset:> is highlighted. To recall previous results from COGO inverse calculations. Upon pressing CONT (F1) in COGO Last Inverse Calculations, the selected result is copied to the field which was highlighted when LAST (F4) was pressed.	37.12

Step	Description	Refer to chapter
	The values for the azimuth, the distance and the offset can be mathematically modified. SHIFT MODIF (F4) when <Azimuth:>, <HDist-XX:> or <Offset:> is highlighted. To add, subtract, multiply and divide values.	37.13
4.	Is the COGO point a foresight? • If yes, CALC (F1). The result is calculated and displayed in COGO Traverse Results. After storing the result and returning to COGO Traverse Input, Input page, the point displayed in <From:> is the newly calculated COGO point. The next COGO calculation can be continued from this new point. • If no, SSHOT (F3). The result is calculated and displayed in COGO Traverse Results. After storing the result and returning to COGO Traverse Input, Input page, the point originally selected in <From:> is still displayed. The next COGO calculation can be continued from that same point.	
5.	COGO Traverse Results, Result page <Point ID:> The identifier for the COGO point depending on the point ID template configured for <Survey Pts:> in CONFIGURE ID Templates. The point ID can be changed.	16.1

Step	Description	Refer to chapter
	<Ortho Ht:> or <Local Ell Ht:> are input fields. They display ----- when entering the Result page. A height value to be stored with the calculated point can be typed in. The calculated coordinates are displayed. Type in a point ID.	
	COORD (F2) views other coordinate types unless <Coord System: None> .	
	STAKE (F5) to access the Stakeout application program and stake out the calculated COGO point. After staking and storing the COGO point, COGO Traverse Results, Result page is displayed.	47.4
	SHIFT ELL H (F2) and SHIFT ORTH (F2) . Available unless <Coord System: None> . Changes between the ellipsoidal and the orthometric height.	
	SHIFT INDIV (F5) for an individual point ID independent of the ID template. SHIFT RUN (F5) changes back to the next ID from the configured ID template.	16.1
6.	PAGE (F6) changes to the Code page.	
7.	COGO Traverse Results, Code page <Code:>/<Point Code:> The thematical code. All codes of the job can be selected. Type in a code if required.	8 and 6.3.2

Step	Description	Refer to chapter
8.	PAGE (F6) changes to the Plot page.	
9.	COGO Traverse Results, Plot page An arrow points from the known point to the calculated COGO point.	35.6
	SHIFT QUIT (F6) does not store the COGO point and exits COGO calculations.	
10.	STORE (F1) to store the result and return to COGO Traverse Input, Input page.	
	For <Write Logfile: Yes> in COGO Configuration, Logfile page the result is written to the logfile.	
11.	Are more COGO traverse calculations to be made? • If yes, repeat steps 2. to 11. • If no, continue with step 12.	
12.	SHIFT QUIT (F6) to exit COGO calculation.	

37.5.3

Traverse with Angle Right

Access

Refer to "37.2 Accessing COGO" to access **COGO Traverse Input**.

COGO

Traverse Input, Input page

12:00
COGO

Traverse Input

Input Map

Method : Angle Right

From : 0002

Backsight : 0001

Angle Right : 230.8432 g

Azimuth : 80.8432 g

HDist-Grid : 54.630 m

Offset : 0.000 m

CALC INV SSHOT LAST SURVY PAGE

CALC (F1)

To calculate the COGO point.

INV (F2)

To calculate the values for the distance and the offset from two existing points. Available if **<HDist-XX:>** or **<Offset:>** is highlighted.

SSHOT (F3)

To calculate the point as a sideshot.

LAST (F4)

To select the values for the distance and the offset from previous COGO inverse calculations. Available if **<HDist-XX:>** or **<Offset:>** is highlighted.

SURVY (F5)

To measure a point for the COGO calculation. Available if **<From:>** or **<Backsight:>** is highlighted.

SHIFT CONF (F2)

To configure the COGO application program.

SHIFT MODIF (F4)

To mathematically modify the values for the angle right, the distance and the offset. Available if **<Angle Right:>**, **<HDist-XX:>** or **<Offset:>** is highlighted.

Description of fields

Field	Option	Description
<Method:>	Angle Right	The direction from the known point to the COGO point is an angle.
<From:>	Choicelist	The point ID of the known point for the COGO calculation.
<Backsight:>	Choicelist	The point ID of a point used as backsight.
<Angle Right:>	User input	The angle between <Backsight:> and the new COGO point to be calculated from the point selected as <From:>. A positive value is for clockwise angles. A negative value is for counterclockwise angles.
<Azimuth:>	Output	The direction from the known point to the COGO point calculated from <Angle Right:>.
<HDist-XX:>	User input	The horizontal distance between the known point and the COGO point.
<Offset:>	User input	The offset of the COGO point from the line of direction. A positive offset is to the right, a negative offset is to the left.

Next step

The work flow is very similar to a COGO traverse calculation with azimuth/bearing. Refer to "37.5.2 Traverse with Azimuth/Bearing".

37.6

37.6.1

Description

COGO Calculation - Intersections Method

Intersection with Bearing - Bearing

The COGO intersection calculation bearing - bearing calculates the intersection point of two lines. A line is defined by a point and a direction.

Elements that must be known are

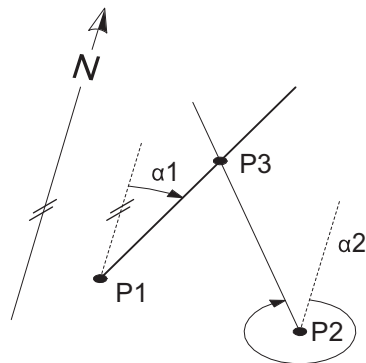
- the coordinates of two points.
- the direction from these known points to the COGO point.
- offsets if required and configured.

The coordinates of the known points

- may be taken from the active job.
- may be measured during the COGO calculation.
- may be entered.

Points with full coordinate triplets and position only points can be used. Position only is calculated, height can be typed in.

Diagram



TPS12_148

Known

- P1 First known point
- P2 Second known point
- $\alpha1$ Direction from P1 to P3
- $\alpha2$ Direction from P2 to P3

Unknown

- P3 COGO point

COGO intersection calculation with bearing - bearing step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to "37.2 Accessing COGO" to access COGO Intersection Input .	
	COGO Intersection Input, Input page SHIFT CONF (F2) to configure the COGO application program.	37.3
2.	COGO Intersection Input, Input page <Method: Brng - Brng> <1st Point:> The point ID of the first known point for the COGO calculation.	

Step	Description	Refer to chapter
	Select the point stored in the job.	
	SURVY (F5) when <1st Point:> is highlighted. To measure a point for the COGO calculation.	48.2
	For all point fields, the MapView interactive display on the Map page can be used to select the desired point.	35.5
	To type in coordinates for a known point open the choicelist when <1st Point:> is highlighted. Press NEW (F2) to create a new point.	6.3.2
3.	COGO Intersection Input, Input page <Azimuth:> The direction from the first known point to the COGO point. <Offset:> Available for <Use Offsets: Yes> in COGO Configuration, Parameters page. The offset of the COGO point from the line of direction. A positive offset is to the right, a negative offset is to the left. Type in the azimuth and the offset, if required.	
	The values for the azimuth and the offset can be calculated from two existing points. INV (F2) when <Azimuth:> or <Offset:> is highlighted. To perform a COGO inverse calculation.  Upon pressing STORE (F1) in COGO Inverse, the result from the COGO inverse calculation is copied to the field which was highlighted when INV (F2) was pressed.	37.4

Step	Description	Refer to chapter
	 For <Write Logfile: Yes> in COGO Configuration, Logfile page the result of the COGO inverse calculation is written to the logfile.	
	The values for the azimuth and the offset can be selected from previous COGO inverse calculations. LAST (F4) when <Azimuth:> or <Offset:> is highlighted. To recall previous results from COGO inverse calculations. Upon pressing CONT (F1) in COGO Last Inverse Calculations, the selected result is copied to the field which was highlighted when LAST (F4) was pressed.	37.12
	The values for the azimuth and the offset can be mathematically modified. SHIFT MODIF (F4) when <Azimuth:> or <Offset:> is highlighted. To add, subtract, multiply and divide values.	37.13
4.	COGO Intersection Input, Input page The procedure to input the second known point and the azimuth is identical to the procedure for the first known point. Repeat steps 2. and 3.	
5.	CALC (F1) to calculate the result.	
6.	COGO Brng - Brng Results, Result page	

Step	Description	Refer to chapter
	<Point ID:> The identifier for the COGO point depending on the point ID template configured for <Survey Pts:> in CONFIGURE ID Templates. The point ID can be changed. <Ortho Ht:> or <Local Ell Ht:> are input fields. They display ----- when entering the Result page. A height value to be stored with the calculated point can be typed in. The calculated coordinates are displayed. Type in a point ID.	16.1
	COORD (F2) views other coordinate types unless <Coord System: None> .	
	STAKE (F5) to access the Stakeout application program and stake out the calculated COGO point. After staking and storing the COGO point COGO Brng - Brng Results, Result page is displayed.	47.4
	SHIFT ELL H (F2) and SHIFT ORTH (F2) . Available unless <Coord System: None> . Changes between the ellipsoidal and the orthometric height.	
	SHIFT INDIV (F5) for an individual point ID independent of the ID template. SHIFT RUN (F5) changes back to the next ID from the configured ID template.	16.1
7.	PAGE (F6) changes to the Code page.	
8.	COGO Brng - Brng Results, Code page	8 and 6.3.2

Step	Description	Refer to chapter
	<Code:>/<Point Code:> The thematical code. All codes of the job can be selected. Type in a code if required.	
9.	PAGE (F6) changes to the Plot page.	
10.	COGO Brng - Brng Results, Plot page Arrows point from the known points to the calculated COGO point.	35.6
	SHIFT QUIT (F6) does not store the COGO point and exits COGO calculation.	
11.	STORE (F1) to store the result and return to COGO Intersection Input, Input page.	
	For <Write Logfile: Yes> in COGO Configuration, Logfile page the result is written to the logfile.	
12.	Are more COGO intersection calculations to be made? - If yes, repeat steps 2. to 12. <Method:> in COGO Intersection Input, Input page can be changed. Refer to the relevant chapters for the other COGO intersection calculation methods. - If no, continue with step 13.	37.6.2, 37.6.3 or 37.6.4.
13.	SHIFT QUIT (F6) to exit COGO calculation.	

37.6.2

Intersection with Bearing - Distance

Description

The COGO intersection calculation bearing - distance calculates the intersection point of a line and a circle. The line is defined by a point and a direction. The circle is defined by the centre point and the radius.

Elements that must be known are

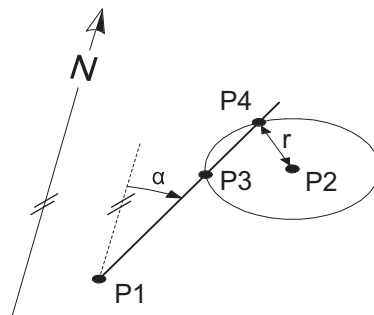
- the coordinates of two points.
- the direction from one known point to the COGO point.
- the distance from the second known point to the COGO point.
- offsets if required and configured.

The coordinates of the known points

- may be taken from the active job.
- may be measured during the COGO calculation.
- may be entered.

Points with full coordinate triplets and position only points can be used.

Diagram



TPS12_149

Known

- P1 First known point
- P2 Second known point
- α Direction from P1 to P3 and P4
- r Radius, as defined by the distance from P2 to P4 and P3

Unknown

- P3 First COGO point
- P4 Second COGO point

COGO intersection calculation with bearing - distance step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	The procedure of a COGO intersection calculation with bearing - distance is similar to a COGO intersection calculation with bearing - bearing. Follow the steps 1. to 5. in paragraph "COGO intersection calculation with bearing - bearing step-by-step". The differences are: • <Method: Brng - Dist> is to be selected in COGO Intersection Input, Input page. • For the second known point <HDist-XX:> is used instead of <Azimuth:>. The keys and advice mentioned are still valid.	37.6.1

Step	Description	Refer to chapter
2.	CALC (F1) to calculate the COGO points.	
	Two results are calculated.	
3.	COGO Brng - Dist Results, Result1 page <Point ID:> The identifier for the first result of the COGO point depending on the point ID template configured for <Survey Pts:> in CONFIGURE ID Templates. The point ID can be changed. <Ortho Ht:> or <Local Ell Ht:> are input fields. They display ----- when entering the Result1 page. A height value to be stored with the calculated point can be typed in. The calculated coordinates are displayed. Type in a point ID.	16.1
	COORD (F2) views other coordinate types unless <Coord System: None> .	
	STAKE (F5) to access the Stakeout application program and stake out the calculated COGO point. After staking and storing the COGO point COGO Brng - Brng Results, Result1 page is displayed.	47.4
	SHIFT ELL H (F2) and SHIFT ORTH (F2) . Available unless <Coord System: None> . Changes between the ellipsoidal and the orthometric height.	

Step	Description	Refer to chapter
	SHIFT INDIV (F5) for an individual point ID independent of the ID template. SHIFT RUN (F5) changes back to the next ID from the configured ID template.	16.1
	PAGE (F6) changes to the Code page where a code and attributes can be selected.	8
	Pressing PAGE (F6) twice changes to the Plot page. Both COGO points and known points are displayed.	35.6
	SHIFT QUIT (F6) does not store the COGO points and exits COGO calculations.	
	RSLT1 (F3) or RSLT2 (F3) to view the first and second result.	
4.	COGO Brng - Dist Results, Result1 page Is the first result to be stored? - If yes, STORE (F1) to store the result and activate the Result2 page. For <Write Logfile: Yes> in COGO Configuration, Logfile page the result is written to the logfile. - If no, RSLT2 (F3) to activate the Result2 page.	
5.	COGO Brng - Dist Results, Result2 page Repeat step 3.	
6.	COGO Brng - Dist Results, Result2 page Is the second result to be stored?	

Step	Description	Refer to chapter
	- If yes, STORE (F1) to store the result and return to COGO Intersection Input, Input page. For <Write Logfile: Yes> in COGO Configuration, Logfile page the result is written to the logfile. - If no, ESC does not store the COGO point and returns to COGO Intersection Input, Input page.	
7.	Are more COGO intersection calculations to be done? - If yes, repeat steps 1. to 7. <Method:> in COGO Intersection Input, Input page can be changed. Refer to the relevant chapters for other COGO intersection calculation method than <Method: Brng - Dist>. - If no, continue with step 8.	37.6.1, 37.6.3 or 37.6.4
8.	SHIFT QUIT (F6) exit COGO calculation.	

37.6.3

Intersection with Distance - Distance

Description

The COGO intersection calculation distance - distance calculates the intersection point of two circles. The circles are defined by the known point as the centre point and the distance from the known point to the COGO point as the radius.

Elements that must be known are

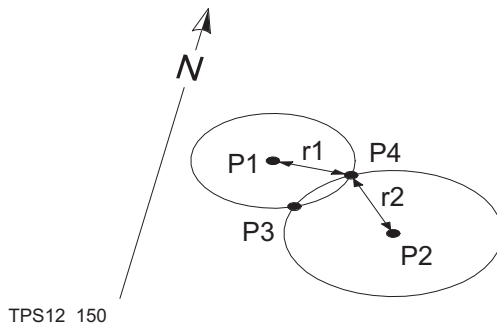
- the coordinates of two points.
- the distance from the known points to the COGO point.

The coordinates of the known points

- may be taken from the active job.
- may be manually occupied during the COGO calculation.
- may be entered.

Points with full coordinate triplets and position only points can be used.

Diagram



Known

P1 First known point

P2 Second known point

r1 Radius, as defined by the distance from P1 to P3 or P4

r2 Radius, as defined by the distance from P2 to P3 or P4

Unknown

P3 First COGO point

P4 Second COGO point

COGO intersection calculation with distance - distance step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	The procedure for a COGO intersection calculation with distance - distance is very similar to a COGO intersection calculation with bearing - bearing. Follow the steps 1. to 5. in paragraph "COGO intersection calculation with bearing - bearing step-by-step". The differences are: • <Method: Dist - Dist> is to be selected in COGO Intersection Input, Input page. • For both known points <HDist-XX:> is used instead of <Azimuth:>. The keys mentioned are still valid. • <Offset:> is unavailable.	37.6.1

Step	Description	Refer to chapter
2.	The remaining procedure is identical to a COGO intersection calculation with bearing - distance. The screen is called COGO Dist - Dist Results. Follow the steps 2. to 8. in paragraph "COGO intersection calculation with bearing - distance step-by-step".	37.6.2

Description

The COGO intersection calculation by points calculates the intersection point of two lines. A line is defined by two points.

Elements that must be known are

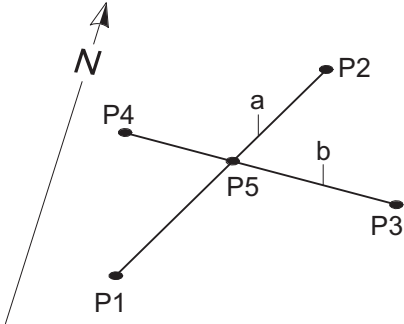
- the coordinates of four points.
- offsets of the lines if required and configured.

The coordinates of the known points

- may be taken from the active job.
- may be measured during the COGO calculation.
- may be entered.

Points with full coordinate triplets and position only points can be used.

Diagram



- Known**
- P1 First known point
 - P2 Second known point
 - P3 Third known point
 - P4 Fourth known point
 - a Line from P1 to P2
 - b Line from P3 to P4
- Unknown**
- P5 COGO point

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COGO intersection calculation with by points step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to "37.2 Accessing COGO" to access COGO Intersection Input .	
	COGO Intersection Input, Input page SHIFT CONF (F2) to configure the COGO application program.	37.3.
2.	COGO Intersection Input, Input page <Method: By Points> <1st Point:> The point ID of the known start point of the first line for the COGO calculation.	

Step	Description	Refer to chapter
	<2nd Point:> The point ID of the known end point of the first line for the COGO calculation. Select the points stored in the job.	
	SURVY (F5) when <1st Point:> or <2nd Point:> is highlighted. To measure a known point for the COGO calculation.	48.2
	For all point fields, the MapView interactive display on the Map page can be used to select the desired point.	35.5
	To type in coordinates for a known point open the choicelist when <1st Point:> or <2nd Point:> is highlighted. Press NEW (F2) to create a new point.	6.3.2
3.	COGO Intersection Input, Input page <Offset:> Available for <Use Offsets: Yes> in COGO Configuration, Parameters page. The offset of the line in the direction <1st Point:> to <2nd Point:>. A positive offset is to the right, a negative offset is to the left. Type in the offset if required.	
	The value for the offset can be calculated from two existing points. INV (F2) when <Offset:> is highlighted. To perform a COGO inverse calculation.  Upon pressing STORE (F1) in COGO Inverse, the result from the COGO inverse calculation is copied to the field which was highlighted when INV (F2) was pressed.	37.4

Step	Description	Refer to chapter
	 For <Write Logfile: Yes> in COGO Configuration, Logfile page the result of the COGO inverse calculation is written to the logfile.	
	The value for the offset can be selected from previous COGO inverse calculations. LAST (F4) when <Offset:> is highlighted. To recall previous results from COGO inverse calculations. Upon pressing CONT (F1) in COGO Last Inverse Calculations, the selected result is copied to the field.	37.12
	The value for the offset can be mathematically modified. SHIFT MODIF (F4) when <Offset:> is highlighted. To add, subtract, multiply and divide values.	37.13
4.	COGO Intersection Input, Input page The procedure for the third and fourth known point and the offset is identical to the procedure for the first and second known point. Repeat steps 2. and 3.	
5.	The remaining procedure is identical to a COGO intersection calculation with bearing - bearing. The screen is called COGO By Points Results. On the Plot page two solid lines are displayed. Follow the steps 5. to 13. in paragraph "COGO intersection calculation with bearing - bearing step-by-step".	37.6.1

37.6.5

Intersection with TPS Observation - TPS Observation

Description

The COGO intersection calculation TPS observation - TPS observation calculates the intersection point of two lines. A line is defined by a TPS station and a TPS measurement from this station.

Elements that must be known are

- the coordinates of two points.
- azimuths of the lines.

The coordinates of the known points

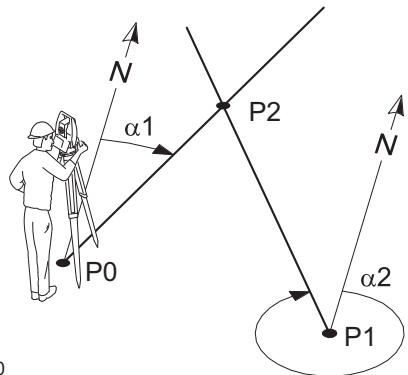
- must be taken from the active job.
- must be TPS station points.

The azimuths of the lines

- must be TPS measurements angle measurements from the known points.
- can be two angle measurements or an angle measurement and a distance measurement.

Points with full coordinate triplets and position only points can be used.

Diagram



GPS12_170

Known
P0 First known point (TPS station)
P1 Second known point (TPS station)
 α_1 Direction from P0 to P2
 α_2 Direction from P1 to P2
Unknown
P2 COGO point

COGO intersection
calculation with TPS
Obs - TPS Obs step-by-
step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to "37.2 Accessing COGO" to access COGO Intersection Input .	
	COGO Intersection Input, Input page SHIFT CONF (F2) to configure the COGO application program.	37.3
2.	COGO Intersection Input, Input page <Method: TPS Obs-TPS Obs> <1st TPS Stn:> The point ID of the first TPS station which is the known start point of the first line for the COGO calculation.	

Step	Description	Refer to chapter
	<TPS Measmnt:> The point ID of the TPS measurement which is the known end point of the first line for the COGO calculation. <Azimuth:> The azimuth related to the known end point of the first line for the COGO calculation. <2nd TPS Stn:> The point ID of the second TPS station which is the known start point of the second line for the COGO calculation. <TPS Measmnt:> The point ID of the TPS measurement which is the known end point of the second line for the COGO calculation. <Azimuth:> The azimuth related to the known end point of the second line for the COGO calculation. Points can only be selected from the active job. Points for the <2nd TPS Stn:> and the <TPS Measmnt:> from that station can also be directly measured when using this method.	
	The value for the azimuth can be calculated from two existing points. INV (F2) when <Azimuth:> is highlighted. To perform a COGO inverse calculation.  Upon pressing STORE (F1) in COGO Inverse, the result from the COGO inverse calculation is copied to the field which was highlighted when INV (F2) was pressed.  For <Write Logfile: Yes> in COGO Configuration, Logfile page the result of the COGO inverse calculation is written to the logfile.	37.4

Step	Description	Refer to chapter
	The value for the azimuth can be selected from previous COGO inverse calculations. LAST (F4) when <Azimuth:> is highlighted. To recall previous results from COGO inverse calculations. Upon pressing CONT (F1) in COGO Last Inverse Calculations, the selected result is copied to the field.	37.12

37.7

37.7.1

Description

COGO Calculation - Line Calculations Method

Line Calculation - Base Point

The COGO line calculation base point calculates the base point, station and offset of a point in relation to a line.

Elements that must be known are

- coordinates of two points and an offset point.

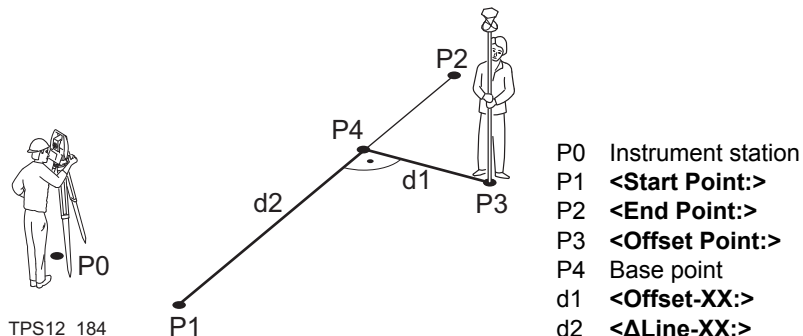
OR

- coordinates of one point and an offset point
- bearing and distance from one point

The coordinates of the known points

- may be taken from the active job.
- may be measured during the COGO calculation.
- may be entered.

Diagram



Line management is not available for COGO line calculations.

Access

Refer to "37.2 Accessing COGO" to access **COGO Line Calculations Input**.

COGO

Line Calculations Input, Input page

12:24		IR		STD		I		Bluetooth		GPS		Battery	
COGO													
Line Calculations Input													
Input Map													
Task	:	Calc Base Point											
Method	:	Pt/Brg/Dist											
Start Point	:	0001											
Azimuth	:	25.0000 g											
HDist-Grid	:	2.500 m											
Offset Point	:	0002											
													Q2 a ↑
CALC	INV			LAST	SURVY	PAGE							

CALC (F1)

To calculate COGO point.

INV (F2)

To calculate the values for the distance and the offset from two existing points. Available if <Azimuth:> or <HDist-XX:> is highlighted.

LAST (F4)

To select the values for the distance and the offset from previous COGO inverse calculations. Available if <Azimuth:> or <HDist-XX:> is highlighted.

SURVY (F5)

To measure a point for the COGO calculation.
Available if **<Start Point:>** or **<End Point:>** is highlighted.

SHIFT CONF (F2)

To configure the COGO application program.

SHIFT MODIF (F4)

To mathematically modify the values. Available if **<Azimuth:>**, **< Δ Line-XX:>** or **<HDist-XX:>** is highlighted.

Description of fields

Field	Option	Description
<Task:>	Calc Base Point	Calculates the base point, the station and offset of a point in relation to a line.
	Calc Offset Point	Calculates the coordinates of a new point after input of station and offset values in relation to a line.
	Segmentation	Calculates the coordinates of new points on a line either equally spaced or with defined segments.
<Method:>	2 Points	The method by which the line will be defined. Uses two known points to define the line.
	Pt/Brg/Dist	Defines the line using a known point, a distance and an azimuth of the line.
<Start Point:>	Choicelist	The start point of the line. All points from COGO Data: Job Name can be selected.

Field	Option	Description
<End Point:>	Choicelist	Available for <Method: 2 Points>. The end point of the line. All points from COGO Data: Job Name can be selected.
<Azimuth:>	User input	Available for <Method: Pt/Brg/Dist>. The azimuth of the line.
<HDist-XX:>	User input	Available for <Method: Pt/Brg/Dist>. The horizontal distance from the start point to the end point of the line.
<ΔLine-XX:>	User input	Available for <Task: Calc Offset Point>. Horizontal distance from start point to base point.
<Offset Point:>	Choicelist	Available for <Task: Calc Offset Point>. The offset point.
<Offset-XX:>	User input	Available for <Task: Calc Offset Point>. Offset from base point to offset point. Positive to the right and negative to the left of the line.

Next step

PAGE (F6) accesses **Map** page. Refer to paragraph "COGO Line Calculations Input, Map page".

COGO Line Calculations Input, Map page

The **Map** page provides an interactive display of the data. Refer to "35 MapView Interactive Display Feature" for information on the functionality and softkeys available.

Next step

IF	THEN
<Task: Calc Base Point>	CALC (F1) accesses COGO Base Point Results . Refer to paragraph "COGO XX Point Results, Result page".
<Task: Calc Offset Point>	CALC (F1) accesses COGO Offset Point Results . Refer to paragraph "COGO XX Point Results, Result page".
<Task: Segmentation>	CALC (F1) accesses COGO Define Segmentation . Refer to paragraph "37.7.3 Line Calculation - Segmentation".

COGO XX Point Results, Result page

The result screens for base point and offset point are very similar. The explanations given for the softkeys below are valid for the **Result** page.

12:07
COGO

Base Point Results

Result Code Plot

Point ID : 0003

Easting : 122.760 m

Northing : 215.253 m

Height : 100.000 m

Offset Point : 0002

ΔLine-Grid : 117.479 m

ΔOffset-Grid : 78.732 m

Q2 a ↑

STORE STAKE PAGE

STORE (F1)

To store result and to return to **COGO Line Calculations Input**.

STAKE (F5)

To access the Stakeout application program and stake out the calculated COGO point.

PAGE (F6)

To change to another page on this screen.

SHIFT ELL H (F2) and SHIFT ORTH (F2)

To change between the ellipsoidal and the orthometric height. Available unless **<Coord System: None>**.

SHIFT INDIV (F5) and SHIFT RUN (F5)

To change between entering an individual point ID different to the defined ID template and the running point ID according to the ID template. Refer to "16.1 ID Templates".

Description of fields

Field	Option	Description
<Point ID:>	User input	The identifier for the COGO point depending on the point ID template configured for <Survey Pts:> in CONFIGURE ID Templates .
<Ortho Ht:> or <Local Ell Ht:>	User input	A height value to be stored with the calculated point can be typed in.
<Offset Point:>	Output	Point ID of offset point. Available for <Task: Calc Base Point> .
<ΔLine-XX:>	Output	Horizontal distance from start point to base point. Available for <Task: Calc Base Point> .
<ΔOffset-XX:>	Output	Offset from base point to offset point. Positive to the right and negative to the left of the line. Available for <Task: Calc Base Point> .
<Line Length:>	Output	Length of line from start point to end point.

Field	Option	Description
<Line Brng:>	Output	Bearing of line from start point to end point.
<Offs Pt Brng:>	Output	Bearing of offset point from base point to offset point.

Next step

PAGE (F6) changes to the **Code** page.

COGO
XX Point Results,
Code page

The functionality of the **Code** page is similar to **COGO Traverse Result, Code** page.

Next step

PAGE (F6) changes to the **Plot** page.

COGO
XX Point Results,
Plot page

The functionality of the **Plot** page is similar to **COGO Traverse Results, Plot** page.

Next step

STORE (F1) stores the result and accesses **COGO Line Calculations Input, Input** page.

Description

The COGO line calculation offset point calculates the coordinates of a new point after input of station and offset values in relation to a line.

Elements that must be known are

- coordinates of two points.
- offsets.

OR

- coordinates of one point.
- bearing and distance from one point.
- offsets.

The coordinates of the known points

- may be taken from the active job.
- may be measured during the COGO calculation.
- may be entered.



**COGO line calculation
offset point step-by-
step**

Line management is not available for COGO line calculations.

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to "37.2 Accessing COGO" to access COGO Line Calculations Input .	

Step	Description	Refer to chapter
	COGO Line Calculations Input, Input page. SHIFT CONF (F2) to configure the COGO application program.	37.3
2.	COGO Line Calculations Input, Input page. <Task: Calc Offset Point>	37.7.1
3.	CALC (F1) calculates the results.	
4.	COGO Offset Point Results, Result page STORE (F1) stores the results.	37.7.1

Description

The COGO line calculation segmentation calculates the coordinates of new points on a line.

Elements that must be known are

- coordinates of the start and the end point of the line

OR

- a bearing and distance from a known point that define the line

AND EITHER

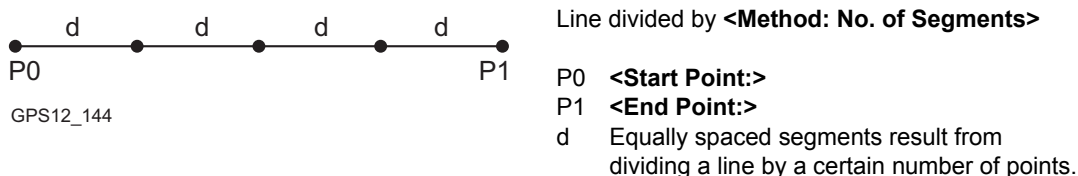
- the number of segments dividing the line

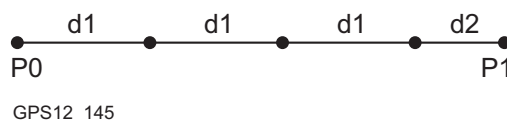
OR

- a segment length for the line.

The coordinates of the known points

- may be taken from the active job.
- may be measured during the COGO calculation.
- may be entered.

Diagram



Line divided by **<Method: Segment Length>**

P0 **<Start Point:>**

P1 **<End Point:>**

d1 **<Seg Length:>**

d2 Remaining segment

COGO line calculation segmentation step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to "37.2 Accessing COGO" to access COGO Line Calculation Input .	
	COGO Line Calculation Input, Input page SHIFT CONF (F2) to configure the COGO application program.	37.3
2.	COGO Line Calculations Input, Input page <Task: Segmentation>	37.7.1
3.	CALC (F1) to access COGO Define Segmentation .	
4.	COGO Define Segmentation <Method:> How the line is to be divided. Refer to paragraph "Diagram". Depending on the selection, the following fields are user input or output fields. <Line Length:> Calculated line length between the selected <Start Point:> and <End Point:> .	

Step	Description	Refer to chapter
	<No. of Segs:> For <Method: No. of Segments> type in the number of segments for the line. For <Method: Segment Length> type in the segment length for the line. A remaining segment may result from this method. <Seg Length:> For <Method: No. of Segments> this is the calculated length of each segment. For <Method: Segment Length> type in the required segment length. <Last Seg Lgth:> Available for <Method: Segment Length>. The length of the remaining segment. <Start PtlID:> The point ID to be assigned to the first new point on the line. The selected point ID templates from CONFIGURE ID Templates are not applied. <PtlID Inc:> <Start PtlID:> is incremented numerically for the second, third, etc. point on the line.	
5.	CALC (F1) to access COGO Segmentation Results .	
	The coordinates of the new points are calculated. The heights are computed along the line assuming a linear slope between <Start Point:> and <End Point:> .	
6.	COGO Segmentation Results, Result page <Number of Segments:> Describes the number of resulting segments for the line including the remaining segment, if it applies.	

Step	Description	Refer to chapter
	< Last Segment Lgth: > Available for < Method: Segment Length >. The length of the remaining segment.	
	STAKE (F5) to access the Stakeout application program and stake out the calculated COGO point. SHIFT QUIT (F6) or ESC return to COGO Segmentation Results, Result page.	
7.	PAGE (F1) to access COGO Segmentation Results, Plot page The known points defining the line and those created on the line are shown in black.	35.6
8.	CONT (F1) returns to COGO Line Calculations Input .	

37.8

37.8.1

COGO Calculation - Arc Calculations Method

Arc Calculation - Arc Center

Description

The COGO arc calculation arc center calculates the coordinates of the centre of the arc.

Elements that must be known are

- coordinates of three points

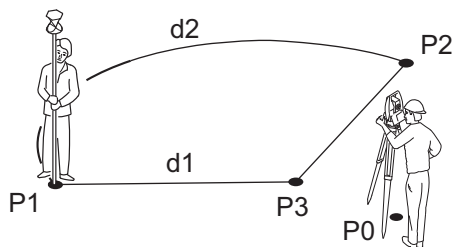
OR

- coordinates of two points
- radius to the two points

The coordinates of the known points

- may be taken from the active job.
- may be measured during the COGO calculation.
- may be entered.

Diagram



TPS12_217

P0 Instrument station
P1 <Start Point:>
P2 <End Point:>
P3 Arc Center
d1 <Arc Radius:>
d2 <Arc Length:>



Access

COGO Arc Calculations Input Input page

Arc management is not available for COGO arc calculations.

Refer to "37.2 Accessing COGO" to access **COGO Arc Calculations Input**.

The softkeys are similar to line calculation. Refer to "37.7.1 Line Calculation - Base Point" for information on softkeys.

Description of fields

Field	Option	Description
<Task:>	Calc Arc Center	Calculates the coordinates of the centre of the arc.
	Calc Offset Point	Calculates the coordinates of a new point after input of station and offset values in relation to an arc.
	Calc Base Point	Calculates the base point, the station and offset of a point in relation to an arc.
	Segmentation	Calculates the coordinates of new points on an arc either equally spaced, in a defined interval or in a defined angle.
<Method:>	3 Points	The method by which the arc will be defined. Uses three known points to define the arc.
	2 Points/Radius	Defines the arc using two known points and a radius of the arc.
	2 Tgnts/Radius	Defines the arc using two tangents and a radius of the arc.

Field	Option	Description
	2 Tgnts/Chrd Lngt	Defines the arc using two tangents and the chord of the arc.
<Start Point:>	Choicelist	The start point of the arc. All points from COGO Data: Job Name can be selected. Available for <Method: 3 Points> and <Method: 2 Points/Radius> .
<Second Point:>	Choicelist	All points from COGO Data: Job Name can be selected. Available for <Method: 3 Points> . The second point of the arc.
<End Point:>	Choicelist	The end point of the arc. All points from COGO Data: Job Name can be selected. Available for <Method: 3 Points> and <Method: 2 Points/Radius> .
<Point 1:>	Choicelist	A point on the first tangent. Available for <Method: 2 Tgnts/Radius> , <Method: 2 Tgnts/Arc Lngt> and <Method: 2 Tgnts/Chrd Lngt> .
<PI Point:>	Choicelist	The point of intersection of the two tangents. Available for <Method: 2 Tgnts/Radius> , <Method: 2 Tgnts/Arc Lngt> and <Method: 2 Tgnts/Chrd Lngt> .
<Point 2:>	Choicelist	A point on the second tangent. Available for <Method: 2 Tgnts/Radius> , <Method: 2 Tgnts/Arc Lngt> and <Method: 2 Tgnts/Chrd Lngt> .
<Radius:>	User input	The radius of the arc. Available for <Method: 2 Points/Radius> and <Method: 2 Tgnts/Radius> .

Field	Option	Description
<Arc Length:>	User input	The length of the arc. Available for <Method: 2 Tgnts/Arc Lngt>.
<Chord Length:>	User input	The length of the chord. Available for <Method: 2 Tgnts/Chrd Lngt>.
<ΔArcDist-XX:>	User input	Horizontal distance along the arc from start point to base point. Available for <Task: Calc Offset Point>.
<ΔOffset-XX:>	User input	Offset from base point to offset point. Positive to the right and negative to the left of the arc. Available for <Task: Calc Offset Point>.
<Offset Point:>	Choicelist	The offset point. Available for <Task: Calc Base Point>.

Next step

IF	THEN
<Task: Calc Arc Center>	CALC (F1) accesses COGO Center of Arc Results . Refer to paragraph "COGO XX Results, Result page".
<Task: Calc Offset Point>	CALC (F1) accesses COGO Offset Point Results . Refer to paragraph "COGO XX Results, Result page".
<Task: Calc Base Point>	CALC (F1) accesses COGO Base Point Results . Refer to paragraph "COGO XX Results, Result page".
<Task: Segmentation>	CALC (F1) accesses COGO Define Segmentation . Refer to "37.8.4 Arc Calculation - Segmentation".

Refer to paragraph "37.7.1 Line Calculation - Base Point" for information on softkeys.

Description of fields

Field	Option	Description
<Point ID:>	User input	The identifier for the COGO point depending on the point ID template configured for <Survey Pts:> in CONFIGURE ID Templates .
<Ortho Ht:> or <Local Ell Ht:>	User input	The height of the start point of the arc is suggested. A height value to be stored with the calculated point can be typed in.
<Arc Radius:>	Output	Computed radius of arc.
<Arc Length:>	Output	Computed length of arc.
<Offs Pt Brng:>	Output	Available for <Task: Calc Offset Point >. Bearing of offset point from base point to offset point.
<Offset Point:>	Output	Available for <Task: Calc Base Point >. Point ID of offset point.
<ΔArcDist-XX:>	Output	Available for <Task: Calc Base Point >. Horizontal distance along the arc from start point to base point.
<ΔOffset-XX:>	Output	Available for <Task: Calc Base Point >. Offset from base point to offset point. Positive to the right and negative to the left of the line.

**COGO
XX Results,
Code page**

Next step

PAGE (F6) changes to the **Code** page.

The functionality of the **Code** page is similar to **COGO Traverse Results, Code** page.

Next step

PAGE (F6) changes to the **Plot** page.

**COGO
XX Results,
Plot page**

The functionality of the **Plot** page is similar to **COGO Traverse Results, Plot** page.

Next step

STORE (F1) stores the result and accesses **COGO Arc Calculations Input, Input** page.

Description

The COGO arc calculation base point calculates the coordinates of the base point, station and offset of a point in relation to an arc.

Elements that must be known are

- coordinates of three points
- coordinates of an offset point

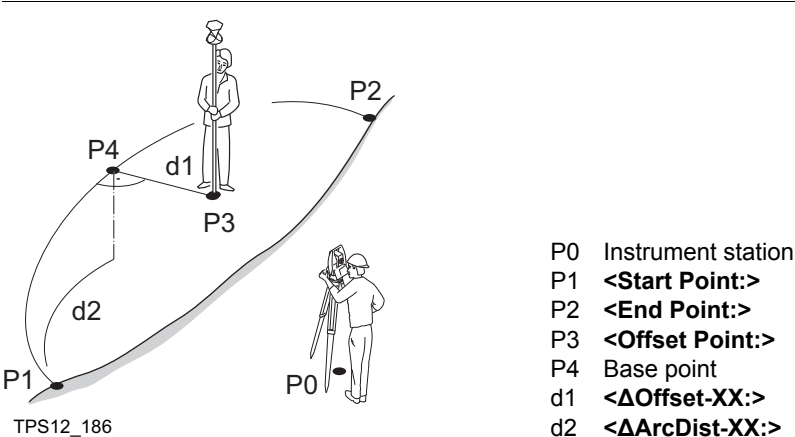
OR

- coordinates of two points
- radius to the two points
- coordinates of an offset point

The coordinates of the known points

- may be taken from the active job.
 - may be measured during the COGO calculation.
 - may be entered.
-

Diagram



**COGO arc calculation
base point step-by-step**

Arc management is not available for COGO arc calculations.

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to "37.2 Accessing COGO" to access COGO Arc Calculations Input, Input page.	
	COGO Arc Calculations Input, Input page. SHIFT CONF (F2) to configure the COGO application program.	37.3
2.	COGO Arc Calculations Input, Input page. <Task: Calc Base Point>	37.8.1

Step	Description	Refer to chapter
3.	CALC (F1) calculates the results.	
4.	COGO Base Point Results, Result page STORE (F1) stores the results.	37.8.1

37.8.3

Arc Calculation - Offset Point

Description

The COGO arc calculation offset point calculates the coordinates of a new point after input of arc and offset values in relation to an arc.

Elements that must be known are

- coordinates of three points.
- offsets.

OR

- coordinates of two points.
- radius to the two points.
- offsets.

The coordinates of the known points

- may be taken from the active job.
- may be measured during the COGO calculation.
- may be entered.



COGO arc calculation offset point step-by- step

Arc management is not available for COGO arc calculations.

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to "37.2 Accessing COGO" to access COGO Arc Calculations Input .	

Step	Description	Refer to chapter
	COGO Arc Calculations Input, Input page. SHIFT CONF (F2) to configure the COGO application program.	37.3
2.	COGO Arc Calculations Input, Input page. <Task: Calc Offset Point>	37.8.1
3.	CALC (F1) calculates the results.	
4.	COGO Offset Point Results, Result page STORE (F1) stores the results.	37.8.1

37.8.4



Exceptions to line calculation segmentation

Arc Calculation - Segmentation

The COGO arc calculation segmentation and the functionality of all screens and fields are similar to those for COGO line calculation segmentation. Refer to "37.7.3 Line Calculation - Segmentation".

New field and option in COGO Define Segmentation

Field	Option	Description
<Method:>	Delta Angle	To divide the arc by an angular value.
<Delta Angle:>	User input	The angular value by which new points will be defined on the arc.

Description

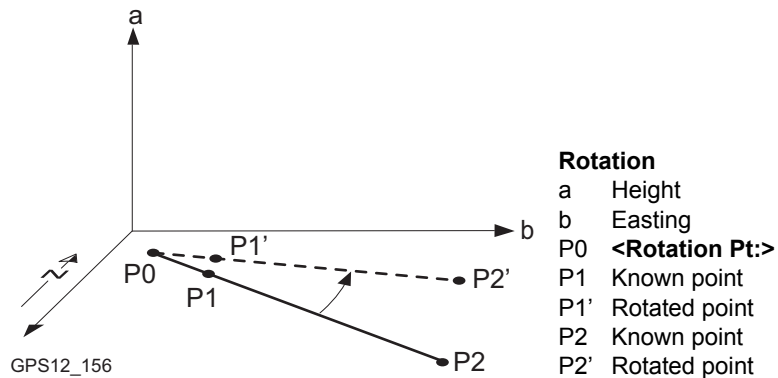
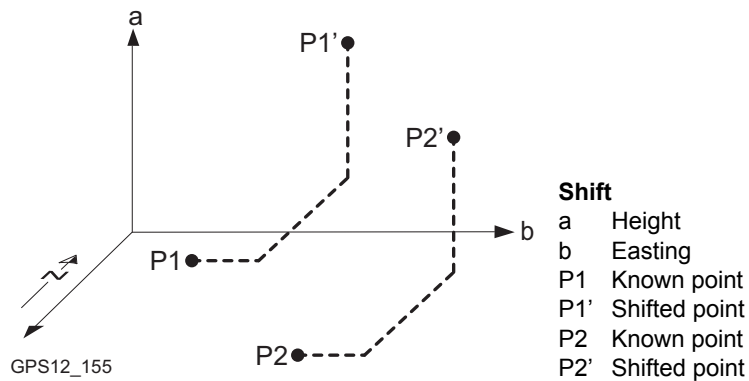
The COGO calculation shift, rotate & scale (manual) applies shifts and/or rotation and/or scale to one or several known points. The values for shifts and/or rotation and/or scale are typed in manually.

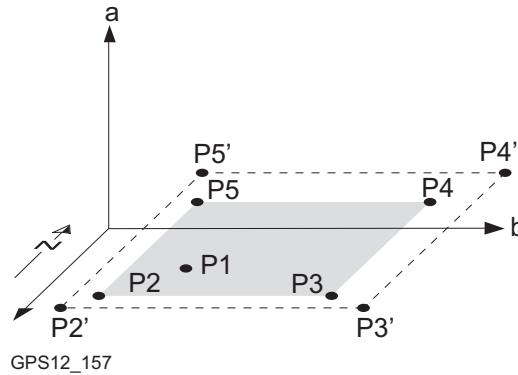
Elements that must be known are

- the coordinates of the points to be shifted, rotated and/or scaled. They must be stored in the active job.
- the shift values. They can be defined as the direction of Easting, Northing and Height or as an azimuth and a grid distance or as shift from one point to another.
- the rotation value. It can be defined by a point as rotation center plus a rotation or by an existing and new azimuth.
- the scale. It is only applied to the position.

Points with full coordinate triplets, position only points and height only points can be used.

Diagram





Scale

a Height

b Easting

P1 **<Rotation Pt:>**, can be held fixed, all other points are then scaled from here

P2 Known point

P2' Scaled point

P3 Known point

P3' Scaled point

P4 Known point

P4' Scaled point

P5 Known point

P5' Scaled point

Access

Refer to "37.2 Accessing COGO" to access **COGO Shift, Rotate & Scale**.

COGO

Shift, Rotate & Scale, Points page

Listed are points which have been selected for shifting, rotating and/or scaling.

Points	Code
0002	-----
0001	-----

CALC ADD ADD 1 REMOV MORE PAGE

CALC (F1)

To perform the shift, rotation and scale calculation and to continue with the subsequent screen. Calculated COGO points are not yet stored.

ADD (F2)

To add several points from the active job to the list. Accesses **COGO Data: Job Name**.

Selected sort and filter settings apply. **CONT (F1)** adds all displayed points to the list in **COGO Shift, Rotate & Scale** and returns to that screen.

ADD 1 (F3)

To add one point from the active job to the list. Accesses **COGO Data: Job Name**. Selected sort and filter settings apply. **CONT (F1)** adds the currently highlighted point to the list in **COGO Shift, Rotate & Scale** and returns to that screen.

REMOV (F4)

To remove the highlighted point from the list. The point itself is not deleted.

MORE (F5)

To display information about the codes if stored with any point, the time and the date of when the point was stored and the 3D coordinate quality and the class.

PAGE (F6)

To change to another page on this screen.

SHIFT REM A (F4)

To remove all points from the list. The points itself are not deleted.

SHIFT RANGE (F5)

To define a range of points from the active job to be added to the list. Refer to paragraph "COGO Select Points by Range".

Next step

IF	THEN
all points from COGO Data: Job Name are to be added	ADD (F2).
one point from COGO Data: Job Name is to be added	ADD 1 (F3).
a range of points from COGO Data: Job Name is to be added	SHIFT RANGE (F5) accesses COGO Select Points by Range . Refer to paragraph "COGO Select Points by Range".
all points are added	PAGE (F1) accesses COGO Shift, Rotate & Scale, Shift page. Refer to paragraph "COGO Shift, Rotate & Scale, Shift page".

COGO

Select Points by Range

12:16
COGO

Select Points by Range

From Pt ID : 0001

To Pt ID : 0050

CONT (F1)

To add the points within the selected range to the list in **COGO Shift, Rotate & Scale, Points** page and to return to the screen from where this screen was accessed.

NEXT (F3)

To add the points within the selected range to the list in **COGO Shift, Rotate & Scale, Points** page without quitting this screen. Another range of point ID's can be selected.

Q2 a ↑

CONT NEXT

Description of fields

Field	Option	Description
<From Pt ID:> and <To Pt ID:>	User input	Numeric point ID's in both fields: Points with numeric point ID's falling within the range are selected. Example: <From Pt ID: 1>, <To Pt ID: 50> Selected are point ID's 1, 2, 3, 4, 5, 6, 7, 8, 9, 10.... 49, 50 as well as 001, 01, 0000045, ... Not selected are point ID's 100,200,300, ...

Field	Option	Description
		Alphanumeric point ID's in both fields: The left most character of both entries is used as the basis for the range. The standard ASCII numerical range is used. Points with alphanumeric point ID's falling within the range are selected. Example: <From Pt ID: a9>, <To Pt ID: c200> Selected are point ID's a, b, c, aa, bb, cc, a1, b2, c3, c4, c5, a610, ... Not selected are point ID's d100, e, 200, 300, tzz ...

Next step

Step	Description
1.	CONT (F1) adds all points within the range to the list in COGO Shift, Rotate & Scale and returns to the screen from where this screen was accessed.
2.	PAGE (F6) accesses COGO Shift, Rotate & Scale, Shift page. Refer to "COGO Shift, Rotate & Scale, Shift page".

Shift, Rotate & Scale, Shift page

12:18
COGO

IR
STD

Shift, Rotate & Scale

Points Shift Rotate Scale

Method : Enter ΔE, ΔN, ΔHt

Δ Easting : 1.500 m
Δ Northing : 1.750 m
Δ Height : 0.355 m

CALC INV LAST SURVY PAGE

To perform the shift, rotation and scale calculation and to continue with the subsequent screen. Calculated COGO points are not yet stored.

To calculate the amount of shift in Easting, Northing and height from two existing points. Available if **<Δ Easting:>**, **<Δ Northing:>** or **<Δ Height:>** is highlighted.

To select the value for the shift from previous COGO inverse calculations. Available if **<Δ Easting:>**, **<Δ Northing:>** or **<Δ Height:>** is highlighted.

To measure a point for the COGO calculation.
Available for **<Method: Use 2 Points>** if
<From:> or **<To:>** is highlighted.

To change to another page on this screen.

To configure the COGO application program. Accesses **COGO Configuration**. Refer to "37.3 Configuring COGO".

SHIFT MODIF (F4)

To mathematically modify the values. Available if **<Δ Easting:>**, **<Δ Northing:>** or **<Δ Height:>** is highlighted.

Description of fields

Field	Option	Description
<Method:>	Enter ΔE,ΔN,ΔHt Enter Bng,Dst,Ht Use 2 Points	The method by which the shift in Δ Easting, Δ Northing and Δ Height will be determined. Defines the shift using coordinate differences. Defines the shift using an azimuth, a distance and a height difference. Computes the shift from the coordinate differences between two known points.
<From:>	Choicelist	Available for <Method: Use 2 Points> . The point ID of the first known point for calculating the shift.
<To:>	Choicelist	Available for <Method: Use 2 Points> . The point ID of the second known point for calculating the shift.
<Azimuth:>	User input	Available for <Method: Enter Bng,Dst,Ht> . The azimuth defines the direction of the shift.
<HDist-XX:>	User input	Available for <Method: Enter Bng,Dst,Ht> . The amount of shift from the original point to the calculated COGO points.

Field	Option	Description
<Δ Easting:>	User input or output	The amount of shift in East direction.
<Δ Northing:>	User input or output	The amount of shift in North direction.
<Δ Height:>	User input or output	The amount of shift in height.

Next step

PAGE (F6) accesses **COGO Shift, Rotate & Scale, Rotate** page. Refer to "COGO Shift, Rotate & Scale, Rotate page".

COGO Shift, Rotate & Scale, Rotate page

The softkeys are the same as on the Shift page. Refer to paragraph "COGO Shift, Rotate & Scale, Shift page" for information on the keys.

Description of fields

Field	Option	Description
<Method:>		The method by which the rotation angle will be determined.
	User Entered	The rotation can be manually typed in.
	Computed	The rotation will be calculated as <New Azimuth:> minus <Existing Az:> .
<Rotation Pt:>	Choicelist	The point around which all points will be rotated.

Field	Option	Description
<Existing Az:>	User input	Available for <Method: Computed>. A known direction before rotating.
<New Azimuth:>	User input	Available for <Method: Computed>. A known direction after rotating.
<Rotation:>	User input or output	The amount by which the points will be rotated.

Next step

PAGE (F6) accesses **COGO Shift, Rotate & Scale, Scale** page. Refer to "COGO Shift, Rotate & Scale, Scale page".

COGO Shift, Rotate & Scale, Scale page

The softkeys are the same as on the Shift page. Refer to paragraph "COGO Shift, Rotate & Scale, Shift page" for information on the keys.

Description of fields

Field	Option	Description
<Method:>		The method by which the scale factor will be determined.
	User Entered	The scale factor can be manually typed in.
	Computed	The scale factor will be calculated as <New Dist:> divided by <Existing Dist:>.

Field	Option	Description
<Existing Dist:>	User input	Available for <Method: Computed>. A known distance before scaling. This value is used for calculating the scale factor.
<New Dist:>	User input	Available for <Method: Computed>. A known distance after scaling. This value is used for calculating the scale factor.
<Scale:>	User input or output	The scale factor used in the calculation.
<Scale From Pt:>	No Yes	Scaling is performed by multiplying the original coordinates of all points by <Scale:>. <Scale:> is applied to the coordinate difference of all points relative to <Rotation Pt:> selected on the Rotation page. The coordinates of <Rotation Pt:> will not change.

Next step

CALC (F1) performs the shift, rotation and scale calculation and accesses **COGO Shift, Rotate & Scale Store**.

COGO
Shift, Rotate & Scale
Store,
General page

12:20
COGO
Shift, Rotate & Scale Store
General | Summary | Plot
Pts Selected : 2
Store Job : construction
Add Identifier: Yes
Identifier : cogo
Prefix/Suffix: Prefix
Q2a ↑
STORE PAGE

STORE (F1)

To to store the results and continue with the next subsequent screen.

PAGE (F6)

To change to another page on this screen.

Description of fields

Field	Option	Description
<Pts Selected:>	Output	The number of selected points having been shifted, rotated and/or scaled.
<Store Job:>	Choicelist	The calculated COGO points will be stored in this job. All jobs from Main Menu: Manage...\Jobs can be selected. The original points are not copied to this job.
<Add Identifier:>	Yes or No	Activates the use of additional identifiers for the point ID's of the calculated COGO points.

Field	Option	Description
<Identifier:>	User input	The identifier with up to four characters is added in front of or at the end of the ID of the calculated COGO points.
<Prefix/Suffix:>	Prefix	Adds the setting for <Identifier:> in front of the original point ID's.
	Suffix	Adds the setting for <Identifier:> at the end of the original point ID's.

Next step

IF	THEN
the used parameters are to be viewed	PAGE (F6) accesses COGO Shift, Rotate & Scale Store, Summary page.
the calculated COGO points are to be viewed graphically	PAGE (F6) accesses COGO Shift, Rotate & Scale Store, Plot page. Original points are displayed in grey, calculated COGO points are displayed in black.
the calculated COGO points are to be stored	STORE (F1) accesses COGO Shift, Rotate & Scale Results, Result page. Refer to paragraph "COGO Shift, Rotate & Scale Results Result page".

COGO
Shift, Rotate & Scale
Results
Result page

Description of fields

Field	Option	Description
<No. of New Pts:>	Output	Number of new points created.
<No. of Skipped Pts>	Output	Number of points which were skipped either due to not being able to convert coordinates or points with identical point ID's already existed in <Store Job:>.

Next step

IF	THEN
the stored COGO points are to be viewed graphically	PAGE (F6) accesses COGO Shift, Rotate & Scale Results, Plot page. Original points are displayed in grey, calculated COGO points are displayed in black.
more points are to be shifted, rotated and/or scaled	CONT (F1) returns to COGO Shift, Rotate & Scale .
COGO is to be ended	SHIFT QUIT (F6) .

Description

The COGO calculation shift, rotate & scale (match pts) applies shifts and/or rotation and/or scale to one or several known points. The shifts and/or rotation and/or scale are calculated from selected points using a 2D Helmert transformation.

Elements that must be known are

- the coordinates of at least two matching points for the calculation of the shifts and/or rotation and/or scale.
- the coordinates of the points to be shifted, rotated and/or scaled. They must be stored in the active job.
- the shift values. They can be defined as the direction of Easting, Northing and Height or as an azimuth and a grid distance or as shift from one point to another.
- the rotation value. It can be defined by a point as rotation center plus a rotation or by an existing and new azimuth.
- the scale. It is only applied to the position.

Points with full coordinate triplets, position only points and height only points can be used.

Computation of shift, rotation and scale values

The number of pairs of points matched determines whether the shift, rotation and scale values are computed.

Number of pairs of points matched	Shift East	Shift North	Shift Height	Rotation	Scale
1	x	x	x	-	-

Number of pairs of points matched	Shift East	Shift North	Shift Height	Rotation	Scale
> 1	x	x	x	x	x

Access

Refer to "37.2 Accessing COGO" to access **COGO Match Common Points (n)**.

COGO Match Common Points (n)

This screen provides a list of points chosen from the active job. The points are used for the determination of the 2D Helmert transformation. The number of points matched is indicated in the title, for example **COGO Match Common Points (3)**. Unless there is no pair of matching points in the list all softkeys are available. Refer to paragraph "Match points step-by-step" for information on how to match points.

Source Pt	Target Pt	Match
0001	100	P & H
0002	200	P & H

12:23 COGO IR STD I [Icons]

Match Common Points (2)

CALC NEW EDIT DEL MATCH RESID

CALC (F1)

To confirm the selections, compute the transformation and continue with the subsequent screen.

NEW (F2)

To match a new pair of points. This pair is added to the list. A new point can be manually occupied. Refer to paragraph "Match points step-by-step".

EDIT (F3)

To edit the highlighted pair of matched points.

DEL (F4)

To delete the highlighted pair of matched points from the list.

MATCH (F5)

To change the type of match for a highlighted pair of matched points. Refer to "Description of columns".

RESID (F6)

To display a list of the matched points used in the transformation calculation and their associated residuals. Refer to paragraph "Fix parameters".

SHIFT PARAM (F5)

To define the parameters to be used in the 2D transformation.

Description of columns

Column	Description
Source Pt	The point ID of the points of origin for the calculation of the shifts and/or rotation and/or scale.
Target Pt	The point ID of the target points for the calculation of the shifts and/or rotation and/or scale.
Match	The type of match to be made between the points. This information is used in the transformation calculation. Position & Height , Position only , Height only or None .

Column	Description
	None removes matched common points from the transformation calculation but does not delete them from the list. This can be used to help improve residuals.

Next step

IF	THEN
the transformation is to be computed	CALC (F1) . The calculated shift, rotation and scale values are displayed in COGO Shift, Rotate & Scale . They cannot be edited. The remaining functionality of the calculation is very similar to COGO calculation shift, rotate & scale (manual). Refer to "37.9 COGO Calculation - Shift, Rotate & Scale (Manual) Method".
a pair of points is to be matched or edited	NEW (F2) or EDIT (F3) . Refer to paragraph "Match points step-by-step".
parameters for the transformation are to be fixed	SHIFT PARAM (F5) . Refer to paragraph "Fix parameters".

Match points step-by-step

Before calculating a transformation, it must be defined which points are to be matched. Matching new points and editing matched points is very similar.

Step	Description
1.	Refer to "37.2 Accessing COGO" to access COGO Match Common Points .
2.	NEW (F2) or EDIT (F3)

Step	Description
3.	COGO Choose Matching Points or COGO Edit Matching Points <Source Pt:> A point of origin for the calculation of the shifts and/or rotation and/or scale. <Target Pt:> A target point for the calculation of the shifts and/or rotation and/or scale. <Match Type:> The type of match to be made between the points selected in <Source Pt:> and <Target Pt:>. Position & Height, Position Only, Height Only or None. Select the points to be matched.
	SURVY (F5). To manually occupy a point and store it in the active job.
4.	CONT (F1) returns to COGO Match Common Points (n) and adds a new line of matched points to the matched points list.

Fix parameters

The settings on this screen define the parameters to be used in the transformation.

IF the value for a field is	THEN the value for this parameter will be
-----	calculated.
any number	fixed to that value.

Description of fields

Field	Option	Description
<Δ Easting:>	User input	Shift in Easting direction.
<Δ Northing:>	User input	Shift in Northing direction.
<Δ Height:>	User input	Shift in Height direction.
<Rotation:>	User input	Rotation around the X axis.
<Scale:>	User input	Scale factor.

Next step

IF	AND	THEN
a field displays ----	the parameter needs to be fixed to a value	highlight the field. Enter the value of the parameter. FIX (F4) .
a field displays a value	the parameter needs to be calculated	highlight the field. ADJST (F4) .
all parameters are configured	-	CONT (F1) to return to COGO Match Common Points (n) .

37.11

37.11.1

Description

Area Division

Overview

The COGO calculation area division divides an area by a defined line, by percentage or by the size of a subarea.

The area division methods are listed in the table below. Elements that must be known for the calculation depend on the area division method. At least three points are required to form an area.

Divide by	Using		Elements required
Defined line	Parallel line	Through a point	- Two points defining the line - One point on the dividing line
		By a distance	- Two points defining the line - Distance
	Perpendicular line	Through a point	- Two points defining the line - One point on the dividing line
		By a distance	- Two points defining the line - Distance
Percentage	Parallel line	-	- Size of new area in percentage - Two points defining the line
	Perpendicular line	-	- Size of new area in percentage - Two points defining the line

Divide by	Using		Elements required
	Swing line	Rotation point	• Size of new area in percentage • Rotation point of the swing line
Area	Parallel line	-	• Size of new area • Two points defining the line
	Perpendicular line	-	• Size of new area • Two points defining the line
	Swing line	Rotation point	• Size of new area • Rotation point of the swing line

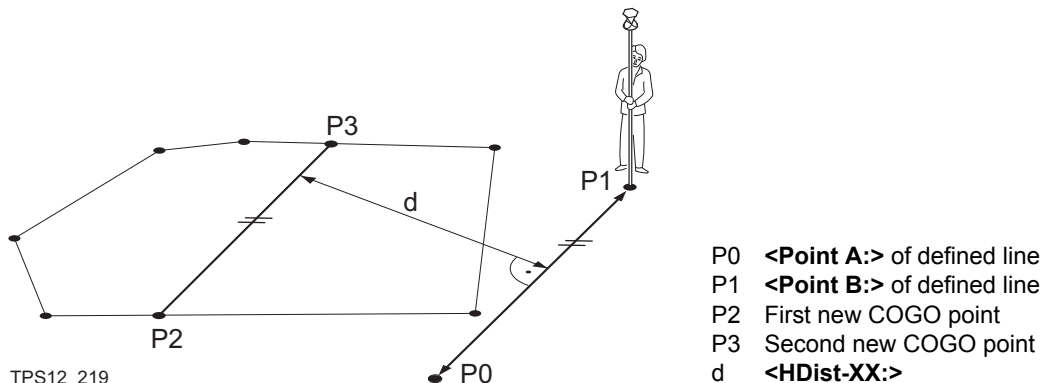
The coordinates of the known points

- may be taken from the active job.
- may be measured during the COGO calculation.
- may be entered.

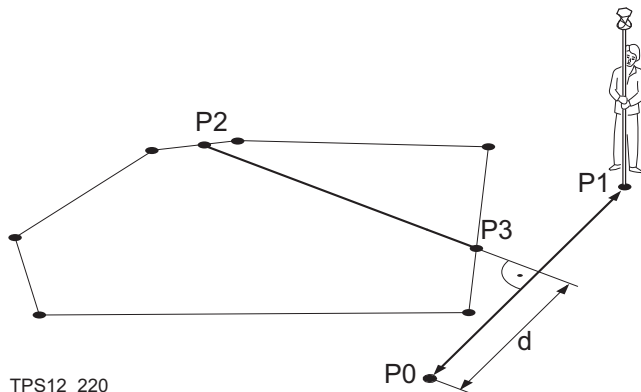
Diagram

The diagrams show the area division methods. Some diagrams apply to several area division methods.

Area division method	<Divide:>	<Using:>	<Shift:>
1.	By Defined Line	Parallel Line	By Distance
2.	By Percentage	Parallel Line	-
3.	By Area	Parallel Line	-

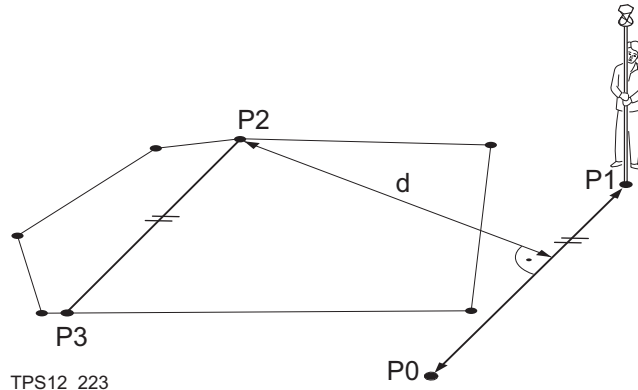


Area division method	<Divide:>	<Using:>	<Shift:>
1.	By Defined Line	Perpendic Line	By Distance
2.	By Percentage	Perpendic Line	-
3.	By Area	Perpendic Line	-



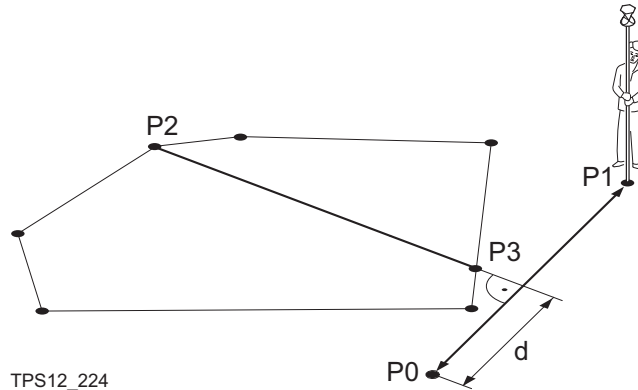
- P0 <Point A:> of defined line
- P1 <Point B:> of defined line
- P2 First new COGO point
- P3 Second new COGO point
- d <HDist-XX:>

Area division method	<Divide:>	<Using:>	<Shift:>
1.	By Defined Line	Parallel Line	Through Point



- P0 <Point A:> of defined line
- P1 <Point B:> of defined line
- P2 <Through Point:>; in this case it is a known point of the existing border
- P3 New COGO point
- d <HDist-XX:>

Area division method	<Divide:>	<Using:>	<Shift:>
1.	By Defined Line	Perpendicular Line	Through Point



- P0 <Point A:> of defined line
- P1 <Point B:> of defined line
- P2 <Through Point:>; in this case it is a known point of the existing border
- P3 New COGO point
- d <HDist-XX:>

37.11.2

Choosing an Area to be Divided

Access

Refer to "37.2 Accessing COGO" to access **COGO Choose Area to be Divided**.

COGO

Choose Area to be Divided

12:28
COGO
Choose Area to be Divided
Area to Use : Select Existing
Area ID : Area0001
No. of Points: 4
Area : 1088.29 m²
Perimeter : 356.135 m

CONT (F1)

Q2 a ↑
CONT

To accept the changes and access the subsequent screen.

Description of fields

Field	Option	Description
<Area to Use:>	Select Existing	The setting determines the availability of the subsequent fields and screen. To use an area from the <Job:> selected in COGO COGO Begin . The area can be edited and a new area can be created from points existing in the <Job:>.

Field	Option	Description
	Survey New Area	To survey points that do not exist in the job yet. The points will be added to a new area.
<Area ID:>	Choicelist	For <Area to Use: Select Existing >. To select the area to be divided.
	User input	For <Area to Use: Survey New Area >. To enter a name for the new area.
<No. of Points:>	Output	Number of points forming the area.
<Area:>	Output	The size of the selected area.
<Perimeter:>	Output	The perimeter of the area.

Next step

IF	THEN
<Area to Use: Select Existing >	CONT (F1) accesses COGO Define How to Divide Area . Refer to "37.11.3 Dividing an Area".
<Area to Use: Survey New Area >	CONT (F1) accesses COGO Survey: Job Name . Refer to "COGO Survey: Job Name, Survey page".

COGO

Survey: Job Name, Survey page

Points to be added to the new area can be surveyed.

12:31
COGO

Survey: construction

Survey Offset Code Map

Point ID : 0003
Reflector Ht : 1.250 m
Hz : 0.0000 g
V : 0.0002 g
Horiz Dist : ----- m
Ht Diff : ----- m

Q2 a ↑

ALL DIST REC DONE PAGE

ALL (F1)

To measure and store distances and angles.

DIST (F2)

To measure and display distances. Available unless **<EDM Mode: Tracking>** and/or **<Log Auto Pts: Yes>**, after the tracking or logging is started.

REC (F3)

To record data.

If **<EDM Mode: Tracking>** and/or **<Log Auto Pts: Yes>**, records measured point and continues tracking.

DONE (F4)

To end surveying an area and to access

COGO Edit Area: Area ID where the area can be stored.

PAGE (F6)

To change to another page on this screen.

SHIFT INDIV (F5) and SHIFT RUN (F5)

To change between entering an individual point ID different to the defined ID template and the running point ID according to the ID template. Refer to "16.1 ID Templates".

Description of fields

Field	Option	Description
<Point ID:>	User input	The identifier for manually occupied points. The configured point ID template is used. The ID can be changed in the following ways: - To start a new sequence of point ID's type over the point ID. - For an individual point ID independent of the ID template SHIFT INDIV (F5). SHIFT RUN (F5) changes back to the next ID from the configured ID template. Refer to "16.1 ID Templates".
<Reflector Ht:>	User input	The last used reflector height is suggested when accessing the Survey application program. An individual reflector height can be typed in.
<Hz:>	Output	The current horizontal angle.
<V:>	Output	The current vertical angle.
<Horiz Dist:>	Output	The horizontal distance after DIST (F2) was pressed. No distance is displayed when accessing the screen and after REC (F3) or ALL (F1) .
<Ht Diff:>	Output	The height difference between station and measured point after DIST (F2) . Displays ----- when accessing the screen and after REC (F3) or ALL (F1) .

Next step

IF the task is to	THEN
change to another page on this screen	PAGE (F6).
stop surveying the area and to store the area	DONE (F4) and then STORE (F1) . COGO Define How to Divide Area is accessed. Refer to "37.11.3 Dividing an Area".
return to COGO Choose Area to be Divided	ESC.

37.11.3

Dividing an Area

Access

Refer to "37.11.2 Choosing an Area to be Divided" to access **COGO Define How to Divide Area**.

COGO Define How to Divide Area, Input page

After each change of parameters in this screen, the values in the output fields are recalculated and updated.

12:43
COGO
Define How to Divide Area
Input Map
Divide By : Defined Line
Using : Parallel Line
Sub-Area-Grid: 39.89 %
Point A : 0001
Point B : 0002
Shift : By Distance
HDist-Grid : 20.000 m
Q2 a
CALC INV SIZE LAST SURVY PAGE

CALC (F1)

To perform the area division and to continue with the subsequent screen. Calculated COGO points are not yet stored.

INV (F2)

To calculate the value for the distance from two existing points. Available if **<HDist-XX:>** is highlighted.

SIZE (F3) and PERC (F3)

To display the size and the perimeter of the sub-area.

LAST (F4)

To select the value for the distance from previous COGO inverse calculations. Available if **<HDist-XX:>** is highlighted.

SURVY (F5)

To manually occupy a point for the COGO calculation. Available if **<Point A:>**, **<Point B:>** or **<Rotation Pnt:>** is highlighted.

PAGE (F6)

To change to another page on this screen.

SHIFT CONF (F2)

To configure the COGO application program.

SHIFT MODIF (F4)

To mathematically modify the values for the distance or angle. Available if **<HDist-XX:>** or **<Azimuth:>** is highlighted.

Description of fields

Field	Option	Description
<Divide By:>	Percentage	This field defines how the size of the sub area is defined.
	Area	The size of the sub area is given in %.
	Defined Line	The size of the sub area is given in m ² . The new border defining the size of the sub area is known.
<Using:>	Parallel Line	This field defines how the new border will run. The border will be parallel to a line defined by <Point A:> and <Point B:> .
	Perpendic Line	The border will be perpendicular to a line defined by <Point A:> and <Point B:> .
	Swing Line	The border will be a line rotated around <Rotation Pnt:> by <Azimuth:> .

Field	Option	Description
<Sub-Area-XX:>	User input	For <Divide By: Percentage> and <Divide By: Area> . The size of the sub area must be typed either in % or in m ² . When dividing the area using a parallel or perpendicular line, a reference line is defined by <Point A:> and <Point B:> . The direction of the new dividing line is always the same as the direction of the reference line. The sub area is always to the left of the new dividing line. When dividing a line using a swing line, the direction of the new dividing line is defined by the <Rotation Pnt:> and the <Azimuth:> . The sub area is always to the left of the new dividing line.
	Output	For <Divide By: Defined Line> . The size of the sub area is calculated in the background and displayed.
<Point A:>	Choicelist	The first point of the line which is used as the reference for a new parallel or perpendicular border. All points from COGO Data: Job Name can be selected.
<Point B:>	Choicelist	The second point of the line which is used as the reference for a new parallel or perpendicular border. All points from COGO Data: Job Name can be selected.
<Shift:>		Available for <Divide By: Defined Line> .

Field	Option	Description
	By Distance	The new border will run in a certain distance from the line defined by <Point A:> and <Point B:> .
	Through Point	The new border will run through a point defined in <Through Point:> .
<Through Point:>	Choicelist	Available for <Shift: Through Point> . The point through which the new border will run.
<Rotation Pnt:>	Choicelist	Available for <Using: Swing Line> . The point around which the new border will rotate by <Azimuth:> .
<Azimuth:>	Output	Available for <Using: Swing Line> . The angle of the new border from <Rotation Pnt:> to the new COGO point.
<HDist-XX:>	User Input	The distance from the line defined by <Point A:> and <Point B:> to the new border.
	Output	For <Divide By: Defined Line> and <Shift: By Distance> . For <Divide By: Percentage> or <Divide By: Area> with <Using: Parallel Line> or <Using: Perpendic Line> .

Next step

PAGE (F6) changes to the **Map** page. Refer to paragraph "COGO Define How to Divide Area, Map page".

COGO
Define How to Divide
Area,
Map page

The **Map** page provides an interactive display of the data. Refer to "35 MapView Interactive Display Feature" for information on the functionality and softkeys available.

Next step

CALC (F1) performs the area division and accesses **COGO Results of Area Division**. Refer to "37.11.4 Results of the Area Division".

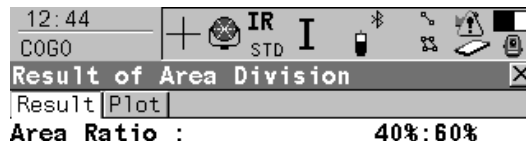
37.11.4

Results of the Area Division

Access

COGO
Results of Area Division,
Result page

CALC (F1) in COGO Define How to Divide Area.



Area 1-Grid: 434.16 m²
Area 2-Grid: 654.13 m²

CONT (F1)

To accept the calculation and to continue with the subsequent screen. Calculated COGO points are not yet stored.

PAGE (F6)

To change to another page on this screen.



SHIFT CONF (F2)

To configure the COGO application program.

Description of fields

Field	Option	Description
<Area Ratio:>	Output	The ratio of the size of the two sub areas in percent.
<Area 1-XX:>	Output	The size of the first sub area in m ² .
<Area 2-XX:>	Output	The size of the second sub area in m ² .

Next step

PAGE (F6) changes to the Plot page.

COGO
Results of Area Division,
Map page

COGO
Area Division Results,
ResultX page

The points defining the area and the calculated COGO points are shown in black.

Next step

CONT (F1) access **COGO Area Division Results**.

The coordinates of the intersection points of the new border with the original area are displayed.

12:46		+ IR STD I		[Icons]	
COGO					
Area Divisions Results [X]					
Result1		Code	Plot		
Point ID	:	0004			
Easting	:	20.000 m			
Northing	:	78.921 m			
Height	:	----- m			
[Buttons: STORE, RSLT2, STAKE, PAGE]					
Q2 a ↑					

STORE (F1)

To store the two results and to return to **COGO Choose Area to be Divided** once both points are stored

RSLT1 (F3) or RSLT2 (F3)

To view the first and second result.

STAKE (F5)

To access the Stakeout application program and stake out the calculated COGO point.

PAGE (F6)

To change to another page on this screen.

SHIFT INDIV (F5) and SHIFT RUN (F5)

To change between entering an individual point ID different to the defined ID template and the running point ID according to the ID template. Refer to "16.1 ID Templates".

Description of fields

Field	Option	Description
<Point ID:>	User input	The identifier for the COGO point depending on the point ID template configured for <Survey Pts:> in CONFIGURE ID Templates .
<Height:>	User input	A height value to be stored with the calculated point can be typed in.

Next step

PAGE (F6) changes to the **Code** page.

COGO Area Division Results, Code page

All codes of the job can be selected. Type in a code if required.

Next step

PAGE (F6) changes to the **Plot** page.

COGO Area Division Results, Plot page

The points defining the area and the points of the new border are shown in black.

Next step

STORE (F1) stores the results and accesses **COGO Choose Area to be Divided**. For <Write Logfile: Yes> in **COGO Configuration, Logfile** page the result is written to the logfile.

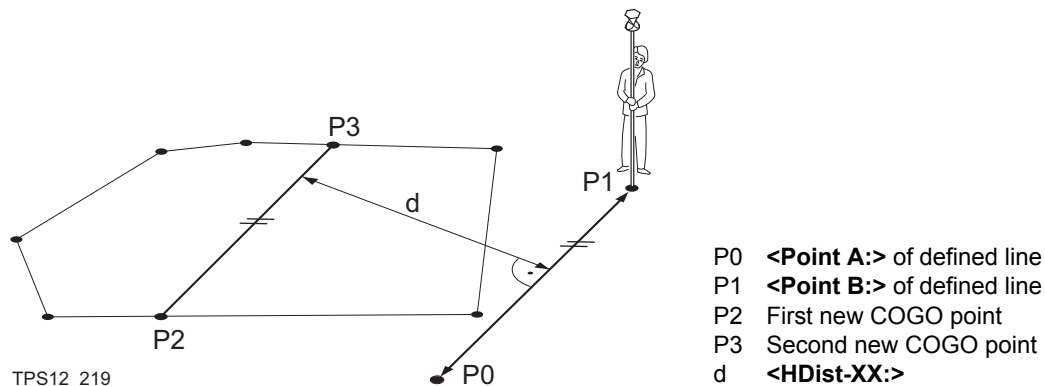
37.11.5

Working Example

Description

Application:	Divide an area by a defined, parallel line. The new border has to run through a known point with the point ID 100.
Working technique:	Real-time kinematic.
Goal:	The points forming the original area are to be picked. The area division is to be calculated.

Diagram



Requirements

- A real-time reference is running.
- For the rover: **<R-Time Mode: Rover>** in **CONFIGURE Real-Time Mode**.

Field procedure step-by-step

Step	Description
1.	Main Menu: Programs...\COGO
2.	COGO COGO Begin Select a job and a configuration set with the settings mentioned above.
	CONF (F2) to configure the COGO application program.
3.	CONT (F1) to access COGO COGO Menu .
4.	Highlight Area Division .
5.	CONT (F1) to access COGO Choose Area to be Divided .
6.	COGO Choose Area to be Divided <Area to Use: Survey New Area> <Area ID:> Type in an ID for the new area.
7.	CONT (F1) to access COGO Survey: Job Name .
8.	COGO Survey: Job Name <Point ID:> Type in a name for the first point of the area.
9.	ALL (F1) to measure and store the first point of the area.
10.	Survey all points belonging to the area. Point 100 must be part of the points.
11.	DONE (F4) once all points are surveyed.
12.	COGO Edit Area: Area ID Check the points forming the area.
13.	STORE (F1) to store the area and to access COGO Define How to Divide Area .
14.	COGO Define How to Divide Area, Input page

Step	Description
	<Divide By: Defined Line> <Using: Parallel Line> <Point A:> and <Point B:> Select the first and the second point of the line which is used as the reference for the new border. The new border will run parallel to this line. <Shift: Through Point> <Through Point: 100>
15.	CALC (F1) to access COGO Results of Area Division .
16.	COGO Results of Area Division, Result page The size of the two new sub areas is displayed,
17.	CONT (F1) to access COGO Area Division Results .
18.	COGO Area Division Results, Result1 page <Point ID:> The identifier for the first COGO point depending on the point ID template configured for <Survey Pts:> in CONFIGURE ID Templates. The point ID can be changed. <Ortho Ht:> or <Local Ell Ht:> are input fields. The height of the first point used in the COGO calculation is suggested. A height value to be stored with the calculated point can be typed in. The calculated coordinates are displayed. Type in a point ID.
	COORD (F2) views other coordinate types.
	RSLT1 (F3) and RSLT2 (F3) to view the first and second result.

Step	Description
	STAKE (F5) to access the Stakeout application program and stake out the calculated COGO point.
	SHIFT ELL H (F2) and SHIFT ORTH (F2) . Available for local coordinates. Changes between the ellipsoidal and the orthometric height.
	SHIFT INDIV (F5) for an individual point ID independent of the ID template. SHIFT RUN (F5) changes back to the next ID from the configured ID template.
19.	STORE (F1) stores the first COGO point and displays the coordinates of the second COGO point.
20.	STORE (F1) stores the second COGO point and returns to COGO Choose Area to be Divided .
21.	SHIFT QUIT (F6) to exit the COGO application program.

Description

Azimuths, distances and offsets required within the COGO traverse and intersection calculations can be selected from previously calculated inverse results.

**Select a result from
previous COGO inverse
calculations step-by-
step**

Step	Description
1.	Refer to "37.2 Accessing COGO" to access COGO Traverse Input or COGO Intersection Input .
2.	COGO XX Input, Input page Highlight <Azimuth:>, <HDist-XX:> or <Offset:>.
3.	LAST (F4) to access COGO Last Inverse Calculations .
4.	COGO Last Inverse Calculations All previous COGO inverse calculations stored in the active job are displayed, sorted by time with the most recent at the top. This screen consists of three columns. • First column From: The point ID of the first known point for the COGO inverse calculation. • Second column To: The point ID of the second known point for the COGO inverse calculation. • Third column: The information displayed can vary. ----- is displayed for unavailable information, for example if a height only point is used, Azimuth cannot be calculated. Azimuth: The direction from the first to the second known point.

Step	Description
	HDist-XX: The horizontal distance between the two known points. Date and Time when the COGO inverse calculation was stored.
	VIEW (F3) to view all calculated values for the highlighted COGO inverse calculation. This includes the height difference, the slope distance, the grade and the coordinate differences between the two known points.
	DEL (F4) to delete the highlighted COGO inverse calculation.
	MORE (F5) to display other information in the third column.
5.	Highlight the COGO inverse calculation of which a result is to be taken over into COGO XX Input, Input page.
6.	CONT (F1) to return to COGO XX Input, Input page.
	The relevant result of the highlighted COGO inverse calculation is copied into the field which was initially highlighted in COGO XX Input, Input page.

37.13

Modifying Values for Azimuths, Distances and Offsets

Description

The values for the azimuth, the distance and the offset required within the COGO traverse and intersection calculation can be mathematically modified.

Access step-by-step

Step	Description
1.	Refer to "37.2 Accessing COGO" to access COGO Traverse Input or COGO Intersection Input .
2.	COGO XX Input, Input page Highlight <Azimuth:>, <HDist-XX:> or <Offset:>.
3.	SHIFT MODIF (F4) to access COGO Modify Value .

COGO Modify Value

On this screen numbers can be typed in for the multiplication, division, addition and subtraction with the original azimuth, distance or offset value. The standard rules of mathematical operations apply.

12:52
COGO

IR STD I

Modify Value

Azimuth : 25.0000 g

Multiply : 0.000

Divide : -----

Add : 50.0000

Subtract : -----

Azimuth : 50.0000 g

Q2 a ↑

CONT

CONT (F1)

To accept the modified value and to return to the screen from where this screen was accessed. The modified value is copied into the field which was initially highlighted in **COGO XX Input, Input** page.

Description of fields

Field	Option	Description
<Azimuth:>, <HDist-XX:> or <Offset:>	Output	The name of the field and the value which was highlighted before accessing COGO Modify Value .
<Multiply:>	User input	The number to multiply by. - Minimum: -3000 - Maximum: 3000 ----- performs a multiplication by 1.
<Divide:>	User input	The number to divide by. Minimum: -3000

Field	Option	Description
		- Maximum: 3000 ----- performs a division by 1.
<Add:>	User input	The number to be added. - For azimuths Minimum: 0 Maximum: Full circle - For distances and offsets Minimum: 0 m Maximum: 30000000 m ----- performs an addition of 0.000.
<Subtract:>	User input	The number to be subtracted. - For azimuths Minimum: 0 Maximum: Full circle - For distances and offsets Minimum: 0 m Maximum: 30000000 m ----- performs a subtraction of 0.000.
<Azimuth:>, <HDist-XX:> or <Offset:>	Output	The modified value for the field in the first line. This field is updated with every mathematical operation. Angles greater than the full circle are reduced accordingly.

Next step

CONT (F1) accepts the modified value and returns to the screen from where this screen was accessed.

Example: Calculations for an azimuth

Step	User input	Value as calculated	Value as displayed
			<Azimuth: 250.0000> g
1.	<Multiply: 2>	500	<Azimuth: 100.0000> g
2.	<Divide: 3>	166.667	<Azimuth: 166.6670> g
3.	<Add: 300>	466.667	<Azimuth: 66.6670> g
4.	<Subtract: 100>	366.667	<Azimuth: 366.6670> g

Example: Calculations for a distance

The behaviour for an offset is identical.

Step	User input	Value as calculated	Value as displayed
			<HDist-Grid: 250.000> m
1.	<Multiply: 2>	500	<HDist-Grid: 500.000> m
2.	<Divide: 3>	166.667	<HDist-Grid: 166.667> m
3.	<Add: 300>	466.667	<HDist-Grid: 466.667> m
4.	<Subtract: 100>	366.667	<HDist-Grid: 366.667> m

38.1

Overview

Description

GPS measured points are always stored based on the global geocentric datum known as WGS 1984. Using GPS measured points with the TPS1200+/TS30/TM30 requires coordinates in a local grid system, for example, based on a country's official mapping datum or an arbitrary grid system used in a particular area such as a construction site. To convert the WGS 1984 coordinates into local coordinates a coordinate system needs to be created. Part of the coordinate system is the transformation used to convert coordinates from the WGS 1984 datum to the local datum.

The Determine Coordinate System application program allows:

- the parameters of a new transformation to be determined.
- the parameters of an existing transformation to be recomputed.

Transformations

A transformation is the process of converting coordinates from one geodetic datum to another.

Requirements

- Transformation parameters.
- In some cases a local ellipsoid.
- In some cases a map projection.
- In some cases a geoid model.

Transformation parameters

A transformation consists of a number of shifts, rotations and scale factors, depending on the type of transformation used. Not all of these parameters are always required. These parameters may already be known, or may need to be computed.

Description of transformations

Three different transformations are provided:

- Classic 3D, also called Helmert transformation
- Onestep
- Twostep

Transformation	Characteristic	Description
Classic 3D	Principle	Transforms coordinates from WGS 1984 cartesian to local cartesian coordinates and vice versa. A map projection can then be applied to obtain grid coordinates. As a similarity transformation, it is the most rigorous transformation type and keeps the full geometrical information.
	Positions and heights	Positions and heights are linked. The accuracy is fully maintained and does not distort the measurements.
	Use	When measurements are to be kept totally homogeneous.

Transformation	Characteristic	Description
	Requirements	• The positions and heights are known in WGS 1984 and in the local system for at least three points. Four points or more are recommended in order to obtain higher redundancy. • Parameters of the local ellipsoid. • Parameters of the local map projection in order to convert between grid coordinates and geodetic coordinates. • Parameters of the local geoid model in order to convert between orthometric and ellipsoidal heights. This is not compulsory.
	Area	Especially wide networks with large height differences. Local grid coordinates must be accurate.
	Advantage	• Accuracy of the measurements is maintained. • It may be used over any area as long as the local coordinates, including heights, are accurate.
	Disadvantage	• The local ellipsoid and map projection must be known for the local grid coordinates. In order to obtain accurate ellipsoidal heights the geoid separation at the measured points must be known. This may be determined from a geoid model. Refer to "10.2 Terminology".

Transformation	Characteristic	Description
Onestep	Principle	Transforms coordinates directly from WGS 1984 to local grid and vice versa without knowledge about the local ellipsoid or the map projection. Procedure: 1. The WGS 1984 coordinates are projected onto a temporary Transverse Mercator projection. The central meridian of this projection passes through the centre of gravity of the common control points. 2. The results of 1. are preliminary grid coordinates for the WGS 1984 points. 3. These preliminary grid coordinates are matched with the local grid control points in order to compute the Easting and Northing shifts, the rotation and the scale factor between these two sets of points. This is known as a classic 2D transformation. 4. The height transformation is a single dimension height approximation.
	Positions and heights	The position and height transformations are separated.

Transformation	Characteristic	Description
	Use	When measurements are to be forced to tie in with local existing control. For example: A site where the coordinates of the control points are based on a purely local grid. The coordinate values within this grid are totally arbitrary and are in no way connected with any ellipsoid or map projection. Obviously a Classic 3D transformation cannot be used here, as cartesian coordinates cannot be calculated from such a grid.
	Requirements	• The position is known in WGS 1984 and in the local system for at least one point. Three or more points are recommended in order to obtain redundancy. • Additional height information for one point enables the transformation of heights. • Parameters of the local geoid model. This is not compulsory. • No parameters of the local ellipsoid. • No parameters of the local map projection.
	Area	• Limited to about 10 x 10 km because no projection scale factor is applied and a standard Transverse Mercator projection is used to compute the preliminary WGS 1984 grid coordinates. • For areas without large height differences.

Transformation	Characteristic	Description
	Points and transformation parameters	The transformation parameters determined depend on the number of available points with position information. • One point: Classic 2D with shift in X and Y. • Two points: Classic 2D with shift in X and Y, rotation about Z and scale. • More than two points: Classic 2D with shift in X and Y, rotation about Z, scale and residuals.
	Points and height transformation	The type of height transformation performed depends on the number of available points with height information. • No point: No height transformation. • One point: Heights are shifted to fit to the height control point. • Two points: Average height shift between the two height control points. • Three points: Tilted plane through the three height control points to approximate the local heights. • More than three points: Best fitting average plane.

Transformation	Characteristic	Description
	Advantage	• Errors in height do not propagate into errors in position since the height and position transformations are separated. • If local heights have low accuracy or do not exist, a transformation of position can still be calculated and vice versa. • The height points and position points do not have to be the same points. • No parameters of the local ellipsoid and map projection is required. • Parameters may be computed with a minimum of points. Care should be taken when computing parameters using just one or two local points as the parameters calculated are valid in the vicinity of the points used for the transformation.
	Disadvantage	• Restriction in the area over which the transformation can be applied. This is mainly due to the fact that there is no provision for scale factor in the projection. • The accuracy in height depends on the undulation of the geoid. The bigger the geoid variations the less accurate the results are.

Transformation	Characteristic	Description
Twostep	Principle	Combines the advantages of the Onestep and the Classic 3D transformation. It allows treating position and height separately, but is not restricted to smaller areas. Procedure: 1. The WGS 1984 coordinates of the common control points are shifted closely to the local datum using a given Classic 3D pretransformation. This is typically a rough transformation valid for the country of the local datum. 2. The coordinates are projected onto a preliminary grid, but this time using the true map projection of the local points. 3. A 2D transformation is applied, exactly as with the Onestep transformation.
	Positions and heights	The position and height transformations are separated.
	Use	When measurements are to be forced to tie in with local existing control in areas larger than 10 x 10 km.
	Requirements	• The position is known in WGS 1984 and in the local system for at least one point. Four points or more are recommended in order to obtain higher redundancy. • Parameters of the local ellipsoid. • Parameters of the local map projection.

Transformation	Characteristic	Description
	Area	Parameters of a pretransformation. Virtually any area as long as the local coordinates are accurate.
	Points and transformation parameters	Identical with the Onestep transformation.
	Points and height transformation	Identical with the Onestep transformation.
	Advantage	- Errors in height do not propagate into errors in position since the height and position transformations are separated. - If local heights have low accuracy or do not exist, a transformation of position can still be calculated and vice versa. - The height points and position points do not have to be the same points.

Transformation	Characteristic	Description
	Disadvantage	- Fits much better over larger areas than a Onestep transformation. Reason: The first step of a Twostep transformation avoids any distortions due to the fact that the preliminary grid coordinates are built on a different ellipsoid than the local points. The second step ensures that the influence of the scale factor of the map projection is equally taken into account before the final 2D transformation is computed. - The local ellipsoid must be known. - The map projection must be known. - A pretransformation must be known. A null transformation can be used. - In order to obtain accurate ellipsoidal heights, the geoid separation at the measured points must be known. This may be determined from a geoid model.



With one common control point, it is still possible to calculate a Classic 3D transformation, as long as the rotations and the scale parameter are fixed. Such a transformation fits perfectly in the vicinity of the common control point, but is degraded by the distance from that point, because neither the orientation of the local reference frame nor any scale factor within the local datum can be taken into account.

Requirements to determine a transformation

To determine a transformation it is necessary to have common control points whose positions are known in both WGS 1984 coordinates and local coordinates. The more points that are common between datums the more accurately the transformation parameters can be calculated. Depending on the type of transformation used, details about the map projection, the local ellipsoid and a local geoidal model may also be needed.

Requirements for control points

- The control points used for the transformation should surround the area for which the transformation is to be applied. It is not good practice to survey or convert coordinates outside of the area covered by the control points as extrapolation errors may be introduced.
- When a geoid field file and/or a CSCS field file is used in the determination of a coordinate system, the control points for the calculation must fall within the areas of the field files.

Coordinate system determination methods

Two different methods for determining a coordinate system are available:

Coordinate system determination method	Characteristic	Description
Normal	Number of control points needed Transformation to use	One or more control points for both the WGS 1984 and the local datum. Onestep, Twostep or Classic 3D, depending on number of control points and available information.
One point localisation	Number of control points needed	One control point for both the WGS 1984 and the local datum.

Coordinate system determination method	Characteristic	Description
	Transformation to use	• Onestep or Twostep when information about the necessary rotations and scale factor is known. • Classic 3D when the rotations are to be set to zero and the scale factor to one.

38.2

Accessing Determine Coordinate System

Access

Select **Main Menu: Programs...\Determine Coordinate System**.

OR

Press **PROG**. Highlight **Determine Coordinate System**. **CONT (F1)**. Refer to "36.2 Accessing the Programs Menu" for information on the **PROG** key.

OR

Press a hot key configured to access the screen **DET C SYS Determine Coord System Begin**. Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

DET C SYS Determine Coord System Begin



Name : new coord system

WGS84 Pts Job: wgs84 job
Local Pts Job: local job

Method : Normal



CONT (F1)

To confirm the selections and to continue with the subsequent screen.

CONF (F2)

To configure the coordinate system determination method selected in **<Method>**.

CSYS (F6)

Available for **<Method: Normal>**. To access **DET C SYS Coordinate Systems** and choose a coordinate system to edit. Refer to "10.4.2 Editing a Coordinate System".

Description of fields

Field	Option	Description
<Name:>	User input	A unique name for the coordinate system. The name may be up to 16 characters in length and may include spaces. Input is mandatory.  Entering the name of a coordinate system will allow that existing system to be updated. Refer to "10.4.2 Editing a Coordinate System".
<WGS84 Pts Job:>	Choicelist	The job from which the points with WGS84 coordinates will be taken. Opening the choicelist accesses MANAGE Jobs (Device). Refer to "5 Manage...\Jobs".
<Local Pts Job:>	Choicelist	The job from which the points with local coordinates will be taken. Opening the choicelist accesses MANAGE Jobs (Device). Refer to "5 Manage...\Jobs".
<Method:>	Normal or One Pt Localistn	Method used to determine the coordinate system.

Next step

IF	AND	THEN
<Method: Normal>	the application program needs configuring	CONF (F2) to access DET C SYS Configuration . Refer to "38.3.1 Configuring Determine Coordinate System - Normal".

IF	AND	THEN
<Method: One Pt Localistn>	the application program needs configuring	CONF (F2) to access DET C SYS Configuration . Refer to "38.3.2 Configuring Determine Coordinate System - One Point Localisation".
<Method: Normal>	the application program does not need configuring	CONT (F1) to access DET C SYS Step 1: Choose Transform Type . Refer to "39 Determine Coordinate System - Normal".
<Method: One Pt Localistn>	the application program does not need configuring	CONT (F1) to access DET C SYS Step 1: Choose Transform Type . Refer to "40 Determine Coordinate System - One Point Localisation".

38.3

38.3.1

Configuring Determine Coordinate System

Configuring Determine Coordinate System - Normal

Description

The configuration of **DET C SYS**, normal method, allows options to be set which are used as the default options within the Determine Coordinate System application program when using the normal method. These settings are stored within the active configuration set.

Access step-by-step

Step	Description
1.	Refer to "38.2 Accessing Determine Coordinate System" to access DET C SYS Determine Coord System Begin .
2.	CONF (F2) to access DET C SYS Configuration, Method page.
3.	Select <Default Method: Normal> .

DET C SYS Configuration, Method page

This screen consists of the **Method** page, the **Residuals** page and the **Classic 3D** page. The explanations for the softkeys given below are valid for all pages, unless otherwise stated.

13:00
DET C SYS

IR STD I

Configuration

Method **Residuals** Classic 3D

Default Method: Normal

Default Transformation: Classic 3D

Default Height Mode : Ellipsoidal

Default Match : Pos & Height

Q2 a ↑

CONT PAGE

CONT (F1)

To accept changes and return to the screen from where this screen was accessed.

FIX (F4) or ADJUST (F4)

Available for **Classic 3D** page unless **<Transf Model:>** is highlighted. To define which parameters are computed or fixed in the Classic 3D transformation. Refer to paragraph "DET C SYS Configuration, Classic 3D page".

PAGE (F6)

To change to another page on this screen.

Description of fields

Field	Option	Description
<Default Method:>	Normal or One Pt Localistn	Method used to determine the coordinate system.  The fields and pages available are different if <Default Method: One Pt Localistn> is selected. Refer to "38.3.2 Configuring Determine Coordinate System - One Point Localisation" for information on how to configure DET C SYS using the one point localisation method.
<Default Transformation:>	Onestep, Twostep or Classic 3D	The default transformation to be used when determining the coordinate system. Refer to "38.1 Overview".

Field	Option	Description
<Default Height Mode:>	Orthometric or Ellipsoidal	The default height type to be used when determining the coordinate system.
<Default Match:>	Pos & Height, Pos Only, Height Only or <None>	Options available depend on the choice made for <Default Transformation:> . Point parameters to be matched between points in both datums.

Next step

PAGE (F6) changes to the **Residuals** page. Refer to paragraph "DET C SYS Configuration, Residuals page".

DET C SYS Configuration, Residuals page

Description of fields

Field	Option	Description
<Easting:>	User input	The limit above which Easting residuals will be flagged as possible outliers.
<Northing:>	User input	The limit above which Northing residuals will be flagged as possible outliers.
<Height:>	User input	The limit above which Height residuals will be flagged as possible outliers.
<Default Residual Distbtn:>		The method by which the residuals of the control points will be distributed throughout the transformation area.

Field	Option	Description
	None	No distribution is made. Residuals remain with their associated points.
	1/Distance^{xx}	Distributes the residuals according to the distance between each control point and the newly transformed point.
	Multiquad-ratic	Distributes the residuals using a multiquadratic interpolation approach.

Next step

PAGE (F6) changes to the **Classic 3D** page. Refer to paragraph "DET C SYS Configuration, Classic 3D page".

DET C SYS Configuration, Classic 3D page

The settings on this page define the parameters to be used in a Classic 3D transformation. Refer to "10.2 Terminology" for more information about how many transformation parameters are needed, based on the number of points common to both datums.

IF the value for a field is	THEN the value for this parameter will be
-----	calculated.
any number	fixed to that value.

Description of fields

Field	Option	Description
<Transf Model:>	Bursa Wolf or Molodensky-Bad	The transformation model to be used. Refer to standard surveying literature for details on the models.
<Shift dX:>	User input	Shift in X direction.
<Shift dY:>	User input	Shift in Y direction.
<Shift dZ:>	User input	Shift in Z direction.
<Rotation X:>	User input	Rotation around the X axis.
<Rotation Y:>	User input	Rotation around the Y axis.
<Rotation Z:>	User input	Rotation around the Z axis.
<Scale:>	User input	Scale factor.

Next step

IF	AND	THEN
a field displays ----	the parameter needs to be fixed to a value	highlight the field. FIX (F4) . Enter the value of the parameter.
a field displays a value	the parameter needs to be calculated	highlight the field. ADJUST (F4) .

IF	AND	THEN
all parameters are configured	-	CONT (F1) to return to DET C SYS Determine Coord System Begin.

38.3.2

Configuring Determine Coordinate System - One Point Localisation

Description

The configuration of **DET C SYS**, one point localisation method, allows options to be set which are used as the default options within the Determine Coordinate System application program when using the one point localisation method. These settings are stored within the active configuration set.

Access step-by-step

Step	Description
1.	Refer to "38.2 Accessing Determine Coordinate System" to access DET C SYS Determine Coord System Begin .
2.	CONF (F2) to access DET C SYS Configuration, Method page.
3.	Select <Default Method: One Pt Localistn> .

DET C SYS Configuration, Method page

This screen consists of the **Method** page, the **Onestep** page, the **Twostep** page and the **Classic 3D** page. The explanations for the softkeys given below are valid for all pages.

13:02
DET C SYS

IR STD I

Configuration

Method **Onestep** Twostep Classic 3D

Default Method: One Pt Localistn

Default Transformation: Classic 3D

Default Height Mode : Ellipsoidal

Q2 a ↑

CONT **PAGE**

CONT (F1)

To accept changes and return to the screen from where this screen was accessed.

PAGE (F6)

To change to another page on this screen.

Description of fields

Field	Option	Description
<Default Method:>	Normal or One Pt Localistn	Method used to determine the coordinate system.  The fields and pages available are different if <Default Method: Normal> is selected. Refer to "38.3.1 Configuring Determine Coordinate System - Normal" for information on how to configure DET C SYS using the normal method.
<Default Transformation:>	Onestep, Twostep or Classic 3D	The default transformation to be used when determining the coordinate system. Refer to "10.2 Terminology".

Field	Option	Description
<Default Height Mode:>	Orthometric or Ellipsoidal	The default height mode to be used when determining the coordinate system.

Next step

PAGE (F6) changes to the **Onestep** page. Refer to paragraph "DET C SYS Configuration, Onestep page".

DET C SYS Configuration, Onestep page

Description of fields

Field	Option	Description
<Default Rotation:>		The default rotation method to be used in the transformation process.
	Use WGS84 North	Rotate to North as defined by WGS 1984.
	User Entered Convergence Angle	Rotation can be manually typed in. Angle between grid North and geodetic North at a certain point. Refer to "40.2 Determine Coordinate System - Onestep Transformation" paragraph "DET C SYS Step 4: Determine Rotation" for a diagram.
	Two WGS84 Points	Rotation defined by two points on the WGS 1984 datum. Refer to "40.2 Determine Coordinate System - Onestep Transformation" paragraph "DET C SYS Step 4: Determine Rotation" for a diagram.

Field	Option	Description
<Default Height SF:>		The default method for determining the height scale factor to be used in the transformation process.
	User Entered	Height scale factor can be manually typed in.
	Known WGS84 Pt	Height scale factor defined by a known point on the WGS 1984 datum.
	Known WGS84 Ht	Height scale factor defined by the known height of a point on the WGS 1984 datum.

Next step

PAGE (F6) changes to the **Twostep** page. Refer to paragraph "DET C SYS Configuration, Twostep page".

DET C SYS Configuration, Twostep page

Description of fields

Field	Option	Description
<Default Rotation:>		The default rotation method to be used in the transformation process.
	Use WGS84 North	Rotate to North as defined by WGS 1984.
	User Entered	Rotation can be manually typed in.
	Convergence Angle	Angle between grid North and geodetic North at a certain point. Refer to "40.2 Determine Coordinate System - Onestep Transformation" paragraph "DET C SYS Step 4: Determine Rotation" for a diagram.

Field	Option	Description
	Two WGS84 Points	Rotation defined by two points on the WGS 1984 datum. Refer to "40.2 Determine Coordinate System - Onestep Transformation" paragraph "DET C SYS Step 4: Determine Rotation" for a diagram.
<Default Scale:>	User Entered Compute CSF	The default method for determining the scale factor to be used in the transformation process. Scale factor can be manually typed in Compute the combined grid and height scale factor.
<Deflt Grid SF:>	User Entered or Known Local Pt	Available for <Default Scale: Compute CFS> . Default method for computing the grid scale factor of the known point.
<Deflt Ht SF:>	User Entered, Known Local Pt or Known Local Ht	Available for <Default Scale: Compute CFS> . Default method for computing the height scale factor of the known point.

Next step

PAGE (F6) changes to the **Classic 3D** page. Refer to paragraph "DET C SYS Configuration, Classic 3D page".

**DET C SYS
Configuration,
Classic 3D page**

Description of fields

Field	Option	Description
<Default Local Height:>	Use WGS84 Pt Ht or Use Local Pt Ht	Source of height information to use.

Next step

CONT (F1) returns to **DET C SYS Determine Coord System Begin**.

39.1

Overview

Description

The Determine Coordinate System application program allows a new coordinate system to be determined or a coordinate system to be updated. The coordinate system is defined by the transformation used to convert coordinates from one geodetic datum to another. Onestep, Twostep or Classic 3D transformations are available. Refer to "38 Determine Coordinate System - General" for more information.

Next step

IF	THEN
a new coordinate system is to be determined	Refer to "39.2 Determining a New Coordinate System".
a coordinate system is to be updated	Refer to "39.3 Updating a Coordinate System".

39.2

Determining a New Coordinate System

Access step-by-step

Step	Description
1.	Refer to "38.2 Accessing Determine Coordinate System" to access DET C SYS Determine Coord System Begin .
2.	Select <Method: Normal> .
3.	CONT (F1) to access DET C SYS Step 1: Choose Transform Type .

DET C SYS Step 1: Choose Transform Type



Transform Name: **new coord system**
Transform Type: **Classic 3D** |>
Height Mode : **Ellipsoidal** |>



CONT (F1)

To confirm the selections and to continue with the subsequent screen.

Description of fields

Field	Option	Description
<Transfrm Name:>	User input	A unique name for the transformation. The name may be up to 16 characters in length and may include spaces. If a coordinate system is being updated then its name is displayed.
<Transfrm Type:>	Onestep, Twostep or Classic 3D Output	The type of transformation to be used when determining a coordinate system. Available when determining a new coordinate system. Available when updating a coordinate system. The transformation type shown is the same as the transformation used in the existing system.
<Height Mode:>	Orthometric or Ellipsoidal Output	The height mode to be used in the determination of a coordinate system. Available when determining a new coordinate system. Available when updating a coordinate system. The height mode shown is the same as the mode used in the existing system.

Next step

CONT (F1) continues to **DET C SYS Step 2: Choose Parameters**.



If a coordinate system was chosen to be edited in **DET C SYS Determine Coord System Begin**, pressing **CONT (F1)** accesses **DET C SYS Step 3: Match Points (n)**. Pressing **ESC** does not re-access **DET C SYS Determine Coord System Begin** but accesses **DET C SYS Step 2: Choose Parameters** and **DET C SYS Step 1: Choose Transform Type**.

DET C SYS Step 2: Choose Parameters

This screen contains different fields, depending on what transformation type was chosen in **DET C SYS Step 1: Choose Transform Type**.

11:42
DET C SYS
Step 2: Choose Parameters
Ellipsoid : new ellipsoid
Projection : new projection
Geoid Model : <None>
CSCS Model : <None>

CONT (F1)

CONT

To confirm the selections and to continue with the subsequent screen.

For <Transfrm Type: Onestep>

Description of fields

Field	Option	Description
<Geoid Model:>	Choicelist	The geoid model to be used in the transformation. Geoid models from MANAGE Geoid Models can be selected.

For <Transfrm Type: Twostep>

Description of fields

Field	Option	Description
<Pre Transform:>	Choicelist	The pre-transformation to use for the preliminary 3D transformation. All 3D transformations from MANAGE Transformations can be selected.
<Ellipsoid:>	Choicelist	The ellipsoid to use in the transformation. All ellipsoids from MANAGE Ellipsoids can be selected.
	Output	The ellipsoid being used by a hard wired projection when selected in <Projection:>.
<Projection:>	Choicelist	The projection to use in the transformation. All projections from MANAGE Projections can be selected.
<Geoid Model:>	Choicelist	The geoid model to be used in the transformation. Geoid models from MANAGE Geoid Models can be selected.

For <Transfrm Type: Classic 3D>

Description of fields

Field	Option	Description
<Ellipsoid:>	Choicelist	The ellipsoid to use in the transformation. All ellipsoids from MANAGE Ellipsoids can be selected.

Field	Option	Description
	Output	The ellipsoid being used by a hard wired projection when selected in <Projection:> .
<Projection:>	Choicelist	The projection to use in the transformation. All projections from MANAGE Projections can be selected.
<Geoid Model:>	Choicelist	The geoid model to use in the transformation. Geoid models from MANAGE Geoid Models can be selected.
<CSCS Model:>	Choicelist	The CSCS model to use in the transformation. All CSCS models from MANAGE CSCS Models can be selected.

Next step

CONT (F1) continues to **DET C SYS Step 3: Match Points (n)**.

DET C SYS

Step 3: Match Points (n)

This screen provides a list of points chosen from **<WGS84 Pts Job:>** and **<Local Pts Job:>**. The number of control points matched between both jobs is indicated in the title, for example **DET C SYS Step 3: Match Points (4)**. Unless there is no pair of matching points in the list all softkeys are available. Refer to "39.4 Matching Points" for information on how to match points.

08:10		IR STD I			
DET C SYS					
Step 3: Match Points (4)					
WGS84 Pts	Local Pts	Match			
101	101	P & H			
200	200	P & H			
300	300	P & H			
400	400	P & H			
					Q2 a ↑
CALC	NEW	EDIT	DEL	MATCH	AUTO

CALC (F1)

To confirm the selections, compute the transformation and continue with the subsequent screen.

NEW (F2)

To match a new pair of points. This pair is added to the list. A new point can be measured. Refer to "39.4.2 Selecting a New Pair of Matching Points".

EDIT (F3)

To edit the highlighted pair of matched points. Refer to "39.4.3 Editing a Pair of Matching Points".

DEL (F4)

To delete the highlighted pair of matched points from the list.

MATCH (F5)

To change the type of match for a highlighted pair of matched points. Refer to "Description of columns".

AUTO (F6)

To scan both jobs for points that have the same point ID. Points with matching point ID's are added to the list.

SHIFT PARAM (F5)

To configure Classic 3D transformation parameters for **<Transfrm Type: Classic 3D>** or 2D & Height transformation parameters for **<Transfrm Type: Onestep>** and **<Transfrm Type: Twostep>** in **DET C SYS Step 1: Choose Transform Type**. Refer to "38.3.1 Configuring Determine Coordinate System - Normal" paragraph "DET C SYS Configuration, Classic 3D page".

Description of columns

Column	Description
WGS84 Pts	The point ID of the points chosen from <WGS84 Pts Job:> .
Local Pts	The point ID of the points chosen from <Local Pts Job:> .
Match	The type of match to be made between the points. This information is used in the transformation calculation. Position & Height, Position only, Height only or None. - For <Transfrm Type: Onestep> or <Transfrm Type: Twostep> possible options are P & H, P only, H only or None. - For <Transfrm Type: Classic 3D> possible options are P & H or None. None removes matched common points from the transformation calculation but does not delete them from the list. This can be used to try and improve the residuals that are obtained when calculating the transformation.

Next step

CALC (F1) computes the transformation and continues to **DET C SYS Step 4: Check Residuals**. Refer to paragraph "DET C SYS Step 4: Check Residuals".



If a coordinate system to be updated contains a point that was deleted from the active job and a new point was created in that job with the same point ID but different coordinates, the coordinates of the old point will still be used for the calculation. Pressing **EDIT (F3)** to edit a highlighted pair of matched points containing the deleted point, will overwrite the coordinates of the old point and the coordinates of the new point will be used in the calculation.

DET C SYS Step 4: Check Residuals

Displays a list of the matched points used in the transformation calculation and their associated residuals.

08:14	IR	STD	I	Bluetooth	GPS	Barcode
DET C SYS						
Step 4: Check Residuals						
WGS84 Pts	East[m]	North[m]				
101	0.009?	0.004				
200	0.000	0.003				
300	-0.002	-0.004				
400	-0.008	-0.004?				
			Q2 a ↑			
CONT		RESLT		MORE		

CONT (F1)

To accept the residuals and to continue with the subsequent screen.

RESLT (F3)

To view results of the transformation.

Accesses **DET C SYS Transformation Results**. Refer to "39.5 Transformation Results".

MORE (F5)

To display information about height residuals.

Description of columns

Column	Description
WGS84 Pts	The point ID of the points chosen from <WGS84 Pts Job:> .
East	The Easting residual. If positions were not used in the transformation calculation then ----- will be displayed.
North	The Northing residual. If positions were not used in the transformation calculation then ----- will be displayed.
Height	The Height residual. If heights were not used in the transformation calculation then ----- will be displayed.
!	Indicates residuals that exceed the residual limit defined in DET C SYS Configuration, Residuals page.
!	Indicates the largest residual in East, North and Height .

Next step

IF the residuals are	THEN
unacceptable	ESC returns to DET C SYS Step 3: Match Points (n) . Matched points can be edited, deleted or temporarily removed from the list and the transformation recalculated.
acceptable	CONT (F1) continues to DET C SYS Step 5: Store Coord System .

DET C SYS
Step 5: Store Coord
System,
Summary page

This screen consists of the **Summary** page and the **Coord System** page. The **Coord System** page contains different fields, depending on what transformation type was chosen in **DET C SYS Step 1: Choose Transform Type**. The explanations for the softkeys given below are valid for all pages.

09:34
 DET C SYS
Step 5: Store Coord System
 Summary | Coord System
 Name : dfas
 Transfrm Type: Classic 3D
 Matched Pts : 4
 Largest Residuals
 Easting : 0.008 m
 Northing : 0.007 m
 Height : 0.002 m
 STORE PAGE Q2 a ↑

STORE (F1)

To store the coordinate system to the DB-X and return to **TPS1200+/TS30/TM30 Main Menu**.

PAGE (F6)

To change to another page on this screen.

Description of fields

Field	Option	Description
<Name:>	User input	The name of the coordinate system can be changed. The name may be up to 16 characters in length and may include spaces.
<Transfrm Type:>	Output	The type of transformation used, as defined in DET C SYS Step 1: Choose Transform Type .

Field	Option	Description
<Matched Pts:>	Output	Number of matched points, as defined in DET C SYS Step 3: Match Points (n) .
<Easting:>	Output	Largest Easting residual from the transformation calculation.
<Northing:>	Output	Largest Northing residual from the transformation calculation.
<Height:>	Output	Largest Height residual from the transformation calculation.

Next step

PAGE (F6) changes to the **Coord System** page. Refer to paragraph "DET C SYS Step 5: Store Coord System, Coord System page".

DET C SYS Step 5: Store Coord System, Coord System page

For <Transfrm Type: Onestep>

Description of fields

Field	Option	Description
<Residuals:>	None, 1/Distance^{xx} or Multiquad- ratic	The method by which the residuals of the control points will be distributed throughout the transformation area. Refer to "38.3.1 Configuring Determine Coordinate System - Normal" paragraph "DET C SYS Configuration, Residuals page".
<Geoid Model:>	Output	Name of geoid model used, as defined in DET C SYS Step 2: Choose Parameters .

For <Transfrm Type: Twostep>

Description of fields

Field	Option	Description
<Residuals:>	None, 1/Distance ^{xx} or Multiquad- ratic	The method by which the residuals of the control points will be distributed throughout the transformation area. Refer to "38.3.1 Configuring Determine Coordinate System - Normal" paragraph "DET C SYS Configuration, Residuals page".
<Pre Transform:>	Output	Name of the pretransformation used, as defined in DET C SYS Step 1: Choose Transform Type.
<Ellipsoid:>	Output	Name of ellipsoid used, as defined in DET C SYS Step 2: Choose Parameters.
<Projection:>	Output	Name of projection used, as defined in DET C SYS Step 2: Choose Parameters.
<Geoid Model:>	Output	Name of geoid model used, as defined in DET C SYS Step 2: Choose Parameters.

For <Transform Type: Classic 3D>

Description of fields

Field	Option	Description
<Residuals:>	None, 1/Distance^{XX} or Multiquad- ratic	The method by which the residuals of the control points will be distributed throughout the transformation area. Refer to "38.3.1 Configuring Determine Coordinate System - Normal" paragraph "DET C SYS Configuration, Residuals page".
<Transform:>	Output	Name of transformation used, as defined in DET C SYS Step 1: Choose Transform Type .
<Ellipsoid:>	Output	Name of ellipsoid used, as defined in DET C SYS Step 2: Choose Parameters .
<Projection:>	Output	Name of projection used, as defined in DET C SYS Step 2: Choose Parameters .
<Geoid Model:>	Output	Name of geoid model used, as defined in DET C SYS Step 2: Choose Parameters .
<CSCS Model:>	Output	Name of CSCS model used, as defined in DET C SYS Step 2: Choose Parameters .

Next step

STORE (F1) stores the coordinate system to the DB-X and attaches it to the **<WGS84 Pts Job:>** selected in **DET C SYS Determine Coord System Begin**, replacing any coordinate system attached to this job. **<WGS84 Pts Job:>** becomes the active job.

39.3

Updating a Coordinate System

Access step-by-step

Step	Description
1.	Refer to "38.2 Accessing Determine Coordinate System" to access DET C SYS Determine Coord System Begin .
2.	Select <Method: Normal> .
3.	Enter the name of a coordinate system in <Name:> OR CSYS (F6) to select a coordinate system.
4.	CONT (F1) to access DET C SYS Step 3: Match Points (n) .
5.	All the following steps are identical with the determination of a new coordinate system from DET C SYS Step 3: Match Points (n) onwards. Refer to "39.2 Determining a New Coordinate System". Follow the instructions from paragraph "DET C SYS Step 3: Match Points (n)" onwards.

39.4

39.4.1

Description

Matching Points

Overview

Before calculating a transformation, it must be defined which points in **<WGS84 Pts Job:>** and **<Local Pts Job:>** are to be matched. Pairs of matched points are displayed in one line in **DET C SYS Step 3: Match Points (n)**. New pairs of matched points can be created, existing pairs of matched points can be edited and pairs of matched points can be deleted.

39.4.2

Selecting a New Pair of Matching Points

Match points step-by-step

Step	Description
1.	Refer to "39.2 Determining a New Coordinate System" to access DET C SYS Step 3: Match Points (n) .
2.	NEW (F2) to access DET C SYS Choose Matching Points .
3.	DET C SYS Choose Matching Points <WGS84 Point:> A WGS 1984 control point. All WGS 1984 stored points from MANAGE Data: Job Name can be selected. <Known Point:> A local control point. All local stored points from MANAGE Data: Job Name of any class, except NONE , can be selected. <Match Type:> The type of match to be made between the points selected in <WGS84 Point:> and <Known Point:> . Position and Height , Position Only , Height Only or None . - For <Transfrm Type: Onestep> or <Transfrm Type: Twostep> possible options are Pos & Ht, Pos Only, Height Only or None. - For <Transfrm Type: Classic 3D> possible options are Pos & Ht or None. Select a control point from both jobs that occupy the same position on the different datums.
	SURVY (F5) . Available when <Known Point:> is highlighted. To measure a point and store it in <Local Pts Job:> .
4.	CONT (F1) returns to DET C SYS Step 3: Match Points (n) and adds a new line of matched points to the matched points list.

39.4.3

Editing a Pair of Matching Points

Edit matching points step-by-step

Step	Description
1.	Refer to "39.2 Determining a New Coordinate System" to access DET C SYS Step 3: Match Points (n) .
2.	DET C SYS Step 3: Match Points (n) Highlight the pair of matching points to be edited.
3.	EDIT (F3) to access DET C SYS Edit Matching Points .
4.	All the following steps are identical with the selecting of new matching points. Refer to "39.4.2 Selecting a New Pair of Matching Points". Follow the instructions from step 3. onwards.

39.5

39.5.1

Transformation Results

Accessing Transformation Results

Access step-by-step

Step	Description
	The results of a transformation can be displayed during the process of determining or updating a coordinate system.
1.	Refer to "39.2 Determining a New Coordinate System". Follow the instructions to access DET C SYS Step 4: Check Residuals .
2.	RESLT (F3) to access DET C SYS Transformation Results .

Next step

IF	THEN
<Transfrm Type: Onestep> or <Transfrm Type: Twostep>	Refer to "39.5.2 Results for Onestep and Twostep Transformations".
<Transfrm Type: Classic 3D>	Refer to "39.5.3 Results for Classic 3D Transformation".

39.5.2

DET C SYS Transformation Results, Position page

Results for Onestep and Twostep Transformations

Results of the transformation between the WGS 1984 datum and the local datum are shown for each of the transformation parameters. This screen consists of the **Position** page and the **Height** page. The explanations for the softkeys given below are valid for the pages as indicated.

09:36		+ IR STD I		[Icons]	
DET C SYS					
Transformation Results					
Position		Height			
Shift dX	:	249519.0014 m			
Shift dY	:	758220.2394 m			
Rotation	:	-5511.36979 "			
Scale	:	34.6421 ppm			
Rot Orig X	:	3.6845 m			
Rot Orig Y	:	5.8791 m			
		Q2 a ↑			
CONT			SCALE	RMS	PAGE

CONT (F1)

To return to **DET C SYS Step 4: Check Residuals**.

SCALE (F4) or PPM (F4)

Available on the **Position** page. To switch between **<Scale:>** displaying the true scale and displaying the ppm.

RMS (F5) or PARAM (F5)

To switch between the root mean square values of the parameters and the actual parameter values. The name of the screen changes to **DET C SYS Transformation Results rms** when displaying rms values.

PAGE (F6)

To change to another page on this screen.

Description of fields

Field	Option	Description
<Shift dX:>	Output	Shift in X direction.
<Shift dY:>	Output	Shift in Y direction.
<Rotation:>	Output	Rotation of transformation.
<Scale:>	Output	Scale factor used in transformation. Either true scale or ppm.
<Rot Orig X:>	Output	Position in the X direction of the origin of rotation.
<Rot Orig Y:>	Output	Position in the Y direction of the origin of rotation.

Next step

PAGE (F6) changes to the **Height** page. Refer to paragraph "DET C SYS Transformation Results, Height page".

DET C SYS Transformation Results, Height page

Description of fields

Field	Option	Description
<Slope in X:>	Output	Tilt of the transformation in the X direction.
<Slope in Y:>	Output	Tilt of the transformation in the Y direction.
<Height Shift:>	Output	Shift in height between WGS 1984 datum and local datum.

Next step

CONT (F1) returns to **DET C SYS Step 4: Check Residuals**.

39.5.3

DET C SYS Transformation Results, Parameters page

Results for Classic 3D Transformation

Results of the transformation between the WGS 1984 datum and the local datum are shown for each of the transformation parameters. This screen consists of the **Parameters** page and the **Rotn Origin** page. The explanations for the softkeys given below are valid for the pages as indicated.

09:38
DET C SYS

Transformation Results

Parameters Rotn Origin

Shift dX : -665.0537 m
Shift dY : -2.1071 m
Shift dZ : -365.9000 m
Rotation X : -0.96799 "
Rotation Y : -0.75489 "
Rotation Z : -0.57971 "
Scale : -5.7349 ppm

CONT SCALE RMS PAGE

CONT (F1)

To return to **DET C SYS Step 4: Check Residuals**.

SCALE (F4) or PPM (F4)

Available on the **Parameters** page. To switch between **<Scale:>** displaying the true scale and displaying the ppm.

RMS (F5) or PARAM (F5)

To switch between the root mean square values of the parameters and the actual parameter values.

PAGE (F6)

To change to another page on this screen.

Description of fields

Field	Option	Description
<Shift dX:>	Output	Shift in X direction.
<Shift dY:>	Output	Shift in Y direction.
<Shift dZ:>	Output	Shift in Z direction.
<Rotation X:>	Output	Rotation around the X axis.

Field	Option	Description
<Rotation Y:>	Output	Rotation around the Y axis.
<Rotation Z:>	Output	Rotation around the Z axis.
<Scale:>	Output	Scale factor used in transformation. Either true scale or ppm.

Next step

PAGE (F6) changes to the **Rotn Origin** page. Refer to paragraph "DET C SYS Transformation Results, Rotn Origin page".

DET C SYS Transformation Results, Rotn Origin page

Description of fields

Field	Option	Description
<Transf Model:>	Output	Classic 3D transformation model used for the transformation as defined in DET C SYS Configuration, Classic 3D page.
<Rot Orig X:>	Output	Available for <Transf Model: Molodensky-Bad>. Position in the X direction of the origin of rotation.
<Rot Orig Y:>	Output	Available for <Transf Model: Molodensky-Bad>. Position in the Y direction of the origin of rotation.
<Rot Orig Z:>	Output	Available for <Transf Model: Molodensky-Bad>. Position in the Z direction of the origin of rotation.

Next step

CONT (F1) returns to **DET C SYS Step 4: Check Residuals**.

40.1

Accessing Determine Coordinate System - One Point Localisation

Access step-by-step

Step	Description
1.	Refer to "38.2 Accessing Determine Coordinate System" to access DET C SYS Determine Coord System Begin .
2.	Select <Method: One Pt Localistn> .
3.	CONT (F1) to access DET C SYS Step 1: Choose Transform Type .

DET C SYS

Step 1: Choose Transform Type



Transform Name: new coord system
 Transform Type: **Onestep** **↵**
 Height Mode : **Ellipsoida1** **↵**

**CONT (F1)**

To confirm the selections and to continue with the subsequent screen.

Description of fields

Field	Option	Description
<Transfrm Name:>	User input	A unique name for the coordinate system. The name may be up to 16 characters in length and may include spaces.
<Transfrm Type:>	Onestep , Twostep or Classic 3D	The type of transformation to be used when determining a coordinate system.
<Height Mode:>	Orthometric or Ellipsoidal	The height mode to be used in the determination of a coordinate system

Next step

IF	THEN
<Transfrm Type: Onestep >	CONT (F1) to access DET C SYS Step 2: Choose Parameters . Refer to "40.2 Determine Coordinate System - Onestep Transformation".
<Transfrm Type: Twostep >	CONT (F1) to access DET C SYS Step 2: Choose Parameters . Refer to "40.3 Determine Coordinate System - Twostep Transformation".
<Transfrm Type: Classic 3D >	CONT (F1) to access DET C SYS Step 2: Choose Parameters . Refer to "40.4 Determine Coordinate System - Classic 3D Transformation".



<Azimuth:> is used throughout this chapter. This should always be considered to also mean **<Bearing:>**.

40.2

Determine Coordinate System - Onestep Transformation

Access step-by-step

Step	Description
1.	Refer to "40.1 Accessing Determine Coordinate System - One Point Localisation" to access DET C SYS Step 1: Choose Transform Type .
2.	DET C SYS Step 1: Choose Transform Type <Transfrm Type: Onestep>
3.	CONT (F1) to access DET C SYS Step 2: Choose Parameters .

DET C SYS

Step 2: Choose Parameters



Geoid Model : <None>  



CONT (F1)

To confirm the selections and to continue with the subsequent screen.

Description of fields

Field	Option	Description
<Geoid Model:>	Choicelist	The geoid model to be used in the transformation. Geoid models from MANAGE Geoid Models can be selected.

Next step

CONT (F1) continues to **DET C SYS Step 3: Choose Common Point**.

DET C SYS Step 3: Choose Common Point

11:58
DET C SYS

Step 3: Choose Common Point

Match Type : Pos Only

WGS84 Point :
Known Point :

Match Height : Yes

WGS84 Point :
Known Point :

Q2 a ↑
CONT SURVY

CONT (F1)

To confirm the selections and to continue with the subsequent screen.

SURVY (F5)

Available for <Known Point:> being highlighted. To measure a point and store it in <Local Pts Job:>.

Description of fields

Field	Option	Description
<Match Type:>		How the horizontal and vertical shifts of the transformation should be computed.
	Pos & Height	Position and height are taken from the same pair of matching points.
	Pos Only	Position is taken from one pair of matching points. The height can be taken from another pair of matching points.
<WGS84 Point:>	Choicelist	The point ID of the horizontal and/or vertical control point chosen from <WGS84 Pts Job:>. All WGS 1984 points from MANAGE Data: Job Name can be selected.
<Known Point:>	Choicelist	The point ID of the horizontal and/or vertical control point chosen from <Local Pts Job:>. All local points from MANAGE Data: Job Name can be selected.
<Match Height:>	Yes or No	Available for <Match Type: Pos Only>. Activates the determination of the vertical shift from a separate pair of matching points.

Next step

CONT (F1) continues to **DET C SYS Step 4: Determine Rotation**.

DET C SYS

Step 4: Determine Rotation

This screen contains different fields, depending on the **<Method:>** selected. The explanations for the softkeys given below are valid as indicated.



09:48
DET C SYS
Step 4: Determine Rotation
Method : Use WGS84 North

CONT (F1)

To confirm the selections and to continue with the subsequent screen.

INV (F2)

Available for **<Method: Two WGS84 Points>** and **<Method: User Entered>**. To compute an azimuth between two local points. Refer to "40.5 Computing Required Azimuth".

Rotation : 0.0000 g



CONT Q2 a ↑

Description of common fields

Field	Option	Description
<Method:>	Use WGS84 North, User Entered, Convergence Angle or Two WGS84 Points	Method by which the rotation angle for the transformation is determined.

For <Method: Use WGS84 North>

Description of fields

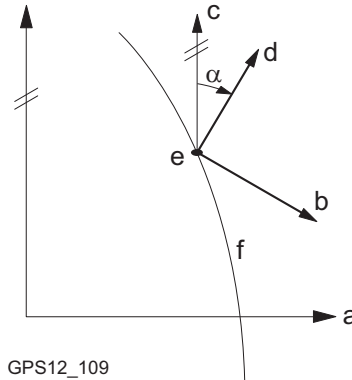
Field	Option	Description
<Rotation:>	Output	Transformation will be rotated to North as defined by the WGS 1984 datum. North is 0.00000°.

For <Method: User Entered>

Description of fields

Field	Option	Description
<Rotation:>	User input	Allows the orientation of the transformation to be manually typed in or calculated in DET C SYS Compute Required Azimuth .

For <Method: Convergence Angle>



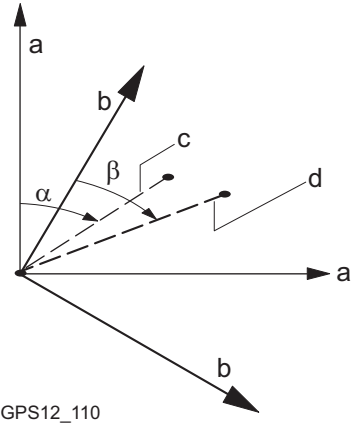
- a WGS 1984 coordinate system
- b Local coordinate system, **<Coord System:>**
- c Geodetic North
- d Grid North
- e Point on WGS 1984 datum, **<WGS84 Point:>**
- f Meridian
- α Convergence angle, **<Rotation:>**

Description of fields

Field	Option	Description
<Coord System:>	Choicelist	Coordinate system to provide the direction of grid North in the area where the control point used for determining the local coordinate system, is located. All coordinate systems from Main Menu: Manage...\Coordinate Systems can be selected.
<WGS84 Point:>	Choicelist	WGS 1984 point of which the convergence angle will be calculated. All points from <WGS84 Pts Job:> selected in DET C SYS Determine Coord System Begin can be selected.

Field	Option	Description
<Rotation:>	Output	The rotation of the transformation calculated as 0.00000° minus the computed convergence angle. The field is updated as <Coord System:> and <WGS84 Point:> are changed.

For <Method: Two WGS84 Points>



- a WGS 1984 coordinate system
- b Local coordinate system
- c Line between two WGS 1984 points.
- d Line between two local points
- α Azimuth of two WGS 1984 points, <Azimuth:>
- β Known azimuth or azimuth of two local points, <Reqd Azimuth:>

Description of fields

Field	Option	Description
<Point 1:>	Choicelist	First point to use for computation of <Azimuth:>. All points from <WGS84 Pts Job:> chosen in DET C SYS Determine Coord System Begin can be selected.
<Point 2:>	Choicelist	Second point to use for computation of <Azimuth:>. All points from <WGS84 Pts Job:> chosen in DET C SYS Determine Coord System Begin can be selected.
<Azimuth:>	Output	Computed azimuth between <Point 1:> and <Point 2:>.
<Reqd Azimuth:>	User input	The required grid azimuth, computed between two local points. Refer to "40.5 Computing Required Azimuth".
<Rotation:>	Output	The rotation of the transformation calculated as <Reqd Azimuth> minus <Azimuth>. The field is updated as <Point 1:>, <Point 2:> and <Reqd Azimuth:> are changed.

Next step

CONT (F1) continues to **DET C SYS Step 5: Determine Scale**.

DET C SYS

Step 5: Determine Scale

This screen contains different fields, depending on the **<Method:>** selected. The explanations for the softkeys given below are valid as indicated. The scale is calculated using the formula $(r + h)/r$ where r is the distance from the centre of the ellipsoid to the WGS 1984 point selected in **DET C SYS Step 3: Choose Common Point** and h is the height of this point above the WGS 1984 ellipsoid.



WGS84 Point : 101

Scale : 0.9999257
(Reduced to Ellipsoid)



CONT (F1)

To confirm the selections and to continue with the subsequent screen.

SCALE (F4) or PPM (F4)

To switch between **<Scale:>** displaying the true scale and displaying the ppm.

Description of common fields

Field	Option	Description
<Method:>	User Entered, Known WGS84 Pt or Known WGS84 Ht	Method of determining the scale factor of the transformation.

For <Method: User Entered>

Description of fields

Field	Option	Description
<Scale:>	User input	Allows the scale factor to be typed in manually.

For <Method: Known WGS84 Pt>

Description of fields

Field	Option	Description
<WGS84 Point:>	Choicelist	WGS 1984 point from which the scale factor will be calculated. The scale factor is calculated using the height of the known WGS 1984 point. All points from the <WGS84 Pts Job:> chosen in DET C SYS Determine Coord System Begin can be selected.
<Scale:>	Output	The calculated scale factor.

For <Method: Known WGS84 Ht>

Description of fields

Field	Option	Description
<Known Height:>	User input	The WGS 1984 height of a point can be typed in. The scale factor is calculated using this height.
<Scale:>	Output	The calculated scale factor.

Next step

CONT (F1) continues to **DET C SYS Step 6: Store Coord System**.

DET C SYS Step 6: Store Coord System

09:51		+ IR STD I		Bluetooth		Battery	
DET C SYS							
Step 6: Store Coord System							
Name	:	dfas					
Shift dX	:	253215.9352		m			
Shift dY	:	764436.0446		m			
Rotation	:	0.00000		"			
Scale	:	-74.3342		ppm			
Rot Orig X	:	0.0000		m			
Rot Orig Y	:	0.0000		m			
						Q2 a ↑	
STORE				SCALE			

STORE (F1)

To store the coordinate system to the DB-X, attach the system to **<WGS84 Pts Job:>** that was selected in **DET C SYS Determine Coord System Begin** and return to **TPS1200+/TS30/TM30 Main Menu**.

SCALE (F4) or PPM (F4)

To switch between **<Scale:>** displaying the true scale and displaying the ppm.

Description of fields

Field	Option	Description
<Name:>	User input	A unique name for the coordinate system. The name may be up to 16 characters in length and may include spaces.
<Shift dX:>	Output	Shift in X direction.
<Shift dY:>	Output	Shift in Y direction.
<Rotation:>	Output	Rotation of transformation.

Field	Option	Description
<Scale:>	Output	Scale factor of transformation.
<Rot Orig X:>	Output	Position in the X direction of the origin of rotation.
<Rot Orig Y:>	Output	Position in the Y direction of the origin of rotation.

Next step

STORE (F1) stores the coordinate system and returns to **TPS1200+/TS30/TM30 Main Menu**.

40.3

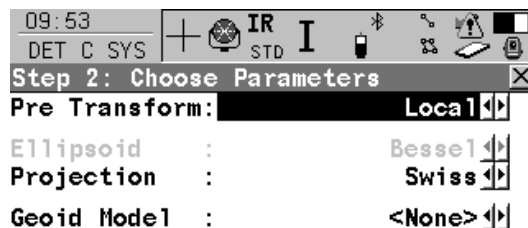
40.3.1

Determine Coordinate System - Twostep Transformation

Access step-by-step

Step	Description
1.	Refer to "40.1 Accessing Determine Coordinate System - One Point Localisation" to access DET C SYS Step 1: Choose Transform Type .
2.	DET C SYS Step 1: Choose Transform Type <Transfrm Type: Twostep>
3.	CONT (F1) to access DET C SYS Step 2: Choose Parameters .

DET C SYS Step 2: Choose Parameters



09:53
DET C SYS

Step 2: Choose Parameters

Pre Transform: Local

Ellipsoid : Bessel

Projection : Swiss

Geoid Model : <None>

CONT (F1)

To confirm the selections and to continue with the subsequent screen.



CONT Q2 a ↑

Description of fields

Field	Option	Description
<Pre Transform:>	Choicelist	The pretransformation to be used for the preliminary 3D transformation. All 3D transformations from MANAGE Transformations can be selected.
<Ellipsoid:>	Choicelist	The ellipsoid to be used in the transformation. All ellipsoids from MANAGE Ellipsoids can be selected.
	Output	The ellipsoid being used by a hard wired projection when selected in <Projection:>.
<Projection:>	Choicelist	The projection to be used in the transformation. All projections from MANAGE Projections can be selected.
<Geoid Model:>	Choicelist	The geoid model to be used in the transformation. Geoid models from MANAGE Geoid Models can be selected.

Next step

CONT (F1) continues to **DET C SYS Step 3: Choose Common Point**.

DET C SYS
Step 3: Choose
Common Point

14:49

DET C SYS

IR STD

Step 3: Choose Common Point

Match Type : Pos Only

WGS84 Point : 400

Known Point : 400

Match Height : Yes

WGS84 Point : 300

Known Point : 300

Q2 a ↑

CONT SURVY

CONT (F1)

To confirm the selections and to continue with the subsequent screen.

SURVY (F5)

Available for <Known Point:> being highlighted. To measured a point and store it in <Local Pts Job:>.

Description of fields

Field	Option	Description
<Match Type:>		How the horizontal and vertical shifts of the transformation should be computed.
	Pos & Height	Position and height are taken from the same pair of matching points.
	Pos Only	Position is taken from one pair of matching points. The height can be taken from another pair of matching points.

Field	Option	Description
<WGS84 Point:>	Choicelist	The point ID of the horizontal and/or vertical control point chosen from <WGS84 Pts Job:>. All WGS 1984 points from MANAGE Data: Job Name can be selected.
<Known Point:>	Choicelist	The point ID of the horizontal and/or vertical control point chosen from <Local Pts Job:>. All local points from MANAGE Data: Job Name can be selected.
<Match Height:>	Yes or No	Available for <Match Type: Pos Only>. Activates the determination of the vertical shift from a separate pair of matching points.

Next step

CONT (F1) continues to **DET C SYS Step 4: Determine Rotation**.

DET C SYS

Step 4: Determine Rotation

This screen contains different fields, depending on the **<Method:>** selected. The explanations for the softkeys given below are valid as indicated.



09:54
DET C SYS
Step 4: Determine Rotation
Method : Use WGS84 North

CONT (F1)

To confirm the selections and to continue with the subsequent screen.

INV (F2)

Available for **<Method: Two WGS84 Points>** and **<Method: User Entered>**. To compute an azimuth between two local points. Refer to "40.5 Computing Required Azimuth".

Rotation : 0.0000 g



CONT [] [] [] [] Q2 a ↑

Description of common fields

Field	Option	Description
<Method:>	Use WGS84 North, User Entered, Convergnce Angle or Two WGS84 Points	Method by which the rotation angle for the transformation is determined.

For <Method: Use WGS84 North>

Description of fields

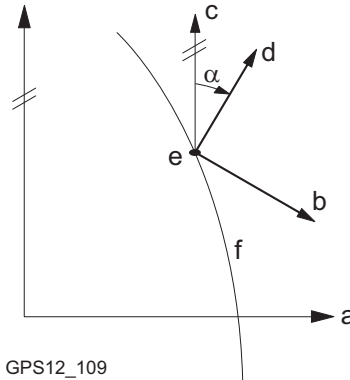
Field	Option	Description
<Rotation:>	Output	Transformation will be rotated to North as defined by the WGS 1984 datum. North is 0.00000°.

For <Method: User Entered>

Description of fields

Field	Option	Description
<Rotation:>	User input	Allows the orientation of the transformation to be manually typed in or calculated in DET C SYS Compute Required Azimuth .

For <Method: Convergence Angle>



GPS12_109

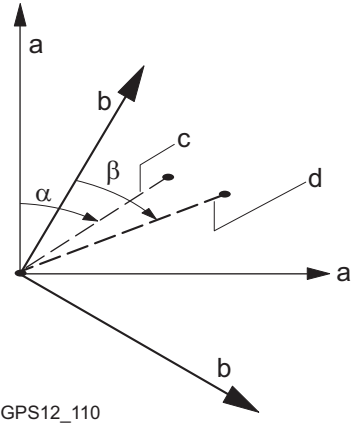
- a WGS 1984 coordinate system
- b Local coordinate system, <Coord System:>
- c Geodetic North
- d Grid North
- e Point on WGS 1984 datum, <WGS84 Point:>
- f Meridian
- α Convergence angle, <Rotation:>

Description of fields

Field	Option	Description
<Coord System:>	Choicelist	Coordinate system to provide the direction of grid North in the area where the control point used for determining the local coordinate system, is located. All coordinate systems from Main Menu: Manage...\Coordinate Systems can be selected.
<WGS84 Point:>	Choicelist	WGS 1984 point of which the convergence angle will be calculated. All points from <WGS84 Pts Job:> chosen in DET C SYS Determine Coord System Begin can be selected.

Field	Option	Description
<Rotation:>	Output	The rotation of the transformation calculated as 0.00000° minus the computed convergence angle. The field is updated as <Coord System:> and <WGS84 Point:> are changed.

For <Method: Two WGS84 Points>



- a WGS 1984 coordinate system
- b Local coordinate system
- c Line between two WGS 1984 points.
- d Line between two local points
- α Azimuth of two WGS 1984 points,
<Azimuth:>
- β Known azimuth or azimuth of two local
points, <Reqd Azimuth:>

Description of fields

Field	Option	Description
<Point 1:>	Choicelist	First point to use for computation of <Azimuth:>. All points from <WGS84 Pts Job:> chosen in DET C SYS Determine Coord System Begin can be selected.
<Point 2:>	Choicelist	Second point to use for computation of <Azimuth:>. All points from <WGS84 Pts Job:> chosen in DET C SYS Determine Coord System Begin can be selected.
<Azimuth:>	Output	Computed azimuth between <Point 1:> and <Point 2:>.
<Reqd Azimuth:>	User input	The required grid azimuth, computed between two local points. Refer to "40.5 Computing Required Azimuth".
<Rotation:>	Output	The rotation of the transformation calculated as <Reqd Azimuth> minus <Azimuth>. The field is updated as <Point 1:>, <Point 2:> and <Reqd Azimuth:> are changed.

Next step

CONT (F1) continues to **DET C SYS Step 5: Determine Scale**.

DET C SYS

Step 5: Determine Scale

This screen contains different fields, depending on the **<Method:>** selected. The explanations for the softkeys given below are valid as indicated. The scale is calculated using the formula $(r + h)/r$ where r is the radius of the ellipsoid at the position of the WGS 1984 point selected in **DET C SYS Step 3: Choose Common Point** and h is the height of this point above the local ellipsoid.



Combined SF : 0.9999257



CONT (F1)

To confirm the selections and to continue with the subsequent screen.

GRID (F2)

Available for **<Method: Compute CSF>**. To compute the grid scale factor. Accesses **DET C SYS Compute Grid Scale Factor**. Refer to "40.3.2 Computing the Grid Scale Factor".

HIGHT (F3)

Available for **<Method: Compute CSF>**. To compute the height scale factor. Accesses **DET C SYS Compute Height Scale Factor**. Refer to "40.3.3 Computing the Height Scale Factor".

Description of fields

Field	Option	Description
<Method:>	User Entered or Compute CSF	The default method for determining the Combined Scale Factor to be used in the transformation process.

Field	Option	Description
<Grid SF:>	Output	Available for <Method: Compute CSF>. The grid scale factor as computed in DET C SYS Compute Grid Scale Factor .
<Height SF:>	Output	Available for <Method: Compute CSF>. The height scale factor as computed in DET C SYS Compute Height Scale Factor .
<Combined SF:>	User input	The combined scale factor of the transformation. Available for <Method: User Entered>. The scale factor can be typed in.
	Output	Available for <Method: Compute CSF>. The product of the grid scale factor and the height scale factor.

Next step

CONT (F1) continues to **DET C SYS Step 6: Store Coord System**.

DET C SYS Step 6: Store Coord System

10:00

IR
 STD
 I

DET C SYS

Step 6: Store Coord System

Name : New Coord System

Shift dX : 220.0908 m

Shift dY : 90.6189 m

Rotation : 0.00000 "

Scale : -74.3342 ppm

Rot Orig X : 252995.8444 m

Rot Orig Y : 764345.4257 m

Q2 a ↑

STORE

SCALE

STORE (F1)

To store the coordinate system to the DB-X, attach the system to <WGS84 Pts Job:> that was selected in **DET C SYS Determine Coord**

System Begin and return to **TPS1200+/TS30/TM30 Main Menu**.

SCALE (F4) or PPM (F4)

To switch between <Scale:> displaying the true scale and displaying the ppm.

Description of fields

Field	Option	Description
<Name:>	User input	A unique name for the coordinate system. The name may be up to 16 characters in length and may include spaces.
<Shift dX:>	Output	Shift in X direction.
<Shift dY:>	Output	Shift in Y direction.
<Rotation:>	Output	Rotation of transformation.
<Scale:>	Output	Scale factor of transformation.
<Rot Orig X:>	Output	Position in the X direction of the origin of rotation.
<Rot Orig Y:>	Output	Position in the Y direction of the origin of rotation.

Next step

STORE (F1) stores the coordinate system and returns to **TPS1200+/TS30/TM30 Main Menu**.

40.3.2

Computing the Grid Scale Factor

Description

Calculates the grid scale factor. The grid scale factor is the scale factor of the point chosen relative to the projection being used.

Access step-by-step

Step	Description
1.	Refer to "40.1 Accessing Determine Coordinate System - One Point Localisation" to access DET C SYS Step 1: Choose Transform Type .
2.	Select <Transfrm Type: Twostep> .
3.	Continue to DET C SYS Step 5: Determine Scale .
4.	Select <Method: Compute CSF> .
5.	GRID (F2) to access DET C SYS Compute Grid Scale Factor .

DET C SYS Compute Grid Scale Factor



Grid SF : 1.0000010



CONT (F1)

To confirm the selections and return to the screen from where this screen was accessed.

Description of fields

Field	Option	Description
<Method:>		Method by which the grid scale factor is to be calculated.
	User Entered	Grid scale factor can be manually typed in.
	Known Local Pt	Grid scale factor is computed using the position of a known local point.
<Local Point:>	Choicelist	Available for <Method: Known Local Pt> . The point ID of the point chosen from <Local Pts Job:> from which the grid scale factor is computed using the projection selected in DET C SYS Step 2: Choose Parameters . All local points from MANAGE Data: Job Name can be selected.
<Grid SF:>	User input	The grid scale factor. Available for <Method: User Entered> . To type in the grid scale factor.
	Output	Available for <Method: Known Local Pt> . The computed grid scale factor.

Next step

CONT (F1) returns to **DET C SYS Step 5: Determine Scale**.

40.3.3

Computing the Height Scale Factor

Description

Calculates the height scale factor of the point chosen.

Access step-by-step

Step	Description
1.	Refer to "40.1 Accessing Determine Coordinate System - One Point Localisation" to access DET C SYS Step 1: Choose Transform Type .
2.	Select <Transfrm Type: Twostep> .
3.	Continue to DET C SYS Step 5: Determine Scale .
4.	Select <Method: Compute CSF> .
5.	HIGHT (F3) to access DET C SYS Compute Height Scale Factor .

DET C SYS Compute Height Scale Factor

10:03
DET C SYS

Compute Height Scale Factor

Method : Known Local Pt

Known Point : 101

Height SF : 0.9999329
(Reduced to Ellipsoid)

CONT Q2 a

CONT (F1)

To confirm the selections and return to the screen from where this screen was accessed.

Description of fields

Field	Option	Description
<Method:>		Method by which the height scale factor is to be calculated.
	User Entered	Height scale factor can be manually typed in.
	Known Local Pt	Height scale factor is computed using the height of a known local point.
	Known Local Ht	Height scale factor is computed using the known height of a local point.
<Known Point:>	Choicelist	Available for <Method: Known Local Pt> . The point ID of the point chosen from <Local Pts Job:> from which the height scale factor is computed. All local points from MANAGE Data: Job Name can be selected.
<Known Height:>	User input	Available for <Method: Known Local Ht> . A known local height.
<Height SF:>	User input	The height scale factor. Available for <Method: User Entered> . To type in the height scale factor.
	Output	Available for <Method: Known Local Pt> and <Method: Known Local Ht> . The computed height scale factor.

Next step

CONT (F1) returns to **DET C SYS Step 5: Determine Scale.**

Access step-by-step

Step	Description
1.	Refer to "40.1 Accessing Determine Coordinate System - One Point Localisation" to access DET C SYS Step 1: Choose Transform Type .
2.	DET C SYS Step 1: Choose Transform Type <Transfrm Type: Classic 3D>
3.	CONT (F1) to access DET C SYS Step 2: Choose Parameters .

DET C SYS

Step 2: Choose Parameters

10:05
DET C SYS

Step 2: Choose Parameters

Ellipsoid : Bessel

Projection : Swiss

Geoid Model : <None>

CSCS Model : <None>

CONT (F1)

To confirm the selections and to continue with the subsequent screen.

CONT

Q2 a ↑

Description of fields

Field	Option	Description
<Ellipsoid:>	Choicelist	The ellipsoid to be used in the transformation. All ellipsoids from MANAGE Ellipsoids can be selected.
	Output	The ellipsoid being used by a hard wired projection when selected in <Projection:>.
<Projection:>	Choicelist	The projection to be used in the transformation. All projections from MANAGE Projections can be selected.
<Geoid Model:>	Choicelist	The geoid model to be used in the transformation. Geoid models from MANAGE Geoid Models can be selected.
<CSCS Model:>	Choicelist	The CSCS model to be used in the transformation. All CSCS models from MANAGE CSCS Models can be selected.

Next step

CONT (F1) continues to **DET C SYS Step 3: Choose Common Point**.

DET C SYS
Step 3: Choose
Common Point



WGS84 Point : 101
 Known Point : 101

Local Height : Use WGS84 Pt Ht

CONT (F1)

To confirm the selections and to continue with the subsequent screen.

SURVY (F5)

To measure a point and store it in **<Local Pts Job:>**.



Description of fields

Field	Option	Description
<WGS84 Point:>	Choicelist	The point ID of the control point chosen from <WGS84 Pts Job:> . All WGS 1984 points from MANAGE Data: Job Name can be selected.
<Known Point:>	Choicelist	The point ID of the control point chosen from <Local Pts Job:> . All local points from MANAGE Data: Job Name can be selected.
<Local Height:>	Use WGS84 Pt Ht or Use Local Pt Ht	The source of the height information to use in the transformation.

Next step

CONT (F1) continues to **DET C SYS Step 4: Store Coord System**.

DET C SYS Step 4: Store Coord System



Shift dX : -643.6830 m
Shift dY : -10.9948 m
Shift dZ : -370.9894 m

STORE (F1)

To store the coordinate system to the DB-X, attach the system to **<WGS84 Pts Job:>** that was selected in **DET C SYS Determine Coord System Begin** and return to **TPS1200+/TS30/TM30 Main Menu**.



COORD (F2)

To view other coordinate types.

Description of fields

Field	Option	Description
<Shift dX:>	Output	Shift in X direction.
<Shift dY:>	Output	Shift in Y direction.
<Shift dZ:>	Output	Shift in Z direction.

Next step

STORE (F1) stores the coordinate system and returns to **TPS1200+ Main Menu**.

Description

Available for **<Method: Two WGS84 Points>** and **<Method: User Entered>** in **DET C SYS Step 4: Determine Rotation**.

Allows two local points to be chosen from **<Local Pts Job:>** selected in **DET C SYS Determine Coord System Begin** between which the required azimuth will be computed. This azimuth is then used with an azimuth computed between two WGS 1984 points chosen from **<WGS84 Pts Job:>** selected in **DET C SYS Determine Coord System Begin**, to calculate the rotation of the transformation.

The computed required azimuth appears in the **<Reqd Azimuth:>** field for **<Method: Two WGS84 Points>** and the **<Rotation:>** field for **<Method: User Entered>** in **DET C SYS Step 4: Determine Rotation**.

Compute azimuth step-by-step

Step	Description
1.	Refer to "40.1 Accessing Determine Coordinate System - One Point Localisation" to access DET C SYS Step 1: Choose Transform Type .
2.	Select <Transfrm Type: Onestep> or <Transfrm Type: Twostep> .
3.	Continue to DET C SYS Step 4: Determine Rotation .
4.	Select <Method: Two WGS84 Points> or <Method: User Entered> .
5.	INV (F2) to access DET C SYS Compute Required Azimuth .
6.	DET C SYS Compute Required Azimuth <From:> The point ID of the first known point for the azimuth calculation. <To:> The point ID of the second known point for the azimuth calculation. Select the points stored in the <Local Pts Job:> .

Step	Description
7.	CONT (F1) to calculate the required azimuth and return to DET C SYS Step 4: Determine Rotation.

41.1

Application Program

Description

GPS Survey is an application program which is used with SmartStation. The main purpose of this application program is to enable measurement of points in GPS mode without having to run through the Setup application program.

Access

Select **Main Menu: Programs...\GPS Survey**.

OR

Press a hot key configured to access the screen **GPS Survey GPS Survey Begin**. Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

OR

Press **PROG**. Highlight **GPS Survey**. **CONT (F1)**. Refer to "36.2 Accessing the Programs Menu" for information on the **PROG** key.

Properties of GPS Survey points

The properties of GPS Survey points are:

Type	Property	Property
Class	MEAS	NAV
Sub class	GPS Fixed GPS Code only	GPS Code only
Source	GPS Survey	GPS Survey

Type	Property	Property
Instrument source	GPS	GPS

GPS SURVEY

GPS Survey Begin

12:13

GPS SURVEY

GPS Survey Begin

Job : construction

Coord System : <None>

Codelist : <None>

Config Set : TCRP SmartStn

Antenna : ATX1230 SmartStn

Q2 a ↑

CONT CSYS

CONT (F1)

To accept changes and access the subsequent screen. The chosen settings become active.

CSYS (F6)

To select a different coordinate system.

Description of fields

Field	Option	Description
<Job:>	Choicelist	The active job. All jobs from Main Menu: Manage...Jobs can be selected.
<Coord System:>	Output	The coordinate system currently attached to the selected <Job:>.

Field	Option	Description
<Codelist:>	Choicelist	No codes are stored in the selected <Job:>. All codelists from Main Menu: Manage...\Codelists can be selected.
	Output	Codes have already been stored in the selected <Job:>. If codes had been copied from a System RAM codelist, then the name of the codelist is displayed. If codes have not been copied from a System RAM codelist but typed in manually, then the name of the active job is displayed.
<Config Set:>	Choicelist	The active configuration set. All configuration sets from Main Menu: Manage...\Configuration Sets can be selected.
<Antenna:>	Output	Opening the choicelist accesses MANAGE Antennas . The default antenna is SmartAntenna.

Next step

CONT (F1) accepts the changes and accesses **GPS SURVEY GPS Survey**.

GPS SURVEY

GPS Survey, Survey page

Overview

Important features about this screen:

- Upon entering **GPS SURVEY GPS Survey** SmartStation switches into GPS mode.
- The display mask for **GPS SURVEY GPS Survey** is fixed and is not configurable.
 - SmartAntenna is automatically turned on upon entry to the screen. SmartAntenna can be turned on beforehand by pressing the ON button located on the side.
 - Some of the screen icons change from TPS specific to GPS specific.
 - The GPS real-time radio link is automatically activated, if configured.
 - The occupation/storing behaviour is dependent on the configuration settings.

Diagram

11:51
GPS SURVEY
GPS Survey
Survey Code Map
Point ID : 0001
Instrument Ht: 1.555 m
3D CQ : 0.013 m
OCUPY PAGE Q2 a ↑

OCUPY (F1)

To start logging of static observations. The position mode icon changes to the static icon. (F1) changes to **STOP**.

STOP (F1)

To end logging of static observations when enough data is collected. When **<Auto STOP: Yes>** in **CONFIGURE Point Occupation Settings**, logging of static observations ends automatically as defined by the stop criteria. The position mode icon changes to the moving icon. (F1) changes to **STORE**.

STORE (F1)

To store the measured point. When **<Auto STORE: Yes>** in **CONFIGURE Point Occupation Settings**, the measured point is stored automatically. **(F1)** changes to **OCUPY**.

It may happen that a point with the same point ID exists in the job. If the codes and/or attribute values of the new and the existing point do not match, a screen opens where they can be corrected. Refer to "8.6 Code and Attribute Mismatch".

PAGE (F6)

To change to another page on this screen.

SHIFT AVGE (F2)

To check the residuals for the averaged position. Available for **<Averaging Mode: Average>** and for more than one measured coordinate triplet recorded for the same point. Refer to "6.3.4 Mean Page".

SHIFT ABS (F2)

To check the absolute difference between measurements. Available for **<Averaging Mode: Absolute Diffs>** and for more than one measured coordinate triplet recorded for the same point. Refer to "6.3.4 Mean Page".

SHIFT CONEC (F3) and SHIFT DISCO (F3)

To dial the number of the reference station configured in the active configuration set and to hang up immediately after the survey is completed. Available for GPS real-time devices of type digital cellular phone or modem. Available for **<Auto CONEC: No>** in **CONFIGURE GSM Connection**.

SHIFT INIT (F4)

To select an initialisation method and to force a new initialisation. Available for configuration sets allowing phase fixed solutions.

SHIFT INDIV (F5) and SHIFT RUN (F5)

To change between entering an individual point ID different to the defined ID template and the running point ID according to the ID template. Refer to "16.1 ID Templates".

Description of fields

Field	Option	Description
<Point ID:>	User input	The identifier for manually occupied points. The configured point ID template is used. The ID can be changed: • To start a new sequence of point ID's overtype the point ID.

Field	Option	Description
		For an individual point ID independent of the ID template SHIFT INDIV (F5). SHIFT RUN (F5) changes back to the next ID from the configured ID template. Refer to "16.1 ID Templates".
<Instrument Ht:>	User input	Current instrument height. SmartAntenna offset is automatically added but not displayed.
<3D CQ:>	Output	The current 3D coordinate quality of the computed position.
<Time at Point:>	Output	The time from when the point is occupied until point occupation is stopped.
<RTK Positions:>	Output	The number of GPS real-time positions recorded over the period of point occupation.

Next step

PAGE (F6) changes to the **Code** page.

GPS SURVEY GPS Survey, Code page

The setting for **<Thematc Codes:>** in **CONFIGURE Coding Settings** determines the availability of the fields and softkeys. Refer to "8 Coding" for information on coding.

Next step

PAGE (F6) changes to the **Map** page.

GPS SURVEY
GPS Survey,
Map page

The **Map** page provides an interactive display of the data. Refer to "35 MapView Interactive Display Feature" for information on the functionality and softkeys available.

Next step

PAGE (F6) changes to the first page on this screen.

41.2

41.2.1

Management of Antennas

Overview

Description

- Leica Geosystems antennas are predefined as default and can be selected from a list.
- Additional antennas can be defined.
- Default antennas contain an elevation dependent correction model.
- New antenna correction models can be set up and transferred to the receiver using LGO.

Default antennas

All Leica Geosystems antennas are supported. The default antenna is SmartAntenna.

Active antenna

One antenna is always considered as the active antenna.

41.2.2

Accessing Antenna Management

Access

Select **Main Menu: Programs...\GPS Survey**.

From **GPS SURVEY GPS Survey Begin** highlight the choicelist for **<Antenna:>**.

Open the choicelist to access **MANAGE Antennas**.

The default antenna is SmartAntenna.

OR

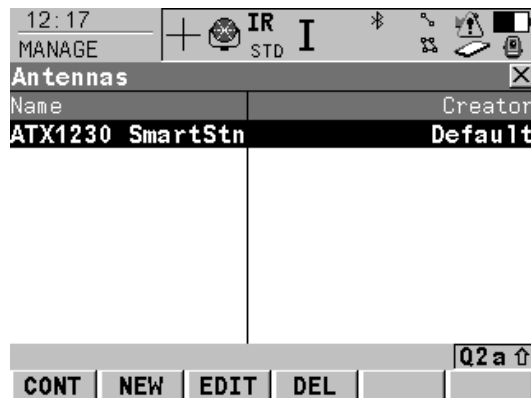
Select **Main Menu: Programs...\Setup**.

From **SETUP Station Setup Begin** press **CONF (F2)**.

Open the choicelist to access **MANAGE Antennas**.

The default antenna is SmartAntenna.

MANAGE Antennas



CONT (F1)

To select the highlighted antenna and to return to the previous screen.

NEW (F2)

To define a new antenna. Refer to "41.2.3 Creating a New Antenna".

EDIT (F3)

To edit the highlighted antenna. It is not possible to edit default antennas. Refer to "41.2.4 Editing an Antenna".

DEL (F4)

To delete the highlighted antenna. It is not possible to delete default antennas.

SHIFT DEFLT (F5)

To recall previously deleted default antennas and to reset default antennas to the default settings. User defined antennas are not affected.

Next step

IF an antenna	THEN
is to be selected	highlight the desired antenna. CONT (F1) closes the screen and returns to the screen from where MANAGE Antennas was accessed.
is to be created	highlight the antenna with offset characteristics similar to those required by the new antenna. NEW (F2) creates a new antenna. Refer to "41.2.3 Creating a New Antenna".
is to be edited	highlight the desired antenna. EDIT (F3) . Refer to "41.2.4 Editing an Antenna".

41.2.3

Creating a New Antenna

Access

Refer to "41.2.2 Accessing Antenna Management" to access **MANAGE Antennas**.

Create new antenna step-by-step

The following table explains the most common settings.

Step	Description
1.	In MANAGE Antennas press NEW (F2) .
2.	MANAGE New Antenna, General page <Name:> A unique name for the new antenna. <Hz Offset:> Horizontal offset of measurement reference point. <V Offset:> Vertical offset of measurement reference point. <L1 PhOffset:> Offset of L1 phase centre. <L2 PhOffset:> Offset of L2 phase centre. <Copy Additional Corrections:> Allows additional corrections to be copied from the antenna which was highlighted when MANAGE New Antenna was accessed. All offsets are copied from the antenna which was highlighted when MANAGE New Antenna was accessed.
3.	PAGE (F6) to access MANAGE New Antenna, IGS page.
4.	MANAGE New Antenna, IGS page <IGS Name:> The International GPS Service name of the antenna. <Serial Number:> The serial number of the antenna. <Set Up Number:> The set up number of the antenna. This identifies the version number of the current calibration.

Step	Description
	The combination of values typed in here provides a unique standardised ID for the antenna being used.
5.	STORE (F1) stores the new antenna and returns to MANAGE Antennas .

41.2.4

Editing an Antenna

Access

Refer to "41.2.2 Accessing Antenna Management" to access **MANAGE Antennas**.

Edit antenna step-by-step

Step	Description
1.	In MANAGE Antennas highlight the antenna to be edited.
2.	EDIT (F3) to access MANAGE Edit Antenna, General page.
3.	MANAGE Edit Antenna All the following steps are identical with the creation of a new antenna. All fields can be edited except those of Leica default antennas. Refer to "41.2.3 Creating a New Antenna". Follow the instructions from step 2. onwards.

41.2.5

Mechanical Reference Plane

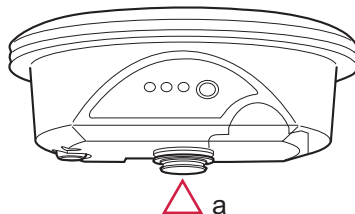
Antenna Heights

Description

The **Mechanical Reference Plane**

- is where the antenna heights are measured to.
- is where the phase centre variations refer to.
- varies for different antennas.

Diagram



GPS12 154

- a) The mechanical reference plane is the underside of the threaded metal insert.

42.1

Overview

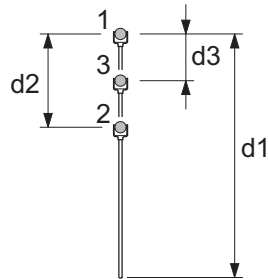
Description

Hidden points cannot be measured directly by TPS. This is because they are not directly visible.

- A hidden point can be calculated from measurements to prisms mounted on a hidden point rod with a known spacing and a known length of the hidden point rod. The hidden point rod may be held at any angle, as long as it is stationary for all measurements.
- Measurements for the hidden point are calculated as if the hidden point was observed directly. These calculated measurements can also be recorded.
- The hidden point rod can have either two or three reflectors. Refer to "42.3 Configuring Hidden Point" for information on configuring the hidden point rod.
- If three reflectors are used the average will be calculated.

Hidden point rod

The reflectors on the hidden point rod are also called auxiliary points after they have been measured.



TPS12_130

- 1 Reflector 1
- 2 Reflector 2
- 3 Reflector 3
- d1 Rod length
- d2 Distance from reflector 1 to reflector 2
- d3 Distance from reflector 1 to reflector 3

Properties of hidden points

The properties stored with the hidden point and auxiliary points are:

Type	Reflector n - auxiliary point	Hidden point
Class	MEAS	MEAS
Sub class	COGO	COGO
Source	Hidden Point	Hidden point
Instrument source	TPS	TPS

Hidden point tasks

The Hidden Point application program can be used for the following tasks:

- The hidden point program may be used to obtain accurate three dimensional coordinates for a point that is currently blocked from direct measurement by an obstruction between the point and the instrument.
- Determination of flow line locations and elevations in manholes, without measuring from the rim of the manhole to the flow line and estimating corrections for nonverticality of the measuring tape and eccentricity from the measurement on the rim to the horizontal location of the flow line;

- Determination of recesses in building corners for detailed surveys, without estimating right angle offsets, with or without taping of the dimensions;
- Measurements behind overhangs, buttresses and columns for quantity determinations in underground construction or mining, without estimating right angle offsets, with or without taping of the dimensions;
- Measurements of industrial process piping or other equipment in close quarters;
- Detailed architectural surveys for remodeling or cultural preservation or restoration work
- Any place where accurate measurements would require many more instrument setups in order to achieve line of sight from the instrument to the points being measured.



TPS Hidden Point application program does not generate a logfile.

42.2

Accessing Hidden Point

Access

Select **Main Menu: Programs...\Hidden Point**.

OR

Press **PROG**. Highlight **Hidden Point**. **CONT (F1)**. Refer to "36.2 Accessing the Programs Menu" for information on the **PROG** key.

OR

Press a hot key configured to access the screen **HIDDEN PT Hidden Point Begin**. Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

HIDDEN PT Hidden Point Begin

The screenshot shows the 'Hidden Point Begin' screen. At the top, there is a status bar with '12:21', 'HIDDEN PT', and several icons including a crosshair, a globe, 'IR STD', and a battery level indicator. Below the status bar, the title 'Hidden Point Begin' is displayed with a close button. The main area contains several fields with labels and values, each with a right arrow for editing: 'Job' is 'construction', 'Coord System' is '<None>', 'Codelist' is '<None>', 'Config Set' is 'TCRP', 'Reflector' is 'Leica Circ Prism', and 'Add. Constant' is '0.0 mm'. At the bottom, there is a row of function keys: 'CONT', 'CONF', 'SETUP', and 'CSYS'. To the right of these keys are two more buttons: 'Q2 a ↑' and 'CSYS'.

CONT (F1)

To accept the changes and access the subsequent screen. The chosen settings become active.

CONF (F2)

To configure the Hidden Point application program. Refer to "42.3 Configuring Hidden Point".

SETUP (F3)

To set up station. Accesses **SETUP Station Setup**.

CSYS (F6)

To select a different coordinate system.

Description of fields

Field	Option	Description
<Job:>	Choicelist	The active job. All jobs from Main Menu: Manage...\Jobs can be selected.
<Coord System:>	Output	The coordinate system currently attached to the selected <Job:>.
<Codelist:>	Choicelist	No codes are stored in the selected job. All codelists from Main Menu: Manage...\Codelists can be selected.
	Output	Codes have already been stored in the selected <Job:>. If codes had been copied from a System RAM codelist, then the name of the codelist is displayed. If codes have not been copied from a System RAM codelist but typed in, then the name of the active job is displayed.
<Config Set:>	Choicelist	The active configuration set. All configuration sets from Main Menu: Manage...\Configuration Sets can be selected.
<Reflector:>	Choicelist	The active reflector. All reflectors from Main Menu: Manage...\Reflectors can be selected.
<Add. Constant:>	Output	The additive constant stored with the chosen reflector.

Next step

CONT (F1) accepts changes and accesses **HIDDEN PT Measure Reflector 1**.

42.3

Configuring Hidden Point

Access

Select **Main Menu: Programs...\Hidden Point**. In **HIDDEN PT Hidden Point Begin** press **CONF (F2)** to access **HIDDEN PT Configuration**.

OR

Press **PROG**. Highlight **TPS HIDDEN PT. CONT (F1)**. In **HIDDEN PT Hidden Point Begin** press **CONF (F2)** to access **HIDDEN PT Configuration**.

OR

Press **SHIFT CONF (F2)** in **HIDDEN PT Survey Reflector 1**.

HIDDEN PT Configuration

17:33	IR	STD	I	Bluetooth	Survey	Q2 a ↑
HIDDEN PT						
Configuration						
Display Mask	:	Survey				
Meas Tolerance	:	0.020 m				
Delete Aux Points:	:	Yes				
No. of Reflectors:	:	3				
Auto Position	:	No				
Rod Length	:	1.000 m				
Dist R1-R2	:	0.350 m				
Dist R1-R3	:	0.200 m				
						Q2 a ↑
CONT		DMASK				

CONT (F1)

To accept changes and return to the screen from where this screen was accessed.

DMASK (F3)

To edit the display mask currently being displayed in this field. Accesses **CONFIGURE Define Display Mask n**. Available for **<Display Mask:>** being highlighted. Refer to "16.2 Display Settings".

SHIFT ABOUT (F6)

To display information about the program name, the version number, the date of the version, the copyright and the article number.

Description of fields

Field	Option	Description
<Display Mask:>	Choicelist	The user defined display mask to be shown in HIDDEN PT Measure Reflector n . All display masks of the active configuration set defined in CONFIGURE Display Settings can be selected.
<Meas Tolerance:>	User input	Limit of the difference between input and measured spacing of the reflectors.  For three reflectors being used, limit for maximum deviation of the three measurements.
<Delete Aux Points:>	Yes or No	The auxiliary points are deleted when the hidden point is stored. The auxiliary points are reflector 1, reflector 2 and reflector 3 of the hidden point rod. The Auxiliary Points ID template is used for the auxiliary points. The Survey Points ID template is used for the computed hidden point.
<No. of Reflectors:>	2 or 3	Two or three reflectors are used on the rod.
<Auto Position:>	Yes or No	Available for <No. of Reflectors: 3>. The third reflector is aimed at automatically.
<Rod Length:>	User input	Total length of hidden point rod.
<Dist R1-R2:>	User input	Spacing between the centres of reflector 1 and reflector 2.

Field	Option	Description
<Dist R1-R3:>	User input	Available for <No. of Reflectors: 3>. Spacing between the centres of reflector 1 and reflector 3. Reflector 3 is situated between reflector 1 and reflector 2.

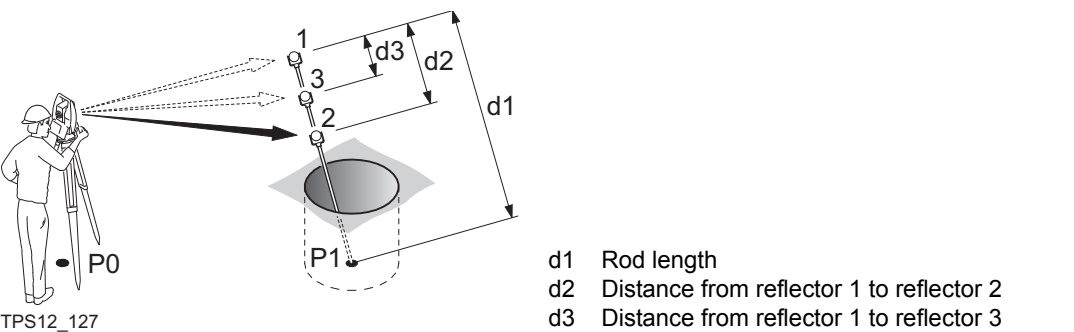
Next step

CONT (F1) returns to the screen from where this screen was accessed from.

42.4

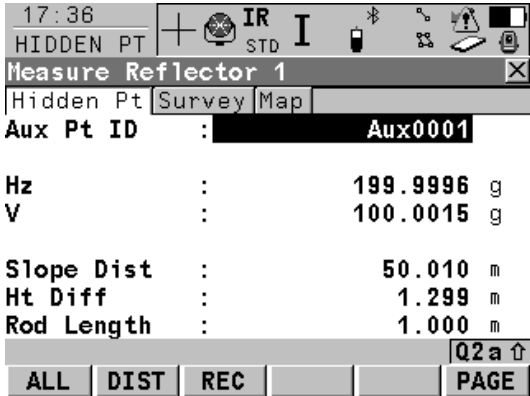
Measuring Hidden Points

Diagram



Measuring hidden point
step-by-step

Step	Description	Refer to chapter
1.	Refer to "42.2 Accessing Hidden Point" to access HIDDEN PT Hidden Point Begin .	
2.	CONF (F2) to access HIDDEN PT Configuration .	
3.	HIDDEN PT Configuration <No. of Reflectors: 3> Enter the values for <Rod Length:> , <Dist R1-R2:> , <Dist R1-R3:>	42.3
4.	CONT (F1) to access HIDDEN PT Hidden Point Begin .	
5.	HIDDEN PT Hidden Point Begin CONT (F1) to access HIDDEN PT Measure Reflector 1	

Step	Description	Refer to chapter
6.	HIDDEN PT Measure Reflector 1, Hidden Pt page  <Aux Pt ID:> The point ID of the auxiliary point, the reflector on the hidden point rod. The Auxiliary Points ID template is used. The horizontal angle, vertical angle, slope distance and height difference to reflector 1, the auxiliary point are displayed. <Rod Length:> The length of the rod can be adjusted before the hidden point result is displayed. The rod length always keeps the distances R1-R2 for 2 prisms and R1-R3 for 3 prisms into account.	
	PAGE (F6) changes to the Map page.	35.5

Step	Description	Refer to chapter
	SHIFT INDIV (F5) for an individual point ID independent of the ID template. SHIFT RUN (F5) changes back to the next ID from the configured ID template.	16.2
7.	ALL (F1) measures reflector 1 and accesses HIDDEN PT Measure Reflector 2 .	
8.	Repeat step 7. for reflector 2 and for reflector 3.  After the last reflector of the hidden point rod is measured, HIDDEN PT Hidden Point Result, Results page is accessed.	
9.	HIDDEN PT Hidden Point Result, Result page <Point ID:> The name of the hidden point. The configured point ID template is used. <Hz:> , <V:> and <Slope Dist:> The calculated horizontal and vertical angle and slope distance to the computed hidden point. ----- is displayed for unavailable information. <Ht Diff:> The calculated height difference from instrument to computed hidden point. ----- is displayed for unavailable information. <Easting:> , <Northing:> and <Ortho Ht:> The calculated coordinates of the computed hidden point. ----- is displayed for unavailable information.	
	NEXT (F5) to store the hidden point and to access HIDDEN PT Measure Reflector 1 .	

Step	Description	Refer to chapter
	SHIFT INDIV (F5) for an individual point ID independent of the ID template. SHIFT RUN (F5) changes back to the next ID from the configured ID template.	16.2
10.	PAGE (F6) to change to Code page.	
11.	HIDDEN PT Hidden Point Result, Code page <Point ID:> The name of the hidden point. The configured point ID template is used. <Point Code:> The thematical code. All codes of the job can be selected. <Attribute n:> The attributes for the thematical code. The behaviour of the fields depend on their definition in the codelist. Type in a code if required.	
12.	PAGE (F6) to change to Plot page.	
13.	HIDDEN PT Hidden Point Result, Plot page Measured distances are indicated by solid arrows.	35.6
14.	STORE (F1) to store the hidden point.	

Test or prove hidden points step-by-step

Step	Description	Refer to chapter
1.	Set up and orient the instrument in an open area.	

Step	Description	Refer to chapter
2.	Repeat steps 1. to 3. from paragraph "Measuring hidden point step-by-step".	
3.	Configure the hidden point rod.	42.3
4.	Position the tip of the hidden point rod on a mark that is directly visible from the instrument location.	
5.	Repeat steps 4. to 14. from paragraph "Measuring hidden point step-by-step".  Make sure the hidden point rod does not move between measurements.	
6.	PROG to access TPS1200+/TS30/TM30 Programs .	
7.	TPS1200+/TS30/TM30 Programs Stakeout to access STAKEOUT Stakeout Begin	
	Make sure <Auto Position: 3D> is selected in STAKEOUT Configuration, General page.	
8.	STAKEOUT Stakeout Begin CONT (F1) to access STAKEOUT XX Stakeout, Stake page	
9.	STAKEOUT XX Stakeout, Stake page Select the hidden point.	
	Motorised instruments position to the hidden point	

43.1

Overview

Description

The Reference Line application program can be used to set out or measure points relative to a reference line or a reference arc.

Tasks

The Reference Line application program can be used for the following tasks:

- Measuring to a line/arc where the position of a target point can be calculated from its position relative to the defined reference line/arc.
- Staking to a line/arc where a target point is known and instructions to locate the point are given relative to the reference line/arc.
- Gridstaking a line/arc where a grid can be staked relative to a reference line/arc.
- Staking to a polyline. Refer to "43.8 Staking to Polyline".

Other functionality available includes:

- Offsetting the reference line/arc horizontally or vertically. The radius of the arc changes with the horizontal offset.
- Shifting the reference line with parallel offsets or rotating to match predefined setting out instructions.
- Measuring points and staking points on slopes related to a reference line/arc.

Activating the program

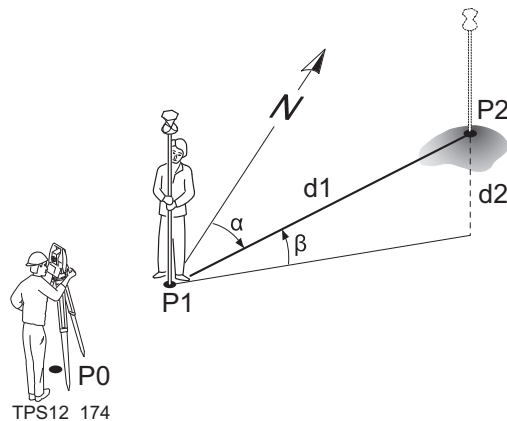
The Reference Line application program must be activated via a licence key. Refer to "28 Tools...\Licence Keys" for information on how to activate the application program.

Point types	Reference lines/arcs can be created from points stored as: • WGS 1984 geodetic • Local grid Heights and positions are always taken into account. Points must have full coordinate triplets.
Properties of measured points	The properties stored with staked points are: • Class: MEAS • Sub class: TPS • Source: RefLine (Grid), RefLine (Meas), RefLine (Stake) or RefLine (Poly) • Instrument source: TPS
Deleting points	A point that is used to define a reference line/arc can be deleted. A reference line/arc can still be used if one or more points defining the reference line/arc have been deleted. Within REFLINE Edit Reference Line and REFLINE Edit Reference Arc the deleted point field is shown in grey. Within MapView the reference line is still displayed but the deleted point or points is/are not.
Terms	Reference point: The term "reference point" is used in this chapter to refer to the point from which the perpendicular offset from the reference line/arc, to the target point, is measured. Refer to paragraph "Defining a reference line/arc" and the diagrams for further explanation. Target point: The design point. • For measuring to a reference line, this is the point with the coordinates of the current position and the designed or calculated height. • For staking or grid staking to a reference line, this is the point to be staked. Measured point: The current position.

Defining a reference line/arc

A reference line can be defined in the following ways:

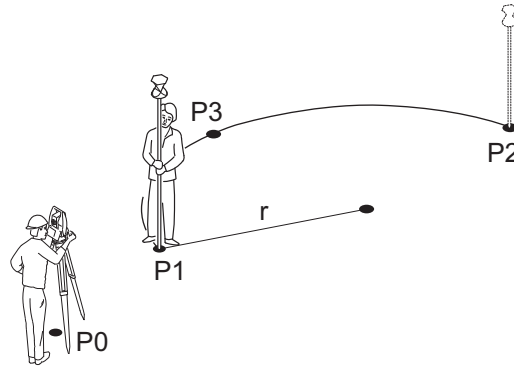
- Two known points
- One known point, an azimuth, a distance and a gradient
- One known point, an azimuth, a distance and a difference in height
- Polylines can be imported from a DXF job and selected from a list or on the **Map** page. Refer to "43.8.1 Overview".



- P0 Instrument station
- P1 Start point
- P2 End point
- d1 Known distance
- d2 Difference in height, ΔH_t
- α Azimuth
- β Elevation angle between the start point and the end point

A reference arc can be defined in the following ways:

- Two known points and a radius
- Three known points



TPS12_175

- P0 Instrument station
- P1 Start point
- P2 End point
- P3 Known point
- r Radius of arc

Defining chainage



The chainage of the start point of a reference line/arc can be defined.

Coordinate systems



It is possible to define an arc that has an opening angle of more than 180°.

It is possible to use a valid coordinate system but have the line or part of the line lying outside of the projection or CSCS model being used.

In these cases the output fields of all prompts relating to the difference in coordinates between the point being staked and the current position are shown as -----.

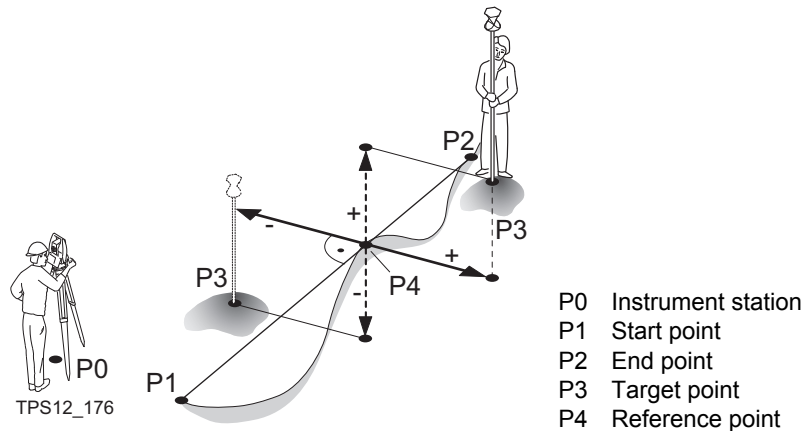


<Azimuth:> is used throughout this chapter. This can also mean **<Bearing:>**.

When describing screens with a title that changes depending on whether a line or an arc was chosen, the terms "line" and "arc" are replaced by XX.

Direction of values

The following diagram shows the direction of positive and negative values for distance and height differences between the target point and the reference point for reference lines.



Access

Select **Main Menu: Programs...\Reference Line**.

OR

Press **PROG**. Highlight **Reference Line. CONT (F1)**.

Refer to "36.2 Accessing the Programs Menu" for information on the **PROG** key.

OR

Press a hot key configured to access the screen **REFLINE Reference Line/Arc Begin**.

Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

The Begin screen

12:27	+ IR STD I		* ? !	
REFLINE				
Reference Line/Arc Begin				
Control Job :	control job			
Job :	active job			
Coord System :	<None>			
Codelist :	<None>			
Config Set :	ref line			
Reflector :	Leica Circ Prism			
Add. Constant:	0.0 mm			
				Q2a ↑
CONT	CONF	SETUP		CSYS

CONT (F1)

To confirm the selections and to continue with the subsequent screen.

CONF (F2)

To configure the Reference Line application program. Refer to "43.3 Configuring Reference Line".

SETUP (F3)

To set up station. Accesses **SETUP Station Setup**.

CSYS (F6)

To select a different coordinate system. Not available for **<Use Auto CrdSys: Yes>** configured in **CONFIGURE Additional Rover Settings**. Refer to "22.1.1 Configuration of Real-Time".

Description of fields

Field	Option	Description
<Control Job:>	Choicelist	The original points to be staked and the reference lines/arcs are stored in this job. All jobs from Main Menu: Manage...\Jobs can be selected.
<Job:>	Choicelist	The active job. Polylines are stored in this job. All jobs from Main Menu: Manage...\Jobs can be selected. Points which are occupied after staking out are stored in this job. The original points to be staked are not copied to this job.
<Coord System:>	Output	The coordinate system currently attached to the selected <Job:> . Cannot be edited for <Use Auto CrdSys: Yes> configured in CONFIGURE Additional Rover Settings . Refer to "22.1.1 Configuration of Real-Time".
<Codelist:>	Choicelist	No codes are stored in the selected <Job:> . All codelists from Main Menu: Manage...\Codelists can be selected.

Field	Option	Description
	Output	Codes have already been stored in the selected <Job:> . If codes had been copied from a System RAM codelist, then the name of the codelist is displayed. If codes have not been copied from a System RAM codelist but typed in manually, then the name of the active job is displayed.
<DTM Job:>	Choicelist	Available for <Heights: Use DTM Model> in REFLINE Configuration, Heights page. To select a DTM to be staked. Heights are then staked out relative to the selected DTM.
<Config Set:>	Choicelist	The active configuration set. All configuration sets from Main Menu: Manage...\Configuration Sets can be selected.
<Reflector:>	Choicelist	The active reflector. All reflectors from Main Menu: Manage...\Reflectors can be selected.
<Add. Constant:>	Output	The additive constant stored with the chosen reflector.

Next step

IF the Reference Line application program	THEN
is to be accessed	CONT (F1) accepts the changes and accesses the Reference Line application program. Refer to "43.4 Starting Reference Line".
is to be configured	CONF (F2) . Refer to "43.3 Configuring Reference Line".

43.3

Configuring Reference Line

Description

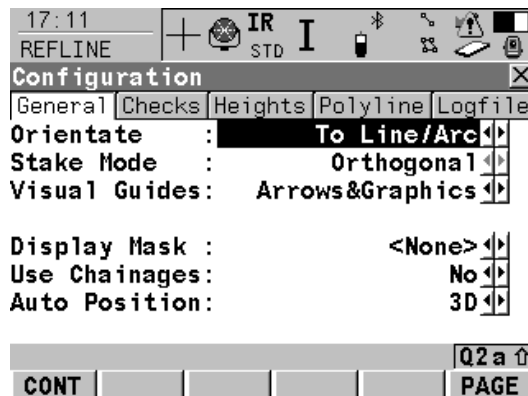
Allows options to be set which are used within the Reference Line application program. These settings are stored within the configuration set.

Access step-by-step

Step	Description
1.	Refer to "43.2 Accessing Reference Line" to access the Begin screen.
2.	CONF (F2) to access REFLINE Configuration .

The General page

This screen consists of the **General** page, the **Checks** page, the **Heights** page, the **Polyline** page and the **Logfile** page. The explanations for the softkeys given below are valid as indicated.



CONT (F1)

To accept changes and return to the screen from where this screen was accessed.

DMASK (F3)

To edit the display mask currently being displayed. Accesses **CONFIGURE Define Display Mask n**. Available when **<Display Mask:>** is highlighted on **General** page. Refer to "16.2 Display Settings".

PAGE (F6)

To change to another page on this screen.

SHIFT ABOUT (F5)

To display information about the application program name, the version number, the date of the version, the copyright and the article number.

Description of fields

Field	Option	Description
<Orientate:>		The reference direction to be used to stakeout points. The stakeout elements and the graphical display shown in the Reference Line application program are based on this selection.
	To Line/Arc	The direction of the orientation is parallel to the reference line or the reference arc.
	To Station	The direction of the orientation is from the measured point to the instrument station.
	From Station	The direction of the orientation is from the instrument station to the measured point.
	To Arrow	The direction of the orientation is from the current position to the point to be staked. The graphical display shows an arrow pointing in the direction of the point to be staked.
<Stake Mode:>		The method of staking out.

Field	Option	Description
	Polar	Available for <Orientate: From Station> or <Orientate: To Station> . The horizontal distance and angle between the current position and the point to be staked, the height difference as defined in REFLINE Configuration , the height of the point to be staked and the check distances are displayed.
	Orthogonal	The distances along and perpendicular to the orientation line between the current position and the point to be staked, the height difference as defined in REFLINE Configuration , the height of the point to be staked and the check distances are displayed.
Visual Guides	Off	Selects the visual guides displayed while staking points to lead to the point to be staked out. Available unless <Orientate: To Arrow> . No symbols or graphics are displayed.
	Arrows	Available unless <Orientate: To Arrow> . Arrows are displayed. The arrows show the direction of the difference in distance between the current position and the point to be staked parallel and perpendicular to the reference object.
	Graphics	A graphical display shows the instrument station, the current position and the point to be staked.
	Arrows&Graphics	Arrows and graphics are displayed.

Field	Option	Description
<Display Mask:>	Choicelist	The user defined display mask to be shown in REFLINE XX Points . All display masks of the active configuration set defined in CONFIGURE Display Settings can be selected.
<Use Chainages:>	Yes or No	Activates the use of chainages within the reference line application program.
<Chain Format:>	+123456.789 +123.4+56.789 +123+456.789 +1234+56.789	Available for <Use Chainages: Yes>. Selects display format for all chainage information fields. Default chainage display form. Separator between tens and hundreds with additional decimal point. Separator between hundreds and thousands. Separators between tens and hundreds.  The distance units <Int Ft/Inch (fi)>, <US Ft/Inch (ft)>, <Kilometres (km)> and <US Miles (mi)> are only supported by the first chainage format. All other chainage formats are restricted to the base units <Metre (m)>, <Int Ft (fi)> and <US Ft (ft)>.
<Auto Position:>	2D 3D	Instrument positions horizontally to the point to be staked out. Instrument positions horizontally and vertically to the point to be staked out.

Field	Option	Description
	Off	Instrument does not position to the point to be staked out.

Next step

PAGE (F6) changes to the **Checks** page.

The Checks page

Description of fields

Field	Option	Description
<Pos Check:>	Yes or No	Allows a check to be made on the horizontal coordinate difference between the staked point and the point to be staked. If the defined <Pos Limit:> is exceeded, the stakeout can be repeated, skipped or stored.
<Pos Limit:>	User input	Available for <Pos Check: Yes> . Sets the maximum horizontal coordinate difference which is accepted in the position check.
<Height Check:>	Yes or No	Allows a check to be made on the vertical difference between the staked point and the point to be staked. If the defined <Height Limit:> is exceeded, the stakeout can be repeated, skipped or stored.
<Height Limit:>	User input	Available for <Height Check: Yes> . Sets the maximum vertical difference accepted in the height check.

Field	Option	Description
<Beep near Pt:>	Yes or No	The instrument beeps when the horizontal radial distance from the current position to the point to be staked is equal to or less than defined in <Dist from Pt:>.
<Dist from Pt:>	User input	Available for <Beep near Pt: Yes>. The horizontal radial distance from the current position to the point to be staked when a beep should be heard.

Next step

PAGE (F6) changes to the **Heights** page.

The Heights page

Description of fields

Field	Option	Description
<Heights:>	Choicelist	Available if this screen was accessed from REFLINE Reference Line/Arc Begin . Depending on the task chosen this parameter controls the following. - When measuring to a line/arc, it determines the delta height value which is displayed when points are being measured. - When staking to or gridstaking a line/arc, it determines the height value to be staked out.
	Use Ref Line	Heights are computed along the reference line/arc.

Field	Option	Description
<Stake Points:>	Choicelist	Sets the type of horizontal points to be staked. Refer to "43.8.4 Staking Operation" for a graphic and an explanation of the abbreviations.
	PC, PT, AP	Only these horizontal key points are calculated for staking, skipping the radius and midpoints of arcs and the angle bisector point on lines.
	PC, PT, AP, BP	Only these horizontal key points are calculated for staking, skipping the radius point and midpoint of all arcs.
	PC, PT, AP, RP, MCP	Only these horizontal key points are calculated for staking, skipping the angle bisector point.
	ALL	All horizontal key points are available for stakeout. Refer to "43.8.4 Staking Operation" for a list of all keypoints.
<Auto Incrment:>	<None:>	Sets behavior of the stationing after a point is stored. Does not change the station after a point is stored.
	Previous	Proceeds to the next key point down station after each stored staked point.
	Next	Proceeds to the next key point up station after each stored staked point.
<Ref. Tangent:>	Back or Forward	Sets the tangent to be used when staking items in void areas.

Field	Option	Description
<Densify Arc:>	Yes or No	Option to use a different station increment along a curve.
<Small Radius:>	User input	Available for <Densify Arc: Yes>. Defines the threshold value of a small radius curve, for example curve of radius smaller than this value uses the station increment defined in the following field.
<Curve Inc.:>	User input	Available for <Densify Arc: Yes>. Station increment to be used along the small radius curve.

Next step

PAGE (F6) changes to the **Logfile** page.

The Logfile page

Description of fields

Field	Option	Description
<Write Logfile:>	Yes or No	To generate a logfile when the application program is exited. A logfile is a file to which data from an application program is written to. It is generated using the selected <Format File:>.
<File Name:>	Choicelist	Available for <Write Logfile: Yes>. The name of the file to which the data should be written. A logfile is stored in the \DATA directory of the active memory device. The data is always appended to the file.

Field	Option	Description
		Opening the choicelist accesses XX Logfiles where a name for a new logfile can be created and an existing logfile can be selected or deleted.
<Format File:>	Choicelist	Available for <Write Logfile: Yes>. A format file defines which and how data is written to a logfile. Format files are created using LGO. A format file must first be transferred from the CompactFlash card to the System RAM before it can be selected. Refer to "24 Tools...\Transfer Objects..." for information on how to transfer a format file. Opening the choicelist accesses XX Format Files where an existing format file can be selected or deleted.

Next step

CONT (F1) returns to the screen from where this screen was accessed.

43.4

43.4.1



Description

Starting Reference Line

Manually Entering a Reference Line/Arc

This chapter does not apply for staking to polylines.

- A reference line/arc can be defined by manually entering known parameters.
- The line/arc is only temporary and is not stored when the program is quit or closed.

Access step-by-step

Step	Description
1.	Refer to "43.2 Accessing Reference Line" to access the Begin screen.
2.	CONT (F1) to access REFLINE Reference Task Menu .
3.	REFLINE Reference Task Menu This screen defines the task to be performed. Measure to Line or Measure to Arc : Calculates the coordinates of a point from its position relative to the reference line/arc. Stake to Line or Stake to Arc : Allows points to be staked relative to the reference line/arc. Gridstake Line or Gridstake Arc : Allows a grid to be staked out relative to the reference line/arc.
4.	CONT (F1) to access REFLINE Choose Reference Line .
5.	REFLINE Choose Reference Line , Reference page. Select <Ref to Use: Manually Enter> .

The Reference page

- This screen contains the **Reference** page and the **Map** page. The explanations for the softkeys given below are valid as indicated. The fields available depend on the options chosen for the task and **<Method:>** in this screen.
- For all point fields, the MapView interactive display on the **Map** page can be used to select the desired point. Refer to "35 MapView Interactive Display Feature" for information on the functionality and softkeys available.

17:10 REFLINE IR STD I

Choose Reference Line

Reference | Map

Ref to Use : **Manually Enter**

Method : 2 Points

Start Point : PT49

End Point : PT48

Line Length : 7.000 m

CONT SLOPE OFFSET SURVY PAGE

CONT (F1)

To accept changes and continue with the subsequent screen.

SLOPE (F3)

To set a slope from a defined reference line/arc. Cut/Fill values can then be displayed to the slope when measurements are taken along the reference line/arc.

OFFSET (F4)

To set horizontal and vertical offsets, shifts and rotations on the defined reference line or to set horizontal and vertical offsets on a defined reference arc.

SURVY (F5)

Available for **<Ref to Use: Manually Enter>** when a point field is highlighted. To measure a point.

PAGE (F6)

To change to another page on this screen.

SHIFT CONF (F2)

To configure the reference line/arc.

Description of fields

Field	Option	Description
<Method:>	2 Points Pt/Brg/Dst/Grade Pt/Brg/Dst/ΔHt 3 Points 2 Points/Radius	The method by which the reference line/arc will be defined. - For task XX Line Uses two known points to define the reference line. Defines the reference line using a known point, a distance, an azimuth and the gradient of the line. The same as above but uses the difference in height instead of the gradient. - For task XX Arc Defines the reference arc using three known points. Defines the reference arc with two known points and a known radius.
<Start Point:>	Choicelist	The start point of the reference line/arc. All points from REFLINE Data: Job Name can be selected.
<Second Point:>	Choicelist	Available for <Method: 3 Points>. The second point of the reference arc. All points from REFLINE Data: Job Name can be selected.
<End Point:>	Choicelist	Available for <Method: 2 Points>, <Method: 3 Points> and <Method: 2 Points/Radius>. The end point of the reference line/arc. All points from REFLINE Data: Job Name can be selected.

Field	Option	Description
<Line Length:>	Output	Available for <Ref to Use: Manually Enter> with <Method: 2 Points>. The horizontal grid distance between <Start Point:> and <End Point:> of the line. ----- is displayed if the distance cannot be calculated.
<Azimuth:>	User input	Available for <Method: Pt/Brg/Dst/Grade> and <Method: Pt/Brg/Dst/ΔHt>. The azimuth of the reference line.
<Horiz Dist:>	User input	Available for <Method: Pt/Brg/Dst/Grade> and <Method: Pt/Brg/Dst/ΔHt>. The horizontal distance from the start point to the end point of the reference line.
<Grade:>	User input	Available for <Method: Pt/Brg/Dst/Grade>. The gradient of the line from the start point to the end point of the reference line.
<ΔHeight:>	User input	Available for <Method: Pt/Brg/Dst/ΔHt>. The difference in height from the start point to the end point of the reference line.
<Radius:>	User input	Available for <Method: 2 Points/Radius>. The radius of the reference arc.
<Arc Dist:>	Output	The horizontal grid distance along the arc between <Start Point:> and <End Point:> of the arc. ----- is displayed if the distance cannot be calculated.

Field	Option	Description
		----- is displayed if the distance cannot be calculated.

Next step

PAGE (F6) changes to the **Map** page.

The Map page

The **Map** page provides an interactive display of the data. Refer to "35 MapView Interactive Display Feature" for information on the functionality and softkeys available.

Next step

IF the selected task is	THEN
Measure to Line/Arc	CONT (F1) accepts the changes and accesses REFLINE Measure Points . Refer to "43.5 Measuring to a Reference Line/Arc".
Stake to Line/Arc	CONT (F1) accepts the changes and accesses REFLINE Enter Offset Values . Refer to "43.6 Staking to a Reference Line/Arc".
Gridstake Line/Arc	CONT (F1) accepts the changes and accesses REFLINE Define Grid . Refer to "43.7 Gridstaking to a Reference Line/Arc".
Stake to Polyline	CONT (F1) accepts the changes and accesses REFLINE Choose Polyline . Refer to "43.8 Staking to Polyline".

43.4.2



Description

Access step-by-step

Selecting an Existing Reference Line/Arc

This chapter does not apply for staking to polylines.

- Reference lines/arcs can be created, edited, stored and deleted in the **<Control Job:>**.

Step	Description
1.	Refer to "43.2 Accessing Reference Line" to access the Begin screen.
2.	CONT (F1) to access REFLINE Reference Task Menu .
3.	REFLINE Reference Task Menu This screen defines the task to be performed. For a description of the tasks refer to "43.4.1 Manually Entering a Reference Line/Arc". Select a task except Stake to Polyline .
4.	CONT (F1) to access REFLINE Choose Reference Line .
5.	REFLINE Choose Reference Line, Reference page . Select <Ref to Use: Select from Job> .

The Reference page

This screen contains the **Reference** page and the **Map** page. The explanations for the softkeys and the fields are as for manually entering a reference line. All line definition fields are outputs, all other differences are described below.

The fields shown depend on:

- the task selected in **REFLINE Reference Task Menu**.

AND

- the option chosen for **<Method:>** in **REFLINE New Reference XX**.

Refer to paragraph "Creating a reference line/arc step-by-step".

Description of fields

Field	Option	Description
<Ref Line:>	Choicelist	Available for the tasks XX Line in REFLINE Reference Task Menu . The reference line to be used. Accesses REFLINE Manage Reference Lines .
<Ref Arc:>	Choicelist	Available for the tasks XX Arc in REFLINE Reference Task Menu . The reference arc to be used. Accesses REFLINE Manage Reference Arcs .

Next step

PAGE (F6) changes to the **Map** page.

The Map page

The **Map** page provides an interactive display of the data. The reference line/arc can be viewed but not defined using this page. Refer to "35 MapView Interactive Display Feature" for information on the functionality and softkeys available.

Next step

IF	THEN
the desired reference line/arc needs to be created, edited or selected	highlight <Ref Line:> or <Ref Arc:> and press ENTER to access REFLINE Manage Reference XX .

IF	THEN
the desired reference line/arc has been selected	• for the task Measure to XX: CONT (F1) to access REFLINE Measure Points, Ref XX page. Refer to "43.5 Measuring to a Reference Line/Arc". • for the task Stake to XX: CONT (F1) to access REFLINE Enter Offset Values. Refer to "43.6 Staking to a Reference Line/Arc". • for the task Gridstake XX: CONT (F1) to access REFLINE Define Grid. Refer to "43.7 Grid-staking to a Reference Line/Arc".
offsets are to be defined	OFFSET (F4) to access REFLINE Define Offsets .

Managing reference lines

The screen name will be either **REFLINE Manage Reference Lines** for the tasks **XX Line** or **REFLINE Manage Reference Arcs** for the tasks **XX Arc**. Apart from the screen name the appearance of the screen and the functionality of the softkeys is the same.

12:38
REFLINE

IR STD

Manage Reference Lines

Name	Date
ref line 0001	04.11.03

Q2 a ↑

CONT NEW EDIT DEL

CONT (F1)

To select the highlighted reference line/arc and to return to the screen from where this screen was accessed.

NEW (F2)

To create a reference line/arc. Refer to paragraph "Creating a reference line/arc step-by-step".

EDIT (F3)

To edit a reference line/arc. Refer to paragraph "Editing a reference line/arc step-by-step".

DEL (F4)

To delete a reference line/arc.

Description of columns

Column	Description
Name	Names of all the reference lines/arcs available in the <Control Job:> .
Date	Date that the reference line/arc was created.

Next step

IF a reference line/arc	THEN
is to be selected	highlight the desired reference line/arc. CONT (F1) closes the screen and returns to REFLINE Choose Reference Line .

Creating a reference line/arc step-by-step

IF a reference line/arc	THEN
is to be created	NEW (F2) . Refer to paragraph "Creating a reference line/arc step-by-step".
is to be edited	highlight the reference line/arc and EDIT (F3) . Refer to paragraph "Editing a reference line/arc step-by-step".

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to "43.2 Accessing Reference Line" to access REFLINE Reference Line/Arc Begin .	
2.	CONT (F1) to access REFLINE Reference Task Menu .	
3.	REFLINE Reference Task Menu This screen defines the task to be performed. Select a task except Stake to Polyline .	43.4.1
4.	CONT (F1) to access REFLINE Choose Reference Line, Reference page.	
5.	REFLINE Choose Reference Line, Reference page Select <Ref to Use: Select from Job> .	
6.	Highlight <Ref Line:> or <Ref Arc:> and press ENTER to access REFLINE Manage Reference XX .	

Step	Description	Refer to chapter
7.	NEW (F2) to access REFLINE New Reference XX, Input page.	
8.	REFLINE New Reference XX, Input page <Ref ID:> The ID of the new reference line/arc. The other fields available depend on the option chosen in REFLINE Reference Task Menu and for <Method:> in this screen. - For task XX Line <Method:> The method by which the reference line will be defined. <Method: 2 Points> uses two known points to define the reference line. <Method: Pt/Brg/Dst/Grade> defines the reference line using a known point, a distance, a bearing and the gradient of the line. <Method: Pt/Brg/Dst/ΔHt> is the same as above but uses the difference in height instead of the gradient. <Line Length:> Available for <Method: 2 Points>. The horizontal grid distance between <Start Point:> and <End Point:> of the line. ----- is displayed if the distance cannot be calculated. - For task XX Arc <Method:> The method by which the reference arc will be defined. <Method: 3 Points> defines the reference arc using three known points. <Method: 2 Points/Radius> defines the reference arc with two known points and a known radius.	43.4.1

Step	Description	Refer to chapter
	<Arc Dist:> The horizontal grid distance along the arc between <Start Point:> and <End Point:> of the arc. ----- is displayed if the distance cannot be calculated. Choose the method by which to define a reference line/arc and enter the appropriate parameters.	
	SURVY (F5) available for <Start Point:> , <Second Point:> and <End Point:> . To measure a known point.	
	For all point fields, the MapView interactive display on the Map page can be used to select the desired point.	35
9.	PAGE (F6) to access REFLINE New Reference XX , Map page.	
10.	REFLINE New Reference XX , Map page MapView displays the reference line/arc as a solid line.	35.5
11.	STORE (F1) to store changes and return to REFLINE Manage Reference XX .	

Editing a reference line/arc step-by-step

Step	Description
1.	Refer to "43.4.2 Selecting an Existing Reference Line/Arc" to access REFLINE Manage Reference XX .
2.	EDIT (F3) to access REFLINE Edit Reference XX , Input page.
3.	All the following steps are identical with the creation of a new reference line/arc except for the following differences.

Step	Description
	• All fields except <Ref ID:> are output fields. • SURVY (F5) is not available. • A Plot page replaces the Map page. Refer to "35 MapView Interactive Display Feature" for information on the functionality and softkeys available. Refer to paragraph "Creating a reference line/arc step-by-step". Follow the instructions from step 8. onwards.

43.4.3



Description

Access step-by-step

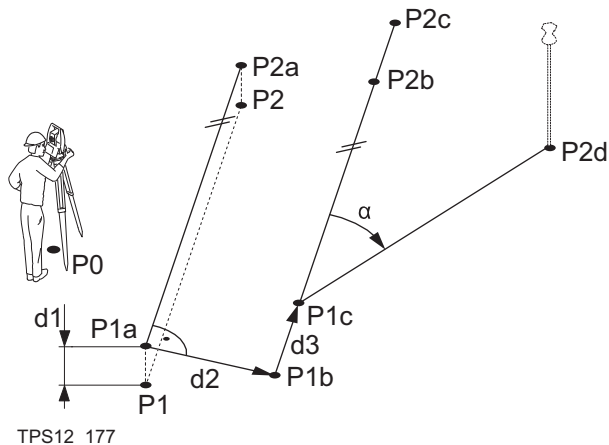
Defining the Offsets related to a Reference Line/Arc

This chapter does not apply for staking to polylines.

A reference line can be offset, shifted and rotated, a reference arc can be offset.

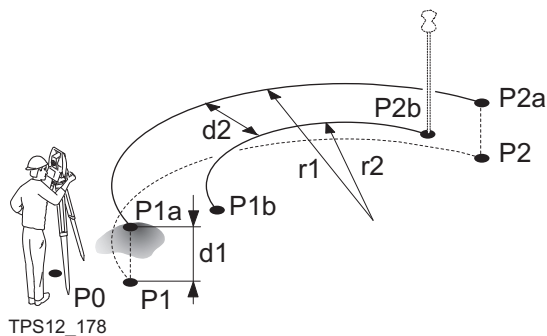
Step	Description
1.	Refer to "43.2 Accessing Reference Line" to access the Begin screen.
2.	CONT (F1) to access REFLINE Reference Task Menu .
3.	REFLINE Reference Task Menu This screen defines the task to be performed. Select a task except Stake to Polyline .
4.	CONT (F1) to access REFLINE Choose Reference Line .
5.	OFFSET (F4) to access REFLINE Define Offsets .

Diagram



Reference line offsets

- P0 Instrument station
- P1 Start point
- P2 End point
- P1a Start point with **<Height Offset:>**
- P2a End point with **<Height Offset:>**
- P1b Start point with **<Offset Line:>**
- P2b End point with **<Offset Line:>**
- P1c Start point with **<Shift Line:>**
- P2c End point with **<Shift Line:>**
- P2d End point with **<Rotation Line:>**
- d1 **<Height Offset:>**
- d2 **<Offset Line:>**
- d3 **<Shift Line:>**
- α **<Rotation Line:>**



Reference arc offsets

- P0 Instrument station
- P1 Start point
- P2 End point
- P1a Start point with **<Height Offset:>**
- P2a End point with **<Height Offset:>**
- P1b Start point with **<Offset Arc:>**
- P2b End point with **<Offset Arc:>**
- d1 **<Height Offset:>**
- d2 **<Offset Arc:>**
- r1 Radius before offset
- r2 Radius after offset

Defining the offsets

This screen contains different fields depending on the options chosen for **<Heights:>** in **REFLINE Configuration, Heights** page, and the selected task.

12:59
REFLINE

Define Offsets

Offset Line : 0.350 m
Shift Line : 0.450 m
Height Offset: 0.100 m
Rotate Line : 0.0000 g

CONT (F1)

To confirm the selections and to return to the previous screen.

SHIFT CONF (F2)

To configure the reference line/arc. Refer to "43.3 Configuring Reference Line".

CONT Q2 a ↑

Description of fields

Field	Option	Description
<Offset Line:> or <Offset Arc:>	User input	Distance to horizontally offset reference line/arc to the left or right.  When an offset is applied to an arc the radius of the arc changes.
<Shift Line:>	User input	Available for task XX Line unless <Heights: Use Ref Line> in REFLINE Configuration, Heights page. Distance to horizontally shift reference line forward or back.

Field	Option	Description
<Height Offset:>	User input	Available for <Heights: Use Start Point> and <Heights: Use Ref Line>. The vertical offset of the reference line/arc.
<DTM Offset:>	User input	Available for <Heights: Use DTM Model>. The vertical offset of the DTM model.
<Rotate Line:>	User input	Available for task XX Line unless <Heights: Use Ref Line> in REFLINE Configuration, Heights page. Angle by which to rotate the reference line.

Next step

CONT (F1) closes the screen and returns to **REFLINE Choose Reference Line**.

43.4.4



Description

Defining the Slope related to a Reference Line/Arc

This chapter does not apply for staking to polylines.

- It is possible to measure points and stake points on slopes related to a reference line/arc. A slope can be defined and cut/fill values can then be displayed to the slope when measuring along the reference line/arc. The slope is a plane from the reference line/arc and extends along the length of the reference line/arc.
- Slopes can be used when measuring to a reference line/arc, staking a point relative to a reference line/arc or performing a grid stakeout relative to a reference line/arc.

Access step-by-step

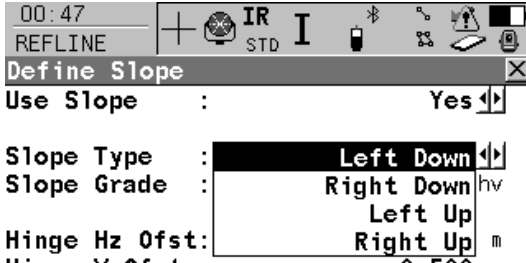
Step	Description
1.	Refer to "43.2 Accessing Reference Line" to access the Begin screen.
2.	CONT (F1) to access REFLINE Reference Task Menu .
3.	REFLINE Reference Task Menu This screen defines the task to be performed. Select a task except Stake to Polyline .
4.	CONT (F1) to access REFLINE Choose Reference Line .
5.	SLOPE (F3) to access REFLINE Define Slope .

Step 1) activating the slope method

Step	Description
1.	Ensure that <Use Slope: Yes> is selected.

Step	Description
	 00:31 REFLINE Define Slope Use Slope : Yes

Step 2) defining the slope parameters

Step	Description
1.	Defining the slope type. Defining a slope type of <Slope Type: Left Down> creates a downward plane extending to the left of the defined reference line/arc. Defining a slope type of <Slope Type: Right Down> creates a downward plane extending to the right of the defined reference line/arc. Defining a slope type of <Slope Type: Left Up> creates an upward plane extending to the left of the defined reference line/arc. Defining a slope type of <Slope Type: Right Up> creates an upward plane extending to the right of the defined reference line/arc.  00:47 REFLINE Define Slope Use Slope : Yes Slope Type : Left Down Slope Grade : Right Down Hinge Hz Ofst: Left Up Hinge V Ofst: Right Up

Step	Description
2.	Defining the slope grade. The inclination of the slope is defined by the slope grade. The units for slope grade are defined in the Configure /Units & Formats screen. Use Slope : Yes Slope Type : Right Down Slope Grade : 1:2 _{h_v}

Step 3)
defining
any necessary offsets

Step	Description
1.	The slope is always defined as starting from a 'hinge line'. The hinge line can be horizontally and/or vertically offset from the reference line/arc. The direction of the reference line/arc is always from the starting point. The offsets are always relative to the direction of the reference line/arc. When Hz Offset=0 and V Offset=0, then the hinge line is the reference line/arc. Slope Grade : 1:2 _{h_v} Hinge Hz Ofst: 1.250 m Hinge V Ofst : 0.500 m

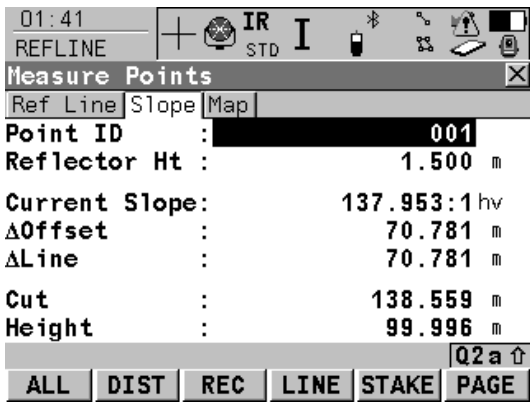
Step 4)
defining
the display mask

Step	Description
1.	Press DMASK (F3) in the Define Slope screen to access the display mask settings

Step	Description
	This display mask is available when using the slope method. It is user configurable and describes the current reflector position in relation to the defined slope and defined reference line/arc.

Step 4) measuring the points

Step	Description
1.	Press CONT (F1) to close the Define Slope screen.
2.	Choose the appropriate Task and choose the relevant reference line/arc.
3.	Press CONT (F1) to access the Measure Points screen, move to the Slope page.

Step	Description
	

Description of all fields from the Slope Display Mask

Field	Description
<Chainage:>	Displays the current chainage.
<Current Slope:>	Displays the current slope of the reflector position to the hinge.
<Design Slope:>	Displays the slope grade as defined by the user.
<East:>	Displays the Easting coordinate of the current reflector position.
<Height:>	Displays the Height value of the current reflector position.
<North:>	Displays the Northing coordinate of the current reflector position.
<Point ID:>	To enter the point ID.

Field	Description
<Reflector Ht:>	To enter the reflector height.
<SD to Hinge:>	Displays the slope distance offset from the hinge to measured point.
<SD to Line:>	Displays the slope distance offset from line/arc to measured point.
<Slope Cut/Fill:>	Displays the value of the difference between the actual reflector elevation to the slope elevation at that position. A cut is above the slope. A fill is below the slope.
<Start Chainage:>	Displays the starting chainage as defined by the user.
< Δ Height Hinge:>	Displays the delta height from the current position to the hinge.
< Δ Height Line:>	Displays the delta height from the current position to the line/arc.
< Δ Line/Arc:>	Displays the horizontal distance from the start point of the line/arc to the base point of the measured point, along the line/arc.
< Δ Line/Arc-End:>	Displays the horizontal distance from the end point of the line/arc to the base point of the measured point, along the line/arc.
< Δ Offset:>	Displays the perpendicular offset from the line/arc to measured point.
< Δ Offset Hinge:>	Displays the perpendicular offset from the hinge to measured point.

43.5

43.5.1



Description

This chapter does not apply for staking to polylines.

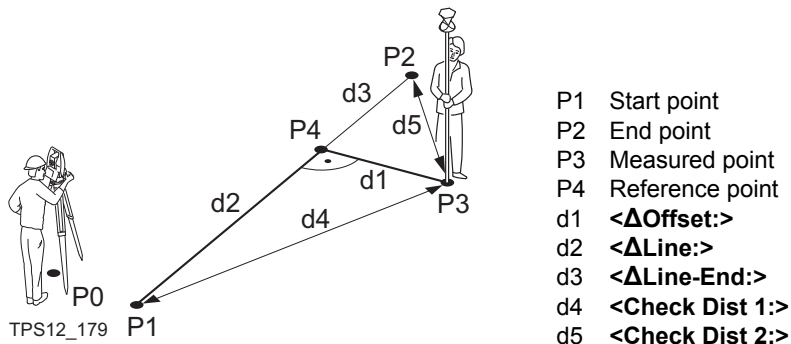
Access

Select the task **Measure to XX** in **REFLINE Reference Task Menu** and press **CONT (F1)** twice to access **REFLINE Measure Points**.

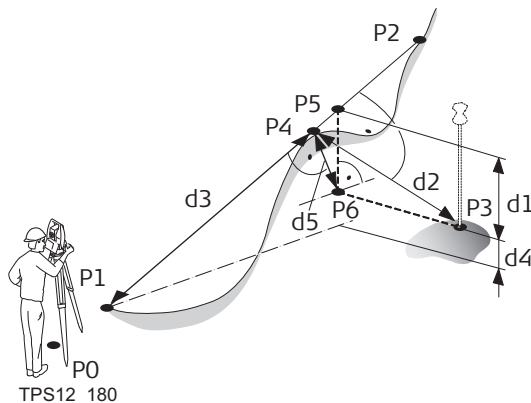
OR

Press **SURVY (F5)** in **REFLINE XX Stakeout** to access **REFLINE Measure Points**.
Refer to "43.6 Staking to a Reference Line/Arc" to access **REFLINE XX Stakeout**.

Measure to line - horizontal measurements



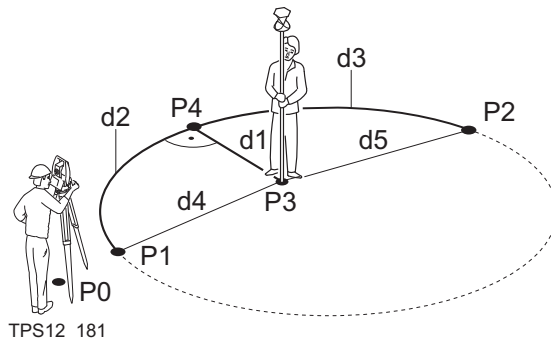
Measure to line - vertical measurements



- P0 Instrument station
- P1 Start point
- P2 End point
- P3 Measured point
- P4 Temporary point
- P5 Reference point
- P6 Horizontal base point
- d1 **<ΔHt-Line:>**
- d2 **<ΔPerp Dist:>**
- d3 **<ΔSpat Dist:>**
- d4 **<ΔHt-Start:>**
- d5 **<ΔPerp Hgt:>**

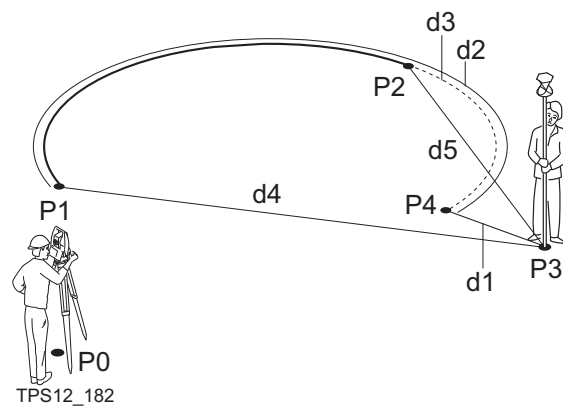
Measure to arc - horizontal measurements

Target point inside arc



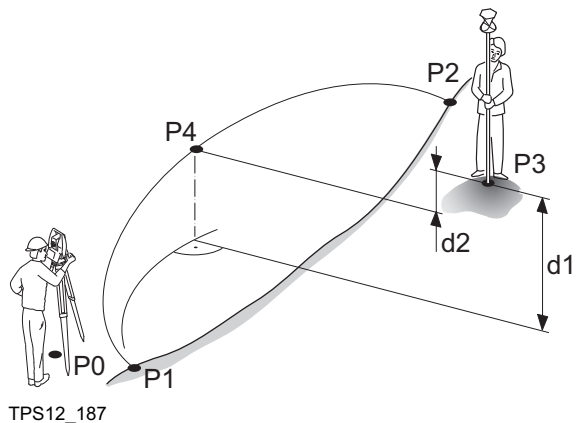
- P0 Instrument station
- P1 Start point
- P2 End point
- P3 Measured point
- P4 Reference point
- d1 **<ΔOffset:>**
- d2 **<ΔArc:>**
- d3 **<ΔArc-End:>**
- d4 **<Check Dist 1:>**
- d5 **<Check Dist 2:>**

Target point outside arc



- P0 Instrument station
- P1 Start point
- P2 End point
- P3 Measured point
- P4 Reference point
- d1 **<ΔOffset:>**
- d2 **<ΔArc:>**
- d3 **<ΔArc-End:>**
- d4 **<Check Dist 1:>**
- d5 **<Check Dist 2:>**

Measure to arc - vertical measurements



- P0 Instrument station
- P1 Start point
- P2 End point
- P3 Measured point
- P4 Reference point
- d1 **<ΔHt-Start:>**
- d2 **<ΔHt-Arc:>**

The Ref Line page

The pages shown are those from a typical configuration set. An additional page is available when a user defined display mask is used.

13:03
REFLINE

IR STD I

Measure Points

Ref Line Map

Point ID	:	0001	
Reflector Ht	:	1.250	m
ΔOffset	:	99.650	m
Chainage	:	135.050	m
ΔLine	:	135.050	m
ΔHt-Start	:	74.920	m
Height	:	75.020	m

Q2 a ↑

ALL DIST REC LINE STAKE PAGE

ALL (F1)

To measure and record the current position. The point ID is incremented according to the configured point ID template.

DIST (F2)

To measure and display distances. The difference between the current position and the point being staked is displayed.

REC (F3)

To record displayed values. The point ID is incremented according to the configured point ID template.

LINE (F4)

To define/select a reference line/arc.

Accesses **REFLINE Choose Reference Line, Reference** page.

STAKE (F5)

To define reference line offsets to be staked out in relation to the reference line. Accesses **REFLINE Enter Offset Values**. Refer to "43.6 Staking to a Reference Line/Arc".

SHIFT CONF (F2)

Available unless **SHIFT AVGE (F2)** is active.

To configure a reference line/arc. Accesses **REFLINE Configuration**. Refer to "43.3 Configuring Reference Line".

SHIFT 2FACE (F4)

To take a measurement in Face I and Face II. The point stored is an average of the two measurements.

When using instruments fitted with ATR, the point is automatically measured in both faces, the resulting point is stored and the instrument is returned to the first face.

This hotkey is only available for <EDM Mode: **Standard**> and <EDM Mode: **Fast**> and in the Survey, Reference Line and Stakeout programs.

SHIFT INDIV (F5) and SHIFT RUN (F5)

To change between entering an individual point ID different to the defined ID template and the running point ID according to the ID template. Refer to "16.1 ID Templates".

The fields available depend on the options chosen for <**Heights:**> and <**Edit Height:**> in **REFLINE Configuration**, **Heights** page and the task selected in **REFLINE Reference Task Menu**. The following fields are always available:

Description of fields

Field	Option	Description
< Point ID: >	User input	The point ID of the point to be measured.

Field	Option	Description
<Reflector Ht:>	User input	The last used reflector height is suggested when accessing REFLINE Measure Points, Ref XX page. An individual reflector height can be typed in.
<Chainage>	Output	Chainage of the current position along the line/arc. This is the chainage of the start of the reference line/arc plus <ΔLine:>/<ΔArc:>.
<ΔOffset:>	Output	Perpendicular offset from the reference line/arc calculated from the reference point to the measured point. For reference arcs, <ΔOffset:>, <ΔArc:> and <ΔArc-End:> values are always calculated so as to produce the smallest <ΔOffset:> possible. To ensure this the arc will be extended if necessary. Refer to paragraph "Measure to arc - horizontal measurements".
<Check Dist 1:>	Output	Horizontal distance from start point to measured point.
<Check Dist 2:>	Output	Horizontal distance from end point to measured point.

For task Measure to Line**Description of fields**

Field	Option	Description
<ΔLine:>	Output	Horizontal distance along the reference line from the start point to the reference point.
<ΔLine-End:>	Output	Horizontal distance along the reference line from the end point to the reference point.

For task Measure to Arc**Description of fields**

Field	Option	Description
<ΔArc:>	Output	Horizontal distance along the reference arc from the start point to the reference point.
<ΔArc-End:>	Output	Horizontal distance along the reference arc from the reference point to the end point.

For task Measure to XX, <Heights: Use Start Point> and <Edit Height: No>**Description of fields**

Field	Option	Description
<ΔHt-Start:>	Output	Height difference between the start point and the measured point.
<Height:>	Output	Height of measured point.

For task Measure to Line, <Heights: Use Ref Line> and <Edit Height: No>

Description of fields

Field	Option	Description
<ΔHt-Line:>	Output	Height difference between the temporary point on the reference line and the measured point.
<Height:>	Output	Height of measured point.
<ΔPerp Dist:>	Output	Slope distance between the reference point and the measured point, perpendicular to the reference line.
<ΔPerp Hgt:>	Output	Slope distance between the reference point and the horizontal base point.
<ΔSpatial Dist:>	Output	Slope distance between the start point and the reference point.

For task Measure to Arc, <Heights: Use Ref Line> and <Edit Height: No>

Description of fields

Field	Option	Description
<ΔHt-Arc:>	Output	Height difference between the reference point on the arc and the measured point.
<Height:>	Output	Height of measured point.

For task Measure to XX, <Heights: Use DTM Model> and <Edit Height: No>
Description of fields

Field	Option	Description
<ΔHt-DTM:>	Output	Height difference between the measured point and the DTM.
<Height:>	Output	Height of measured point.

For task Measure to XX, <Heights: XX> and <Edit Height: Yes>
Description of fields

Field	Option	Description
<Design Ht:>	User input	Allows input of the design height of the target point. The suggested value for the <Design Ht:> is as configured in the <Heights:> field in REFLINE Configuration, Heights page.
<ΔHt-Design:>	Output	Height difference between the <Design Ht:> and the height of the measured point.

Next step

PAGE (F6) changes to the **Map** page.

The Map page

The **Map** page provides an interactive display of the data. Displayed is also

- the horizontal distance along the reference line/arc from the start point to the reference point.
- the perpendicular offset from the reference line/arc measured from the reference point to the measured point.

Refer to "35 MapView Interactive Display Feature" for information on the functionality and softkeys available.

Next step

PAGE (F6) changes to the first page on this screen.

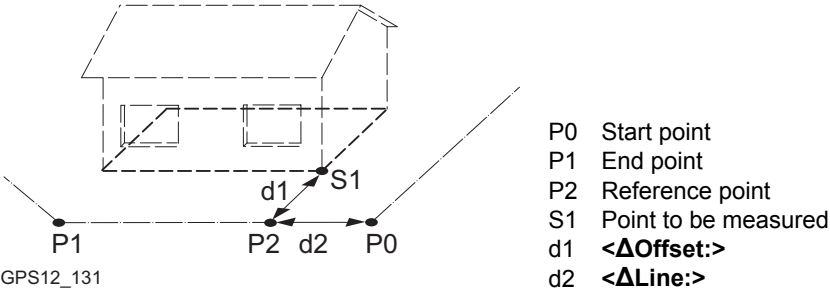


Description

Application: The positions of stakes, indicating the corners of a house that is to be built, need to be measured relative to the title boundary of the property that the house is to be built on. This is done to check that the house is not being built too close to the title boundary in keeping with council regulations.

Reference line/arc: The title boundary is used to define a reference line.

Diagram



Requirements

- The reference line does not need to be stored.
- **<Write Logfile: Yes>** in **REFLINE Configuration, Logfile** page.

Field procedure step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to "43.2 Accessing Reference Line" to access REFLINE Reference Line/Arc Begin .	
2.	REFLINE Reference Line/Arc Begin Select a job and a configuration set with the settings mentioned above.	43.2
3.	CONT (F1) to access REFLINE Reference Task Menu .	
4.	REFLINE Reference Task Menu Select Measure to Line .	
5.	CONT (F1) to access REFLINE Choose Reference Line, Reference page.	
6.	REFLINE Choose Reference Line, Reference page <Ref to Use: Manually Enter> <Method: 2 Points>	43.4.1
7.	Highlight <Start Point:> .	
8.	SURVY (F5) to measure P2.	
9.	Highlight <End Point:> .	
10.	SURVY (F5) to measure P3.	
	The Map page provides an interactive display of the defined reference line.	35

Step	Description	Refer to chapter
11.	CONT (F1) to access REFLINE Measure Points .	
12.	Walk to the first point to be measured.	
13.	REFLINE Measure Points <Point ID: S1>	43.5
14.	ALL (F1) measures and stores the point.	
	The results are displayed on the screen. The values in the fields indicate the position of the measured point relative to the reference line.	
	It may happen that a point with the same point ID exists in the job. If the codes and/or attribute values of the new and the existing point do not match, a screen opens where they can be corrected.	
15.	Are more points to be measured? • If yes, continue with step 16. • If no, continue with step 18.	
16.	Walk to the next point	
17.	Repeat steps 13. to 15.	
	The Map page provides an interactive display of the defined reference line and the points measured relative to it. Displayed is also • the horizontal distance along the reference line/arc from the start point to the reference point. • the perpendicular offset from the reference line/arc measured from the reference point to the measured point.	35

Step	Description	Refer to chapter
18.	SHIFT QUIT (F6) returns to TPS1200+/TS30/TM30 Main Menu .	
	The results are written to the logfile.	

43.6

43.6.1



Description

Access

Stake to line - horizontal measurements

Staking to a Reference Line/Arc

Staking the Points

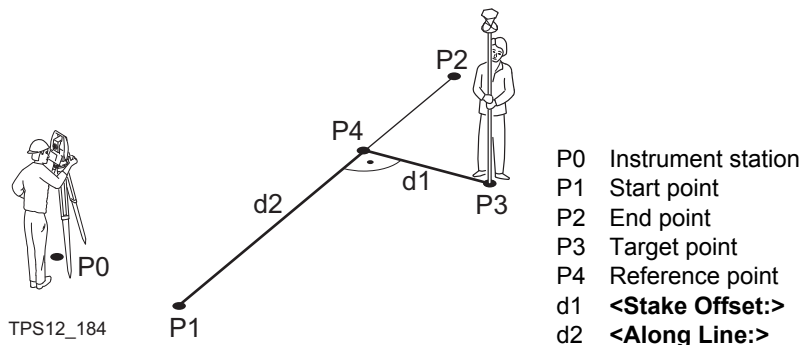
This chapter does not apply for staking to polylines.

Allows for the position of a point to be defined relative to a reference line/arc and then staked.

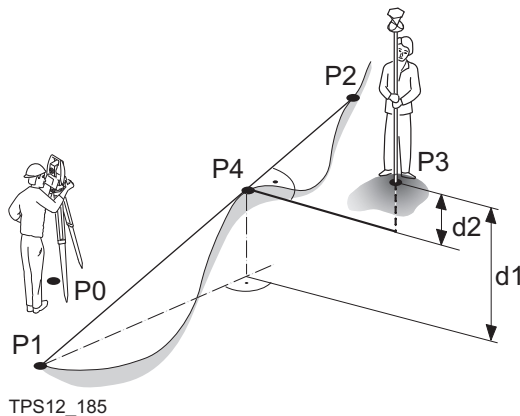
Select the task **Stake to XX** in **REFLINE Reference Task Menu** and press **CONT (F1)** twice to access **REFLINE Enter Offset Values**.

OR

Press **STAKE (F5)** in **REFLINE Measure Points**. Refer to "43.5 Measuring to a Reference Line/Arc" to access **REFLINE Measure Points**.

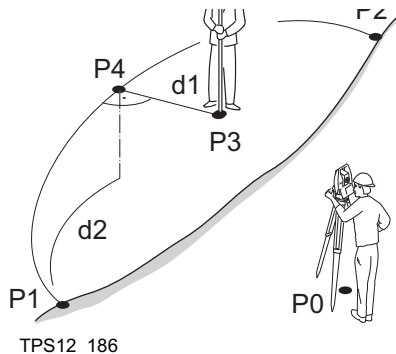


Stake to line - vertical measurements



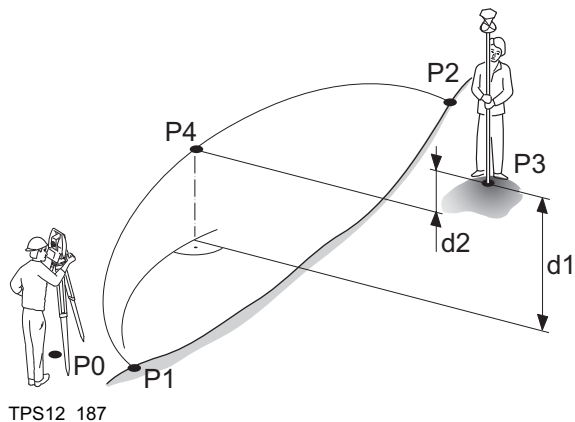
- P0 Instrument station
- P1 Start point
- P2 End point
- P3 Target point
- P4 Reference point
- d1 **<Height Offset:>** for **<Heights: Use Start Point>**
- d2 **<Height Offset:>** for **<Heights: Use Ref Line>**

Stake to arc - horizontal measurements



- P0 Instrument station
- P1 Start point
- P2 End point
- P3 Target point
- P4 Reference point
- d1 **<Stake Offset:>**
- d2 **<Along Arc:>**

Stake to arc - vertical measurements



- P0 Instrument station
- P1 Start point
- P2 End point
- P3 Target point
- P4 Reference point
- d1 **<Height Offset:>** for **<Heights: Use Start Point>**

Entering offset values

This screen is for typing in the stakeout values for a point relative to the reference line/arc. The screen contains different fields depending on the options chosen for **<Heights:>** and **<Edit Height:>** in **REFLINE Configuration, Heights** page and the task selected in **REFLINE Reference Task Menu**. The explanations for the softkeys given below are valid in all cases.

13:10
REFLINE

IR STD

Enter Offset Values

Point ID : 0005

Stake Offset : 0.250 m

Along Line : 5.250 m

Chainage : 5.250 m

Design Ht : 0.100 m

Q2 a ↑

CONT LINE SURVY

CONT (F1)

To confirm the selections and to continue with the subsequent screen.

LINE (F4)

To define/select a reference line/arc.

Accesses **REFLINE Choose Reference Line**.

SURVY (F5)

To measure a point relative to the reference line/arc.

SHIFT CONF (F2)

To configure the reference line/arc. Refer to "43.3 Configuring Reference Line".

SHIFT INDIV (F5) and SHIFT RUN (F5)

To change between entering an individual point ID different to the defined ID template and the running point ID according to the ID template. Refer to "16.1 ID Templates".

Description of fields

Field	Option	Description
<Point ID:>	User input	The point ID of the target point to be staked.
<Stake Offset:>	User input	The offset from the reference point to the target point.

Field	Option	Description
<Along Line:>	User input	Available for task Stake to Line . Horizontal distance from the start point to the reference point along the reference line.
<Along Arc:>	User input	Available for task Stake to Arc . Horizontal distance from the start point to the reference point along the reference arc.
<Chainage:>	User input	Chainage along the line/arc. This is the chainage of the start of the reference line/arc plus <Along Line:>/<Along Arc:>.
<Height Offset:>	User input	Available for <Edit Height: No> unless <Heights: Use DTM Model> in REFLINE Configuration. The height offset of the target point. - For <Heights: Use Start Point> The height of the target point is calculated as the height of the start point plus <Height Offset:>. - For <Heights: Use Ref Line> The height of the target point is calculated as the height of the reference point plus <Height Offset:>.
<Design Ht:>	User input	Available for <Edit Height: Yes> in REFLINE Configuration, Heights page. The design height of the target point. For <Heights: Use Start Point> The height of the target point can be input. The suggested height is the height of the start point.

Field	Option	Description
		For <Heights: Use Ref Line> The height of the target point can be input. The suggested height is the height of the reference point.

Next step

CONT (F1) to accept changes and continue to **REFLINE XX Stakeout**.

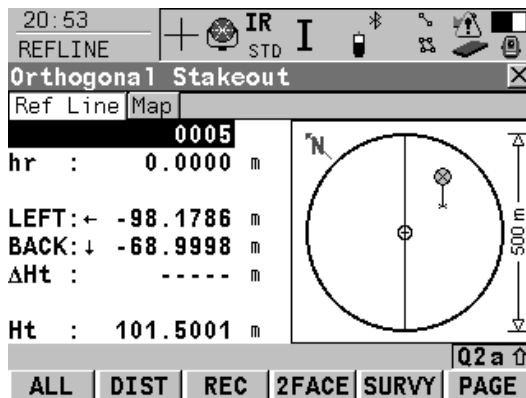
The Ref Line page

The pages shown are those from a typical configuration set. An additional page is available when a user defined display mask is used.

Refer to "47.4.1 Elements of the Graphical Display in the Stakeout" for an explanation of the appearance of the elements of the graphical display within this screen. The display changes depending on what option is chosen for **<Orientate:>** in **REFLINE Configuration, General** page.

This screen contains different fields depending on the options chosen for **<Stake Mode:>** in **REFLINE Configuration, General** page. The explanations for the fields and softkeys given below are valid as indicated.

If **<Auto Position: Yes>** in **STAKEOUT Configuration, General** page the instrument will position the telescope to the point to be staked automatically.



ALL (F1)

To measure the point being staked and return to the **REFLINE Enter Offset Values** screen. The last used values are displayed. The point ID is incremented according to the configured point ID template.

DIST (F2)

To measure and display distances. The difference between the current position and the point being staked is displayed.

REC (F3)

To record displayed values.

2FACE (F4)

To take a measurement in Face I and Face II. The point stored is an average of the two measurements.

When using instruments fitted with ATR, the point is automatically measured in both faces, the resulting point is stored and the instrument is returned to the first face.

This hotkey is only available for <EDM Mode: Standard> and <EDM Mode: Fast> and in the Survey, Reference Line and Stakeout programs.

SURVY (F5)

To measure a point. Accesses **REFLINE Measure Points**. Refer to "43.5 Measuring to a Reference Line/Arc".

PAGE (F6)

To change to another page on this screen.

SHIFT CONF (F2)

To configure a reference line/arc. Accesses **REFLINE Configuration**. Refer to "43.3 Configuring Reference Line".

SHIFT POS2D (F3)

To position the telescope (X,Y) onto the point to be staked.

SHIFT POS3D (F4)

To position the telescope (X,Y,Z) onto the point to be staked.

SHIFT INDIV (F5) and SHIFT RUN (F5)

To change between entering an individual point ID different to the defined ID template and the running point ID according to the ID template. Refer to "16.1 ID Templates".

Description of fields

Field	Option	Description
<Point ID:>	User input	The point ID of the target point to be staked.
<Reflector Ht:> or <hr:>	User input	The default reflector height as defined in the active configuration set is suggested.

Field	Option	Description
<ΔHt-Line:>, <ΔHt-Start:>, <ΔHt-DTM:>, <ΔHt-Design:> or <ΔHt:>	Output	Displays the difference between the measured height and the height to be staked.
<Height:> or <Ht:>	Output	Available for <Edit Height: No> in REFLINE Configuration, Heights page. The height of the measured point is displayed.
<Design Ht:> or <D Ht:>	User input	Available for <Edit Height: Yes> in REFLINE Configuration, Heights page. The design height as shown in REFLINE Enter Offset Value .
<Check Dist 1:>	Output	Available for <Visual Guides: Off> and <Visual Guides: Arrows>. Horizontal distance from start point to target point.
<Check Dist 2:>	Output	Available for <Visual Guides: Off> and <Visual Guides: Arrows>. Available for horizontal distance from end point to target point.

For <Stake Mode: Polar>

Description of fields

Field	Option	Description
< Δ Hz:>	Output	Horizontal angle between the point to be staked and the current position as seen from the instrument station.  For < Orientate: From Station > and < Orientate: To Station > the value is calculated and displayed permanently. For other orientation methods, the distance must be measured before the value can be displayed.
< Δ Distance:> or < Δ Dst:>	Output	Horizontal distance from the current position to the point to be staked along the line between the instrument and the current position.

For <Orientate: To Line/Arc> and <Stake Mode: Orthogonal>

Description of fields

Field	Option	Description
< Δ Offset:> or < Δ Off:>	Output	Horizontal distance from the point to be staked to the current position perpendicular to the reference line/arc.

Field	Option	Description
<ΔLine:>, <ΔLne:> or <ΔArc:>	Output	Horizontal distance from the point to be staked to the current position along the reference line/arc.

For <Orientate: To Station>, <Orientate: From Station> or <Orientate: To Arrow> and <Stake Mode: Orthogonal>

Description of fields

Field	Option	Description
<LEFT:> or <RGHT:>	Output	Offset from the point to be staked out to the current position, perpendicular to the orientation line. If <Orientate: From Station> , this value is positive when the point to be staked is to the right of the line of orientation when looking from the instrument station towards the current position. If <Orientate: To Station> , this value is positive when the point to be staked is to the right of the line of orientation when looking from the current position towards the instrument station. If <Orientate: To Arrow> this value is always zero.

Field	Option	Description
<FORW:> or <BACK:>	Output	Horizontal distance between the point to be staked and the current position along the orientation line. If <Orientate: From Station>, this value is positive when the point to be staked is behind the current position when looking from the instrument station towards the current position. If <Orientate: To Station>, this value is positive when the point to be staked is between the current position and the instrument station.

Next step

PAGE (F6) changes to the **Map** page.

The Map page

The **Map** page provides an interactive display of the data. Displayed is also

- the horizontal distance from the current position to the point to be staked along the line between the instrument and the current position or along the orientation line.
- the difference between the measured height and the height to be staked.

Refer to "35 MapView Interactive Display Feature" for information on the functionality and softkeys available.

Next step

PAGE (F6) changes to the first page on this screen.

43.6.2

Working Example



Description

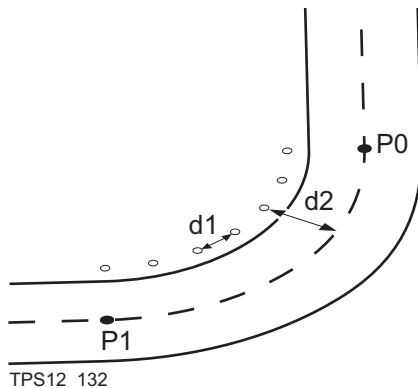
This chapter does not apply for staking to polylines.

Application: A curb is to be defined using offsets from the centreline of a road that is being built.

Reference line/arc: The defined centre line of the curve is used as a reference arc.

Working technique: set **<EDM Mode: Tracking>** and **<Automation: LOCK>** in **CONFIGURE EDM & ATR Settings**.

Diagram



P0 Start point
P1 End point
d1 **<Along Arc:>**
d2 **<Stake Offset:>**

Requirements

- The reference arc is already defined and saved in a job.
- **<Write Logfile: Yes>** in **REFLINE Configuration, Logfile** page.

Field procedure step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to "43.2 Accessing Reference Line" to access REFLINE Reference Line/Arc Begin .	
2.	REFLINE Reference Line/Arc Begin Select a job and a configuration set with the settings mentioned above.	43.2
3.	CONT (F1) to access REFLINE Reference Task Menu .	
4.	REFLINE Reference Task Menu Select Stake to Arc .	
5.	CONT (F1) to access REFLINE Choose Reference Line, Reference page.	
6.	REFLINE Choose Reference Line, Reference page <Ref to Use: Select from Job>	43.4.2
7.	Highlight <Ref Arc:>.	
8.	ENTER to access REFLINE Manage Reference Arcs .	
9.	REFLINE Manage Reference Arcs Select the correct reference arc.	43.4
10.	CONT (F1) returns to REFLINE Choose Reference Line, Reference page.	

Step	Description	Refer to chapter
	The Map page provides an interactive display of the defined reference arc.	35
11.	CONT (F1) to access REFLINE Enter Offset Values .	
12.	REFLINE Enter Offset Values <Point ID: CL1> <Stake Offset: 5.20000> <Along Arc: 2.0000> <Height Offset: 0.0000>	43.6
13.	CONT (F1) to REFLINE XX Stakeout, Ref XX page.	
14.	REFLINE XX Stakeout, Ref XX page Depending on the configuration of the staking options in REFLINE Configuration, General page, the graphical display and the values in the fields indicate how to find the point to be staked. The values are updated constantly.	
15.	ALL (F1) measures and stores the point.	
	The results are displayed on the screen.	
	It may happen that a point with the same point ID exists in the job. If the codes and/or attribute values of the new and the existing point do not match, a screen opens where they can be corrected.	
16.	Are more points to be staked? • If yes , continue with step 17.	

Step	Description	Refer to chapter
	If no, continue with step 19.	
17.	REFLINE Enter Offset Values Enter the parameters of the next point to be staked.	43.6
18.	Repeat steps 13. to 16.	
	The Map page provides an interactive display of the defined reference arc and the points that have been staked out. Displayed is also - the horizontal distance from the current position to the point to be staked along the line between the instrument and the current position or along the orientation line. - the difference between the measured height and the height to be staked.	35
19.	SHIFT QUIT (F6) returns to TPS1200+/TS30/TM30 Main Menu .	
	The results are written to the logfile.	

43.7

43.7.1



Description

Access step-by-step

Gridstaking to a Reference Line/Arc

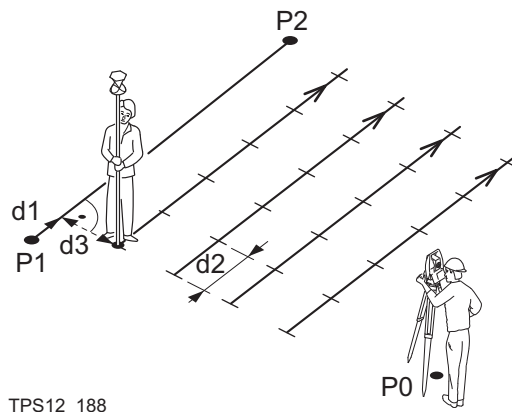
Gridstaking the Points

This chapter does not apply for staking to polylines.

A grid can be defined relative to a reference line/arc and points staked out in that defined grid.

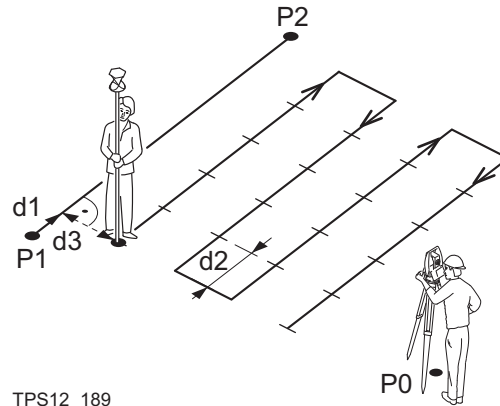
Step	Description
1.	Refer to "43.2 Accessing Reference Line" to access the Begin screen.
2.	CONT (F1) to access REFLINE Reference Task Menu .
3.	REFLINE Reference Task Menu Select Gridstake XX .
4.	CONT (F1) to access REFLINE Choose Reference Line .
5.	REFLINE Choose Reference Line, Reference page
6.	CONT (F1) to access REFLINE Define Grid .

Gridstake line methods Start at Begin



- P0 Instrument station
- P1 Start point
- P2 End point
- d1 **<Begin at Stn:>**
- d2 **<Increment:>**
- d3 **<Line Offsets:>**

Current Station

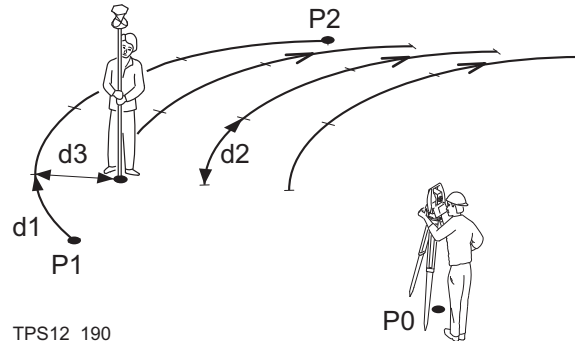


TPS12_189

- P0 Instrument station
- P1 Start point
- P2 End point
- d1 **<Begin at Stn:>**
- d2 **<Increment:>**
- d3 **<Line Offsets:>**

Gridstake arc methods

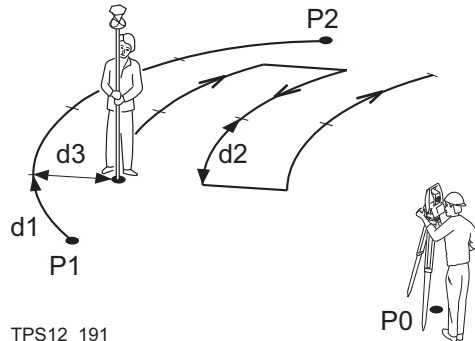
Start at Begin



TPS12_190

- P0 Instrument station
- P1 Start point
- P2 End point
- d1 **<Begin at Stn:>**
- d2 **<Increment:>**
- d3 **<Line Offsets:>**

Current Station



TPS12_191

- P0 Instrument station
- P1 Start point
- P2 End point
- d1 <Begin at Stn:>
- d2 <Increment:>
- d3 <Line Offsets:>

Defining the grid

13:16		IR		STD		I		+		-		x		y		z		w		v		u		t		s		r		q		p		o		n		m		l		k		j		i		h		g		f		e		d		c		b		a			
REFLINE		+/-		IR		STD		I		+		-		x		y		z		w		v		u		t		s		r		q		p		o		n		m		l		k		j		i		h		g		f		e		d		c		b		a	
Define Grid																																																																	
Begin Grid At:														0.000 m																																																			
Chainage :														0.000 m																																																			
Increment By :														10.000 m																																																			
Line Offsets :														10.000 m																																																			
Next Line :														Current Grid Pt																																																			
Point ID :														Grid ID																																																			
Q2 a ↑																																																																	
CONT														LINE																																																			

CONT (F1)

To confirm the selections and to continue with the subsequent screen.

LINE (F4)

To define/select a reference line/arc.

Accesses **REFLINE Choose Reference Line**.

SHIFT CONF (F2)

To configure the reference line/arc. Refer to "43.3 Configuring Reference Line".

Description of fields

Field	Option	Description
<Begin Grid at:>	User input	Distance along the reference line/arc from the start point to the first target point to be staked.
<Chainage:>	User input	Chainage of the first target point to be staked along the line/arc. This is the chainage of the start of the reference line/arc plus <Begin Grid At:> .
<Increment by:>	User input	Spacing between points on the grid line.
<Line Offsets:>	User input	Spacing between grid lines.
<Next Line:>	Start at Begin	Method by which the grid will be staked out. Each new grid line is started at the same end as where the previous grid line started.
	Current Grid Pt	Each new grid line is started at the same end as where the previous grid line finished.
<Point ID:>	Grid ID	Determines the format of the point ID for grid points. Point ID is shown as the position of the grid being staked where +yyy.yy is the station position along the grid line and +xxx.xx is the grid line offset.
	Pt ID Template	The point ID template as defined in the active configuration set is used. The point ID template can be defined for <Survey Pts:> in CONFIGURE ID Templates . Refer to "16.1 ID Templates".

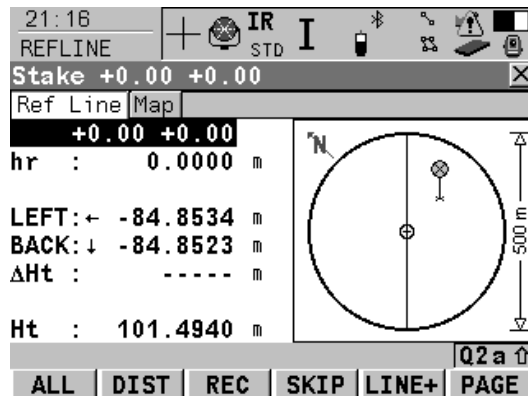
Next step

CONT (F1) to accept changes and continue to **REFLINE Stake +yyy.yy +xxx.xx, Ref XX** page.

The Ref Line page

The title of this screen indicates the position of the grid being staked where +yyy.yy is the station position along the grid line and +xxx.xx is the grid line offset.

The functionality of this screen is very similar to **REFLINE XX Stakeout, Ref XX** page. Differences between the two screens are outlined below.



SKIP (F4)

To skip the currently displayed station and increment to the next station.

LINE (F5)

To start staking the next grid line. The position of the first point on the new line is determined by the option selected for **<Next Line>**.

Description of fields

Field	Option	Description
<Point ID:>	User input	The point ID of the grid point to be staked. The point ID is based on the selection for <Point ID:> in REFLINE Define Grid . If a different point ID is typed in, the next point ID will still be shown as the next automatically computed point ID.
<Design Ht:> or <D Ht:>	User input	Available for <Edit Height: Yes> in REFLINE Configuration, Heights page. To type in the design height. If a design height has been entered and SKIP (F4) or LINE (F5) is used the true grid height for the next point is shown as the suggested height.

Next step

PAGE (F6) changes to the **Map** page.

The Map page

The **Map** page provides an interactive display of the data. Displayed is also

- the horizontal distance from the current position to the point to be staked along the line between the instrument and the current position or along the orientation line.
- the difference between the measured height and the height to be staked.

Refer to "35 MapView Interactive Display Feature" for information on the functionality and softkeys available.

Next step

PAGE (F6) changes to the first page on this screen.

43.7.2

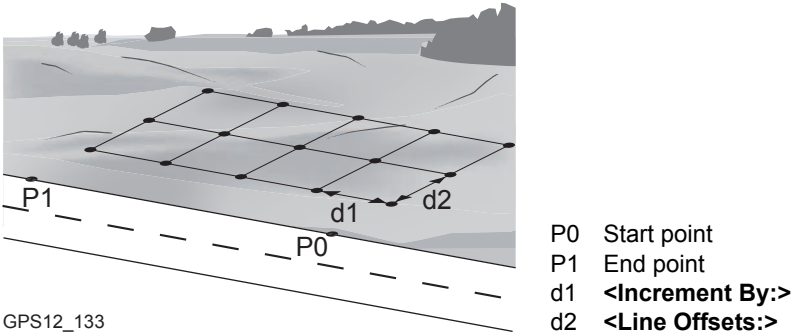
Working Example



Description

This chapter does not apply for staking to polylines.	
Application:	The positions of bore-holes need to be staked out in a regular grid over the area of a site to be used for landfill.
Reference line/arc:	Two known points on the site can be used to define the reference line.
Working technique:	set <EDM Mode: Tracking> and <Automation: LOCK> in CONFIGURE EDM & ATR Settings .

Diagram



Requirements

- A new reference line needs to be created and saved with the job.
- **<Write Logfile: Yes>** in **REFLINE Configuration, Logfile** page.

Field procedure step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to "43.2 Accessing Reference Line" to access REFLINE Reference Line/Arc Begin .	
2.	REFLINE Reference Line/Arc Begin Select a job and a configuration set with the settings mentioned above.	43.2
3.	CONT (F1) to access REFLINE Reference Task Menu .	
4.	REFLINE Reference Task Menu Select Gridstake Line .	
5.	CONT (F1) to access REFLINE Choose Reference Line, Reference page.	
6.	REFLINE Choose Reference Line, Reference page <Ref to Use: Select from Job>	43.4.1
7.	Highlight <Ref Line:> .	
8.	ENTER to access REFLINE Manage Reference Lines .	
9.	NEW (F2) to access REFLINE New Reference Line, Input page.	
10.	REFLINE New Reference Line, Input page	43.4.1

Step	Description	Refer to chapter
	<Ref ID: Line001> <Method: 2 Points> Select the appropriate points from the choicelist.	
	The Map page provides an interactive display of the defined reference line.	35
11.	STORE (F1).	
12.	CONT (F1) returns to REFLINE Choose Reference Line, Reference page.	
	The Map page provides an interactive display of the defined reference line.	35
13.	CONT (F1) to access REFLINE Define Grid.	
14.	REFLINE Define Grid <Begin Grid at: 0> <Increment by: 20> <Line Offsets: 20> <Next Line: Current Grid Pt> <Point ID: Grid ID>	43.7
15.	CONT (F1) to access REFLINE Stake +yyy.yy +xxx.xx, Ref XX page.	
16.	REFLINE Stake +yyy.yy +xxx.xx, Ref XX page	43.7

Step	Description	Refer to chapter
	Depending on the configuration of the staking options in REFLINE Configuration, General page, the graphical display and the values in the fields indicate how to find the point to be staked. The values are updated constantly.	
17.	ALL (F1) measures and stores the point.	
	The results are displayed on the screen.	
	It may happen that a point with the same point ID exists in the job. If the codes and/or attribute values of the new and the existing point do not match, a screen opens where they can be corrected.	
18.	Repeat steps 16. and 17. until all grid points have been staked.	
	The Map page provides a graphical view of the defined reference line and the points that have been staked out. Displayed is also - the horizontal distance from the current position to the point to be staked along the line between the instrument and the current position or along the orientation line. - the difference between the measured height and the height to be staked.	35
19.	SHIFT QUIT (F6) returns to TPS1200+/TS30/TM30 Main Menu .	
	The results are written to the logfile.	

43.8

43.8.1

Staking to Polyline

Overview

Description

The reference line task **Staking to a Polyline** allows points to be staked relative to a polyline. This option makes use of line and area data from CAD as simple as possible.

Preparing the data

Line data can be created by one of the following methods:

Method	Description
Data from CAD	Selecting the polylines in the drawing that you want to stake in the field and saving them into a DXF file.
Manually creating lines with existing points	In some cases electronic DXF files are not available to create lines and areas. If this is the case, the lines can be created from uploaded points using the line management function. Refer to "6.4.3 Editing a Line/Area".
Measuring lines in the field	It is also possible to create the lines to be staked by measuring points in the field. Lines can be made using the linework commands in the Survey page. Also, taking measurements with line objects open as well using the MANAGE Data, Lines page or line codes can create lines. Refer to "6.4.4 Working Example". Any line that is listed in the MANAGE Data, Lines page can be used for staking in this application program.

Method	Description
Using Design to Field	Using the Design to Field tool of LEICA Geo Office, the user has the ability to bring in lines from multitudes of formats including XML, DXF, Microstation XML and many more. Refer to LGO Online Help for information on Design to Field.
Using Alignment Tool Kit	Using the ATK application, a simple centerline alignment can be created and be imported in Staking to Polyline .  Only straight and curve elements are supported. The alignment created with the ATK application has to be converted to a RoadRunner Job.
Creating Lines in LGO	It is possible as well to create the necessary lines in LGO. Refer to LGO Online Help.

Options to convert the DXF file to a job

To facilitate the electronic transfer of lines from the plans to the surveying instrument, different tools have been created to read DXF format into a System1200 job.

DXF Import: Copy the DXF files to the \data directory on the CompactFlash card of the TPS1200+ instrument. Once the card is back in the instrument the DXF import program can be used to bring the lines into the job. Refer to "14.5 Importing Data in DXF Format".

Design to Field: This module is included in LEICA Geo Office and allows the conversion of DXF files into a System1200 job. This method makes the task of transferring several lines into a single job quick and efficient.



Refer to "Appendix C Directory Structure of the Memory Device" for the placements of the data files on the CompactFlash card.

43.8.2

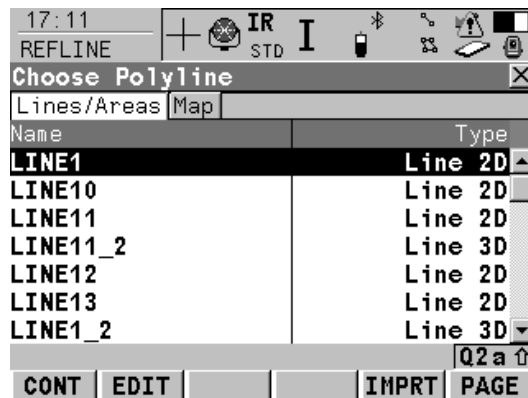
Accessing Staking to Polyline & Choosing a Polyline

Access step-by-step

REFLINE Choose Polyline, Lines/Areas page

Select the task **Stake to Polyline** in **REFLINE Reference Task Menu** and press **CONT (F1)** to access **REFLINE Choose Polyline**.

The **Lines/Areas** page allows for a tabular selection of a polyline. Lines can be either 2D or 3D depending on the input data and are shown as such.



CONT (F1)

To select the highlighted polyline and to continue with the subsequent screen.

EDIT (F2)

To change the start or end chainage value of the selected line. If **<Strt Chainage:>** is edited then the **<End Chainage:>** is computed from the new input plus the length.

IMPRT (F5)

To import lines or Road objects from another job as long as the coordinate systems are compatible.

PAGE (F6)

To change to another page on this screen.

REFLINE
Choose Polyline,
Map page

Next step

PAGE (F6) changes to the **Map** page.

The **Map** page allows a selection of the line to be staked in the graphical view with the <-- (F2) or --> (F3) keys or by mean of the stylus. Only visible lines can be selected. The selected line is highlighted and its name shown in the upper left corner of the screen.

43.8.3

Stake Parameters

Description

This screen allows defining operating parameters while the **Coords** and **Map** pages allow validating the points to be staked.

Access

CONT (F1) in **REFLINE Choose Polyline**.

REFLINE

Stake, Parameters page

Operating parameters are defined on this page.

This screen contains the **Parameters** page, the **Coords** page and the **Map** page. The explanations for the softkeys are valid for all three pages. Refer to "35 MapView Interactive Display Feature" for information on the functionality and softkeys available.

17:11 REFLINE IR STD I

Stake: BOP, VPI

Parameters Coords Map

Line Name : LINE1_9

Strt Chainage: 0.000 m

Length : 5.400 m

End Chainage : 5.400 m

Chainage : 0.000 m

Offset : 0.000 m

Vert. Shift : 0.000 m

Chainage Inc.: 1.000 m

CONT PREV NEXT PAGE

CONT (F1)

To accept the parameters and to continue with the subsequent screen.

PREV (F4)

To decrease the chainage value, down chainage, by the defined chainage interval <Chainage Inc.:>.

NEXT (F5)

To increase the chainage value, up chainage, by the defined chainage interval <Chainage Inc.:>.

PAGE (F6)

To change to another page on this screen.

SHIFT BOP (F4)

To return the chainage value to the beginning of the project.

SHIFT EOP (F5)

To send the chainage value to the end of project.

Description of fields

Field	Option	Description
<Line Name:>	Output	The name of the selected polyline.
<Strt Chainage:>	Output	The beginning chainage of the line.  The start chainage can be edited from REFLINE Choose Polyline with EDIT (F2) .
<Length:>	Output	The length of the line.
<End Chainage:>	Output	The chainage of the end of the line.
<Chainage:>	User input	The chainage to be staked initially. Any chainage can be entered.
<Offset:>	User input	The distance to stake off the line. Any value between -2000 m and 2000 m can be entered.
<Vert. Shift:>	User input	To shift the line vertically. The best example of the use of this feature is a situation where all grades of the line are finish grade but the stakes are set referenced to sub-grade.
<Chainage Inc.:>	User input	The interval at which chainages will be staked. Incrementing begins from <Chainage:> set above.

Next step

PAGE (F6) changes to the **Coords** page.

REFLINE
Stake,
Coords page

This page allows to validate the coordinate values of the point to be staked.

Next step

PAGE (F6) changes to the **Maps** page.

REFLINE
Stake,
Map page

This page allows to visualize the position of the points. Top line shows the current horizontal geometry as well as any horizontal or vertical key points.

Next step

CONT (F1) changes to **REFLINE Stakeout**.

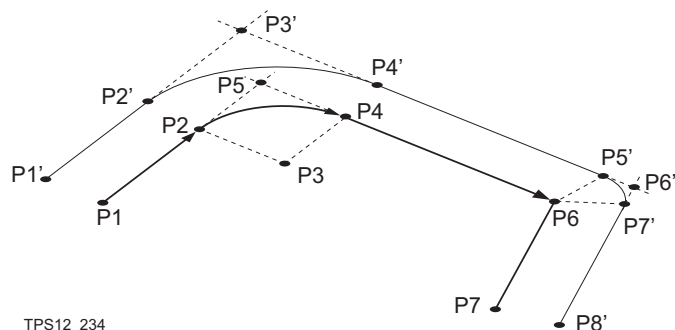
43.8.4

Staking Operation

Description

Once in the Staking screens, the user is guided to reach design positions.

Basic rules for polyline stakeout



- P1 BOP - Beginning of project
- P2 PC - Beginning of curve
- P3 RP - Radius point
- P4 PT - End of curve
- P5 PI - Point of intersection
- P6 AP - Angle point
- P7 EOP - End of project
- P1' BOP - Beginning of project
- P2' PC - Beginning of curve
- P3' PI - Point of intersection
- P4' PT - End of curve
- P5' AP-B - Angle point, back tangent
- P6' BP - Bisected point
- P7' AP-F - Angle point, forward tangent
- P8' EOP - End of project

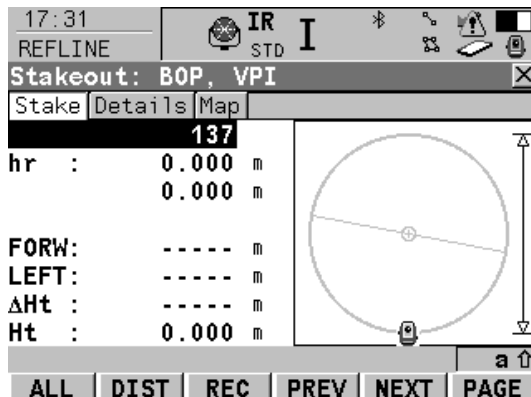
General terms:
Curve - Curve segment
Extension - Line xtension
MCP - Mid curve point
Straight - Straight segment

Access

CONT (F1) in REFLINE Stake.

REFLINE Stakeout, Stake page

The explanations for the softkeys given below are valid for all pages.



ALL (F1)

To measure a distance and store distance and angles. Accesses **REFLINE Results**.

DIST (F2)

To measure a distance.

REC (F3)

To store angles and distance. Distance must be measured before.

PREV (F4)

To decrease the chainage value, down chainage, by the defined chainage interval **<Chainage Inc.:>**.

NEXT (F5)

To increase the chainage value, up chainage, by the defined chainage interval **<Chainage Inc.:>**.

PAGE (F6)

To change to another page on this screen.

SHIFT CONF (F2)

To configure reference line. Refer to "43.3 Configuring Reference Line".

SHIFT POS2D (F3)

To position the telescope (X,Y) onto the point to be staked.

SHIFT POS3D (F4)

To position the telescope (X,Y,Z) onto the point to be staked.

SHIFT INDIV (F5) and SHIFT RUN (F5)

To change between entering an individual point ID different to the defined ID template and the running point ID according to the ID template. Refer to "16.1 ID Templates".

Description of fields

Field	Option	Description
First line on screen	User input	The point ID of the point to be staked. Editable.
<hr:>	User input	The default reflector height as defined in the active configuration set is suggested.
Third line on screen	User input	The current chainage to be staked. Editable.
<FORW:>	Output	The horizontal distance along the line defined by station and reflector from the current position to the point to be staked. ↓ or ↑ to move towards the station depending on the selection for <Visual Guides:> in REFLINE Configuration, General page.
<BACK:>	Output	The horizontal distance in reverse direction from the line defined by station and reflector from the current position to the point to be staked. ↑ or ↓ to move away from the station depending on the selection for <Visual Guides:> in REFLINE Configuration, General page.

Field	Option	Description
<RGHT:>	Output	The direction depends on <Stake Mode:> in REFLINE Configuration, General page. The horizontal distance orthogonal to the right of the line defined by station and reflector from the current position to the point to be staked. → to move to the right of the line defined in <Visual Guides>, ← to move to the left of the line defined in <Visual Guides>.
<LEFT:>	Output	The direction depends on <Stake Mode:> in REFLINE Configuration, General page. The horizontal distance from the current position to the point to be staked orthogonal to the left of the line defined by station and reflector. ← to move to the left of the line defined in <Visual Guides>, → to move to the right of the line defined in <Visual Guides>.
<CUT:>	Output	The negative height difference from the height of the current position to the height of the point to be staked. Move down.
<FILL:>	Output	The positive height difference from the height of the current position to the height of the point to be staked. Move up.
<ΔHt:>	Output	Displays the difference between the height of the current position and the height to be staked.

Field	Option	Description
<Ht:>	Output	The orthometric height of the current position is displayed. If the orthometric height cannot be displayed, the local ellipsoidal height is displayed. If it is not possible to display the local ellipsoidal height, the WGS 1984 height is displayed.

Next step

PAGE (F6) changes to the **Details** page.

REFLINE Stakeout, Details page

This page shows a live version of more information regarding the staked point.

Description of fields

Field	Option	Description
<Design Sta:>	User input	Current chainage to be staked. Editable.
<Design Offset:>	User input	Current offset being staked. Editable.
<Design Ht:>	User input	The design height, which is the orthometric height of the point to be staked, is displayed. If the orthometric height cannot be displayed, the local ellipsoidal height is displayed. If it is not possible to display the local ellipsoidal height, the WGS 1984 height is displayed.

Next step

PAGE (F6) changes to the **Map** page.

REFLINE Stakeout, Map page

The **Map** page provides an interactive display of the data. Refer to "35 MapView Interactive Display Feature" for information on the functionality and softkeys available.

Next step

ALL (F1) changes to **REFLINE Results**.

43.8.5

Results of Stakeout

Access

ALL (F1) in REFLINE Stakeout.

REFLINE Results, General page

17:23

REFLINE

IR STD I

Results: EOP, VPI

General Coords Map

Point Id : 123

Code : <None>

Meas Chainage: 1020.400 m

Meas Offset : 5008.400 m

Design Ht. : 0.000 m

Meas Ht. : -1.250 m

CONT (F1)

To return to **REFLINE Stakeout**.

+ELEV (F3)

To add a vertical offset to the design height and to display the new height.

PAGE (F6)

To change to another page on this screen.

CONT +ELEV PAGE

Description of fields

Field	Option	Description
<Point ID:>	Output	The point ID of the point staked.
<Code:>	User input	With codelist: Select a code from the choicelist. Only point codes are available for selection. <None> to store a point without code or to perform Linework without coding.

Field	Option	Description
		Without codelist: Type in a code. ----- to store a point without code or to perform Line-work without coding.
<Meas Chainage:>	Output	The chainage measured at the staked point.
<Meas Offset:>	Output	The offset from the polyline measured at the staked point.
<Design Ht:>	Output	Allows input of the design height of the target point. The suggested value for the <Design Ht:> is as configured in the <Heights:> field in REFLINE Configuration, Heights page.
<Meas Ht:>	Output	The height measured at the staked point.

Next step

PAGE (F6) changes to the **Coords** page.

REFLINE Results, Coords page

This page displays the design coordinates as well as the differences between design and measured coordinates.

Next step

PAGE (F6) changes to the **Map** page.

REFLINE
Results,
Map page

The Map page provides an interactive display of the data.
Refer to "35 MapView Interactive Display Feature" for information on the functionality and softkeys available.

Next step

PAGE (F6) changes to the first page on this screen.

44.1

Overview

Description

The Reference Plane & Face Scan application program can be used to measure points relative to a reference plane. A reference plane can also be scanned via Face Scan.

Reference plane tasks

The Reference Plane & Face Scan application program can be used for the following tasks:

- Measuring points to calculate and store the perpendicular distance to the plane.
- Viewing and storing the instrument and/or local coordinates of the measured points.
- Viewing and storing the height difference from the measured points to the plane.
- Scanning a defined area.



Face scan is available for motorised instruments with reflectorless EDM.



Planes can only be computed with grid coordinates.

Activating the application program

The Reference Plane application program must be activated via a licence key. Refer to "28 Tools...\Licence Keys" for information on how to activate the application program.

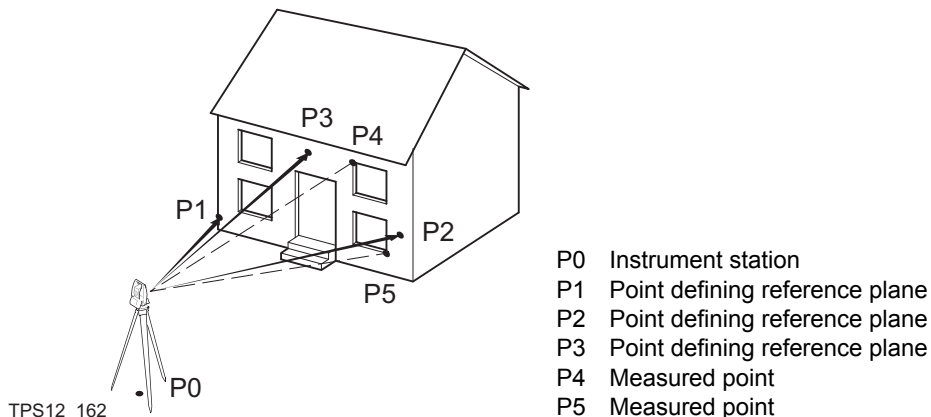
Properties of measured points

The properties stored with measured points are:

Type	Reference Plane	Face Scan
Class	MEAS	MEAS
Sub class	TPS	TPS

Type	Reference Plane	Face Scan
Source	Ref Plane (Meas) or Ref Plane (Face Scan Meas)	Face Scan
Instrument source	TPS	TPS

Defining a reference plane



Reference planes are created using a right hand system. For two points defining a plane a vertical plane is used. A reference plane is defined with the X axis and the Z axis of the plane. The Y axis of the plane defines the positive direction of the Y axis. A reference plane can be defined in the following ways.

- vertical
- tilted

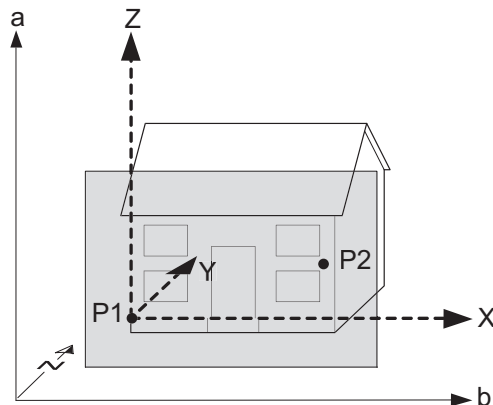
Vertical plane

The axis of the vertical reference plane are:

X axis: Horizontal and parallel to the plane; X axis starts in point defined as origin point

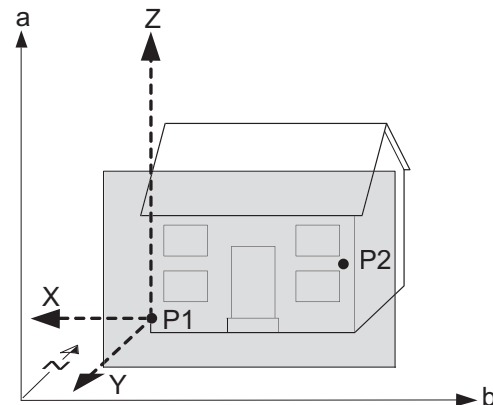
Z axis: Parallel to the instrument zenith and parallel to the plane

Y axis: Perpendicular to the plane; increases in the direction as defined
Offsets are applied in the direction of the Y axis.



TPS12_163

a Height
b Easting
N Northing
P1 Origin of plane
P2 Point of plane
X X axis of plane
Y Y axis of plane
Z Z axis of plane



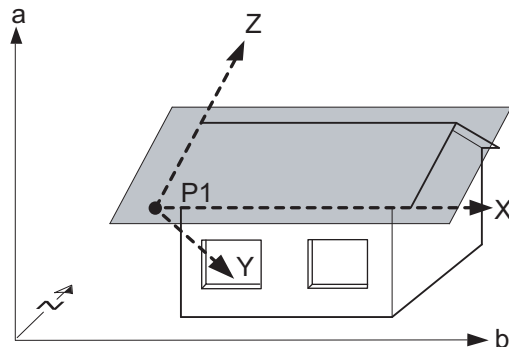
TPS12_163a

a Height
b Easting
N Northing
P1 Origin of plane
P2 Point of plane
X X axis of plane
Y Y axis of plane
Z Z axis of plane

Tilted plane

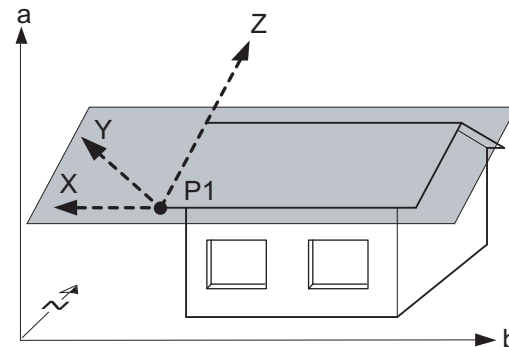
Any number of points define the plane, perimeter to be scanned is defined by a bottom left-topright window. The axis of the tilted reference plane are:

X axis: Horizontal and parallel to the plane
Z axis: Defined by steepest direction of the plane
Y axis: Perpendicular to the plane; increases in the direction as defined
☞ Offsets are applied in the direction of the Y axis.



TPS12_165

a Height
b Easting
N Northing
P1 Origin of plane
X X axis of plane
Y Y axis of plane
Z Z axis of plane



TPS12_165a

a Height
b Easting
N Northing
P1 Origin of plane
X X axis of plane
Y Y axis of plane
Z Z axis of plane



With four or more points a least squares adjustment is calculated resulting in a best fit plane.

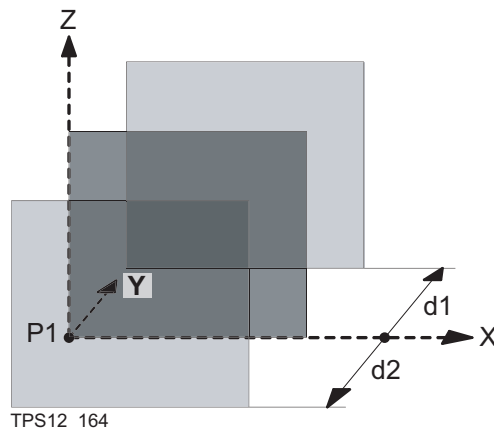
Origin

The origin of the reference plane can be defined to be in the plane coordinates or in the instrument coordinates.

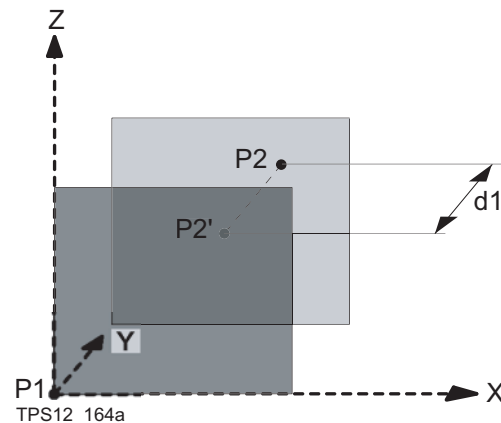
Positive direction of plane

The positive direction of the plane is defined by the direction of the Y axis. The direction can be changed by selecting a point which defines the negative direction of the Y axis.

Offset of the plane



- P1 Origin of plane
- X X axis of plane
- Y Y axis of plane
- Z Z axis of plane
- d1 Positive offset
- d2 Negative offset



- P1 Origin of plane
- P2 Point defining offset of plane
- P2' P2 projected on original plane
- d1 Offset defined by P2
- X X axis of plane
- Y Y axis of plane
- Z Z axis of plane

Access

Select **Main Menu: Programs...\Reference Plane**.

OR

Press **PROG**. Highlight **Reference Plane**. **CONT (F1)**. Refer to "36.2 Accessing the Programs Menu" for information on the **PROG** key.

OR

Press a hot key configured to access the screen **REFPLANE Reference Plane Begin**. Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

REFPLANE
Reference Plane Begin

13:23		IR STD		[Icons]	
REFPLANE					
Reference Plane Begin					
Job	:	construction			
Coord System	:	<None>			
Codelist	:	<None>			
Config Set	:	ref plane			
Reflector	:	Leica Circ Prism			
Add. Constant	:	0.0 mm			
					Q2a ↑
CONT	CONF	SETUP			CSYS

CONT (F1)

To confirm the selections and to continue with the subsequent screen.

CONF (F2)

To configure the Reference Plane application program. Refer to "44.3 Configuring Reference Plane".

SETUP (F3)

To set up station. Accesses **SETUP Station Setup**.

CSYS (F6)

To select a different coordinate system. Not available for **<Use Auto CrdSys: Yes>** configured in **CONFIGURE Additional Rover Settings**. Refer to "22.1.1 Configuration of Real-Time".

Description of fields

Field	Option	Description
<Job:>	Choicelist	The active job. All jobs from Main Menu: Manage...\Jobs can be selected.
<Coord System:>	Output	The coordinate system currently attached to the selected <Job:> . Cannot be edited for <Use Auto CrdSys: Yes> configured in CONFIGURE Additional Rover Settings . Refer to "22.1.1 Configuration of Real-Time".
<Codelist:>	Choicelist	No codes are stored in the selected job. All codelists from Main Menu: Manage...\Codelists can be selected.
	Output	Codes have already been stored in the selected <Job:> . If codes had been copied from a System RAM codelist, then the name of the codelist is displayed. If codes have not been copied from a System RAM codelist but typed in manually, then the name of the active job is displayed.

Field	Option	Description
<Config Set:>	Choicelist	The active configuration set. All configuration sets from Main Menu: Manage...\Configuration Sets can be selected.
<Reflector:>	Choicelist	The active reflector. All reflectors from Main Menu: Manage...\Reflectors can be selected.
<Add. Constant:>	Output	The additive constant stored with the chosen reflector.

Next step

IF the Reference Plane application program	THEN
is to be accessed	CONT (F1) accepts the changes and accesses the Reference Plane application program.
is to be configured	CONF (F2) . Refer to "44.3 Configuring Reference Plane".

44.3

Configuring Reference Plane

Description

Allows options to be set which are used within the Reference Plane application program. These settings are stored within the configuration set.

Access step-by-step

Step	Description
1.	Refer to "44.2 Accessing Reference Plane" to access REFPLANE Reference Plane Begin .
2.	CONF (F2) to access REFPLANE Configuration .

REFPLANE Configuration, Parameters page

This screen consists of the **Parameters** page and the **Logfile** page.

13:25 REFPLANE

Configuration

Parameters Logfile

Display Mask : <None>

Max ±Ad for Plane Def. : 0.300 m

Face Scan : 0.300 m

Display : All Points

Slice Width : 0.300 m

CONT PAGE

CONT (F1)

To accept changes and return to the screen from where this screen was accessed.

DMASK (F3)

To edit and display mask currently being displayed. Accesses **CONFIGURE Define Display Mask n**. Available when **<Display Mask:>** is highlighted on **Parameters** page. Refer to "16.2 Display Settings".

PAGE (F6)

To change to another page on this screen.

SHIFT ABOUT (F5)

To display information about the application program name, the version number, the date of the version, the copyright and the article number.

Description of fields

Field	Option	Description
<Display Mask:>	Choicelist	The user defined display mask is shown in REFPLANE Measure Points to Plane . All display masks of the active configuration set defined in CONFIGURE Display Settings can be selected.
<Max $\pm\Delta d$ for Plane Def.:>	User input	The maximum perpendicular deviation of a point from the calculated plane.
<Face Scan:>	User input	The maximum perpendicular deviation of a measured point in face scan from defined plane. Scanned points outside the defined limit are not stored.
<Display:>	All Points Points in Slice	This parameter defines the points displayed in the Plot and Map page views of the Reference Plane application program in the plan view. <Display: All Points> displays all points in the plan view. <Display: Points in Slice> displays points within the defined <Slice Width:> in the plan view.
<Slice Width:>		Available for <Display: Points in Slice> .

Field	Option	Description
	User input	This parameter defines the distance from the plane in which points are displayed. This distance is applied to both sides of the plane. If lines and areas are to be displayed in a particular Map page, then parts of lines and areas falling within the defined slice are also displayed.

Next step

PAGE (F6) changes to the **Logfile** page. Refer to paragraph "REFPLANE Configuration, Logfile page"

REFPLANE Configuration, Logfile page

Description of fields

Field	Option	Description
<Write Logfile:>	Yes or No	To generate a logfile when the application program is exited. A logfile is a file to which data from an application program is written to. It is generated using the selected <Format File:> .
<File Name:>	Choicelist	Available for <Write Logfile: Yes> . The name of the file to which the data should be written. A logfile is stored in the \DATA directory of the active memory device. The data is always appended to the file.

Field	Option	Description
		Opening the choicelist accesses XX Logfiles where a name for a new logfile can be created and an existing logfile can be selected or deleted.
<Format File:>	Choicelist	Available for <Write Logfile: Yes>. A format file defines which and how data is written to a logfile. Format files are created using LGO. A format file must first be transferred from the CompactFlash card to the System RAM before it can be selected. Refer to "24 Tools...\Transfer Objects..." for information on how to transfer a format file. Opening the choicelist accesses XX Format Files where an existing format file can be selected or deleted.

Next step

CONT (F1) returns to the screen from where this screen was accessed.

Description

A reference plane is used to measure points relative to the plane or to scan the plane.

Measure to plane

- Reference planes can be created, edited, stored and deleted in the active job.
- The reference planes can be recalled for later use.
- The plane can be shifted through a point or a defined offset.

Scan a plane

<Task: Scan> in **REFPLANE Choose Task & Reference Plane** to scan the selected plane with the defined grid.

REFPLANE
Choose Task & Reference
Plane

13:28
REFPLANE
Choose Task & Reference Plane

Task : Measure to Plane

Plane to Use : Select From Job

Ref Plane : ref plane 0001

No. of Points: 2

Std Deviation: ----- m

Max Δd : ----- m

Offset : None

Origin : Instrument Coords

Q2 a ↑

CONT

CONT (F1)

To accept changes and to continue with the subsequent screen.

SHIFT CONF (F2)

To configure the reference plane. Refer to "44.3 Configuring Reference Plane".

Description of fields

Field	Option	Description
<Task:>	Measure to Plane Scan	The coordinates of measured points are calculated relative to the reference plane. Measures a sequence of points along a vertical, tilted or horizontal face.
<Plane to Use:>	Create New Plane Select From Job	Defines a new reference plane. Reference plane is selected in <Ref Plane:>.
<Ref Plane:>	Choicelist	Available for <Plane to Use: Select From Job >. The reference plane to be used. Accesses REFPLANE Manage Reference Planes .
<No. of Points:>	Output	Available for <Plane to Use: Select From Job >. Number of points used for plane definition for the plane shown in the <Ref Plane:>.
<Std Deviation:>	Output	Standard deviation of used points for plane definition. ----- is displayed for less than four points.
<Max Δd:>	Output	Maximum distance between a point and the calculated plane. ----- is displayed for less than four points.
<Offset:>	Output	The offset method used as defined in REFPLANE XX Reference Plane, Offset page.
<Origin:>	Output	The origin method used as defined in REFPLANE XX Reference Plane, Origin page.

Next step

IF	THEN
a new plane is to be created	CONT (F1) accesses REFPLANE New Reference Plane, General page. Refer to paragraph "Create reference plane step-by-step".
points are to be measured to a plane	CONT (F1) accessses REFPLANE Measure Points to Plane, Reference page. Refer to "44.5 Measuring Points to a Reference Plane".
a plane is to be scanned	CONT (F1) accesses REFPLANE Define Scanning Parameters . Refer to "44.6 Scanning a Plane".

Create reference plane step-by-step

Step	Description	Refer to chapter
1.	Refer to "44.2 Accessing Reference Plane" to access REFPLANE Reference Plane Begin .	
2.	CONT (F1) to access REFPLANE Choose Task & Reference Plane .	
3.	REFPLANE Choose Task & Reference Plane Select <Plane to Use: Create New Plane> .	
4.	CONT (F1) to access REFPLANE New Reference Plane, General page.  NEW (F2) in REFPLANE Manage Reference Planes to access REFPLANE New Reference Plane, General page.	

Step	Description	Refer to chapter
5.	REFPLANE New Reference Plane, General page <Ref Plane:> The ID of the new reference plane. <No. of Points:> Number of points used for plane definition. <Std Deviation:> Standard deviation of used points for plane definition. ----- is displayed unless more than four points are used to define the plane. <Max Δd:> Maximum distance between measured point and defined plane. ----- is displayed unless more than four points are used to define the plane.	
6.	PAGE (F6) to change to the Points page.	
7.	REFPLANE New Reference Plane, Points page. An * is shown to the right of the point for a point which will be used as origin of the plane. An ! is shown to the left of the point if the point is outside maximum distance between a point and the calculated plane as defined in REFPLANE Configuration, Parameters page. The column Δd(m) displays the perpendicular distance of the point from the definition of the plane.	
	ADD (F2) to add points from REFPLANE Data: Job Name to define the reference plane.	
	USE (F3) to change between Yes and No for the highlighted point.	

Step	Description	Refer to chapter
	DEL (F4) to remove the highlighted point from the list.	
	SURVY (F5) to measure a point to be used for the plane.  DONE (F4) to return to REFPLANE New Reference Plane .	
	SHIFT ORIGIN (F4) to use the highlighted point as the origin of the plane.	
8.	PAGE (F6) to change to the Origin page.	
9.	REFPLANE New Reference Plane, Origin page. <Use As Origin: Plane Coords> Point results are additionally stored with X, Y, Z coordinates based on the local plane coordinate system. <Use As Origin: Instrumnt Coords> Points on the plane have instrument coordinates. <X-coord:> Available for <Use As Origin: Plane Coords> . Enter local X coordinate of origin. The origin is defined as the projection of the measured point onto the calculated plane. <Z-coord:> Available for <Use As Origin: Plane Coords> . Enter local Z coordinate of origin. The origin is defined as the projection of the measured point onto the calculated plane. <Point:> Defines the positive direction of the Y axis.	
	DIREC (F5) Available for <Point:> being hightlighted. To access REFPLANE Survey: XX . Measure a point to define the positive plane direction.	
10.	PAGE (F6) to change to the Offset page.	

Step	Description	Refer to chapter
11.	REFPLANE New Reference Plane, Offset page <Define Offset:> An offset can be defined by a point or a distance. The defined plane is shifted along the Y axis by the offset. <Offset PtID:> Available for <Define Offset: By Point ID>. Point ID of offset point. <Offset:> Distance by which to offset the plane along the Y axis. For <Define Offset: By Distance> the distance can be entered. For <Define Offset: By Point ID> the calculated distance to the adjusted plane is displayed. <Offset:-----> if no values are available.	
	OFFSET (F5) Available for <Offset PtID:> being highlighted. To access REFPLANE Survey: XX, Survey page. Measure a point to define the offset point.	
12.	PAGE (F6) to change to the Plot page.	
13.	REFPLANE New Reference Plane, Plot page Points displayed depend on the settings in REFPLANE Configuration, Parameters page. Points defining the plane are displayed in black, the other points are displayed in grey.	44.3
	SHIFT FACE (F1) to access the face view of the plane.  SHIFT PLAN (F1) to access the plan view of the plane.	
14.	STORE (F1) to compute and store the reference plane.	

Edit a reference plane step-by-step

Step	Description
1.	Refer to "44.2 Accessing Reference Plane" to access REFPLANE Reference Plane Begin .
2.	CONT (F1) to access REFPLANE Choose Task & Reference Plane .
3.	REFPLANE Choose Task & Reference Plane Select <Plane to Use: Select From Job> . Highlight <Ref Plane:>
4.	ENTER to access REFPLANE Manage Reference Planes .
5.	REFPLANE Manage Reference Planes EDIT (F3) to access REFPLANE Edit Reference Plane, General page.
6.	REFPLANE Edit Reference Plane, General page Continue with Step 5. from paragraph "Create reference plane step-by-step".

Select a reference plane from the job step-by- step

Step	Description
1.	Refer to "44.2 Accessing Reference Plane" to access REFPLANE Reference Plane Begin .
2.	CONT (F1) to access REFPLANE Choose Task & Reference Plane .
3.	REFPLANE Choose Task & Reference Plane Select <Plane to Use: Select From Job> .
4.	Highlight <Ref Plane:>
5.	ENTER to access REFPLANE Manage Reference Planes .

Step	Description
6.	REFPLANE Manage Reference Planes Select a reference plane.
	MORE (F5) displays information about date and time of when the reference plane was created and the number of points defining the plane.
7.	CONT (F1) to access REFPLANE Measure Points to Plane, Reference page.

Measure points to plane
step-by-step

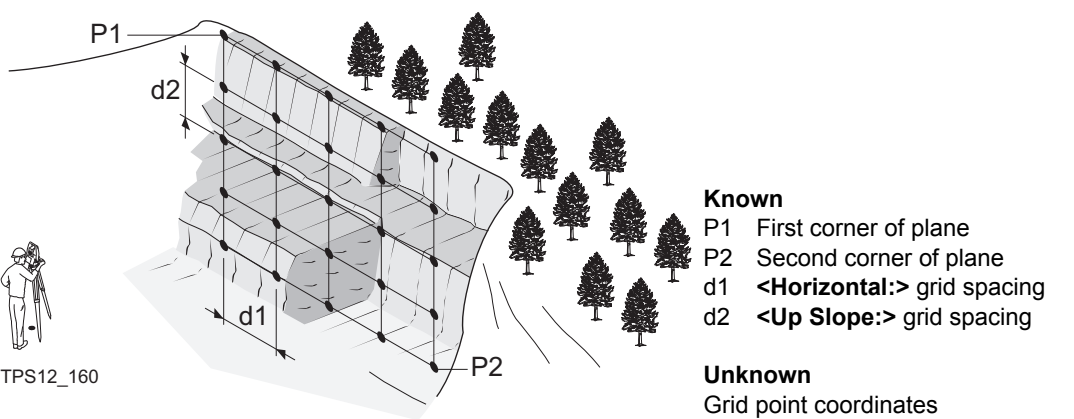
Step	Description
1.	Refer to "44.2 Accessing Reference Plane" to access REFPLANE Reference Plane Begin .
2.	CONT (F1) to access REFPLANE Choose Task & Reference Plane .
3.	REFPLANE Choose Task & Reference Plane Select a reference plane. Refer to paragraph "Select a reference plane from the job step-by-step".
4.	CONT (F1) to access REFPLANE Measure Points to Plane, Reference page.
5.	REFPLANE Measure Points to Plane, Reference page <Offset ΔPer d:> The perpendicular distance between measured point and adjusted plane. <Offset ΔHt:> The vertical distance between measured point and adjusted plane. For <Use As Origin: Plane Coords> <X Coordinate:> , <Y Coordinate:> and <Z Coordinate:> are displayed. For <Use As Origin: Instrumnt Coords> <Easting:> , <Northing:> and <Height:> are displayed.
	CMPR (F4) to calculate offsets to previously measured points.  STORE (F1) to store the results for the point currently being displayed.  DONE (F4) to return to REFPLANE Measure Points to Plane, Reference page.

Step	Description
	PLANE (F5) to edit the selected reference plane.
	SHIFT INDIV (F5) for an individual point ID independent of the ID template. SHIFT RUN (F5) changes back to the next ID from the configured ID template.
6.	PAGE (F6) to change to the Map page.
7.	REFPLANE Measure Points to Plane, Map page.
	SHIFT FACE (F1) to access the face view of the plane.
	SHIFT PLAN (F1) to access the plan view of the plane.
8.	ALL (F1) to measure points on the plane.

Description

Face Scan automates the process of measuring a sequence of points along the defined vertical, tilted or horizontal face. The boundaries of the window of interest and the interval values for vertical and horizontal grid are defined by the user. Face scan can be run on motorised instruments with the option "reflectless EDM" only.

Diagram



Scan a new plane step-by-step

Step	Description	Refer to chapter
1.	Refer to "44.2 Accessing Reference Plane" to access REFPLANE Reference Plane Begin.	
2.	CONT (F1) to access REFPLANE Choose Task & Reference Plane.	

Step	Description	Refer to chapter
	SHIFT CONF (F2) to access REFPLANE Configuration, Parameters page.	44.3
3.	REFPLANE Choose Task & Reference Plane <Task: Scan> <Plane to Use: Create New Plane>	
4.	CONT (F1) to access REFPLANE New Reference Plane	
5.	REFPLANE New Reference Plane Define new reference plane. Refer to paragraph "Create reference plane step-by-step".	
6.	STORE (F1) to store the new reference plane.	
7.	Define the first and second corner of the area to be scanned.	
8.	REFPLANE Define Scanning Parameters For tilted and vertical planes: <Horizontal:> Horizontal grid distance. <Up Slope:> Up slope grid distance. <Pt ID Inc:> The incrementation used for <Start Pt ID:>. No point ID template used.	

Step	Description	Refer to chapter
	- For <Start Pt ID: RMS> and <Pt ID Inc: 10> the points are <Point ID: RMS>, <Point ID: RMS10>, <Point ID: RMS20>, ..., <Point ID: RMS100>, ... - For <Start Pt ID: 100> and <Pt ID Inc: 10> the points are <Point ID: 100>, <Point ID: 110>, ..., <Point ID: 200>, <Point ID: 210>, ... - For <Start Pt ID: abcdefghijklmn89> and <Pt ID Inc: 10> the points are <Point ID: abcdefghijklmn99>, point ID incrementing fails. <Scan Area:> Size of the area to be scanned. <Estimated Pts:> Estimated number of points to be scanned.	
9.	START (F1) to access REFPLANE Scanning Status, Scanning page.	
	PAUSE (F3) to pause the scanning of points.  SCAN (F3) to continue scanning.	
	STOP (F1) to stop the scanning of points.	
10.	REFPLANE Scanning Status, Scanning page Status of the scanning is displayed when under process. <Pts Scanned:> Number of points being scanned. <Pts Remaining:> Number of points remaining to be scanned. <Pts Rejected:> Number of skipped points. <% Completed:> Percentage of points scanned.	

Step	Description	Refer to chapter
	<Time Left:> Estimated time remaining until scan is finished. <Point ID:> Point ID of last stored point.	
11.	PAGE (F6) to access REFPLANE Scanning Status, Plot page	
12.	REFPLANE Scanning Status, Plot page Points currently scanned are displayed in black, previously measured points, lines and areas are displayed in grey.	
	SHIFT FACE (F1) to access the face view of the plane.  SHIFT PLAN (F1) to access the plan view of the plane.	
13.	CONT (F1) to access REFPLANE Choose Task & Reference Plane .	

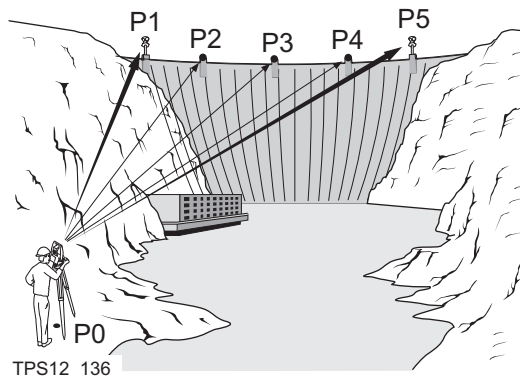
45.1

Overview

Description

- Sets of Angles:
 - This program (which can include Monitoring as an option) is used to measure multiple sets of directions and distances (optional) to pre-defined target points in one or two faces.
 - The mean direction and mean distance (optional) to each target point, within a set is calculated. The residual for each direction and distance (optional) within a set is also calculated.
 - The reduced average direction and average distance (optional) to each target point, for all active sets is calculated.
- Monitoring:
 - This module can be integrated within the Sets of Angles program.
 - With this module, it is possible to use a timer to enable repeated and automated angle and distances measurements to pre-defined target points at defined intervals.

Diagram



Known:

- P1 Pre-defined target point - E,N,Height (optional)
- P2 Pre-defined target point - E,N,Height (optional)
- P3 Pre-defined target point - E,N,Height (optional)
- P4 Pre-defined target point - E,N,Height (optional)
- P5 Pre-defined target point - E,N,Height (optional)

Unknown:

- a) Mean direction and mean distance (optional) to each target point, within a set
- b) Mean coordinates (optional) for each target point, for all active sets
- c) Residual for each direction and distance (optional), within a set
- d) Reduced average direction and average distance (optional) to each target point, for all active sets

Measure at least:

- a) Two target points
- b) Two sets

ATR - automatic target recognition

ATR search and ATR measurements can be performed to a reflector. After completing the first measurements to each target point, the measurements to the target points in subsequent sets are automated.

Station setup and station orientation

A station set up and station orientation is required before starting the Sets of Angles program, if oriented grid coordinates are to be recorded.

Point properties

The properties stored with Sets of Angles points are:

- Class: **MEAS** or **NONE**
 - Sub class: **TPS**
 - Source: **Sets of Angles**
 - Instrument source: **TPS**
-

Point averaging

An average is never calculated for Sets of Angles points, even if a measured point of class **MEAS** already exists with the same point ID.

45.2

45.2.1

Access

Sets of Angles

Accessing Sets of Angles

Select **Main Menu: Programs...\Sets of Angles**.

OR

Press **PROG**. Highlight **Sets of Angles**. **CONT (F1)**.

Refer to "36.2 Accessing the Programs Menu" for information on the **PROG** key.

OR

Press a hot key configured to access the screen **SETS Sets of Angles Begin**.

Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

SETS

Sets of Angles Begin

17:27 SETS IR STD I

Sets of Angles Begin

Fixpoint Job : fixpoint job

Job : measure job

Coord System : <None>

Codelist : <None>

Config Set : configure set

Reflector : Leica Circ Prism

Add. Constant : 0.0 mm

Q2a ↑

CONT CONF SETUP CSYS

CONT (F1)

To accept changes and access the next screen. The chosen settings become active.

CONF (F2)

To configure the Sets of Angles program. Accesses **SETS Configuration**. Refer to "45.2.2 Configuring Sets of Angles".

SETUP (F3)

To set up the station. Accesses **SETUP Station Setup**.

CSYS (F6)

To select a different coordinate system.

Description of fields

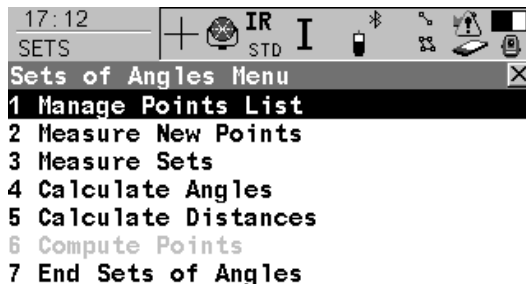
Field	Option	Description
<Fixpoint Job:>	Choicelist	The job where the target points to be observed can be selected and a points list created. All jobs from Main Menu: Manage...\Jobs can be selected. Determines the active coordinate system. The data from this job is shown in MANAGE Data: Job Name .
<Job:>	Choicelist	The active job. All jobs from Main Menu: Manage...\Jobs can be selected. Determines the active coordinate system. The data from this job is shown in MANAGE Data: Job Name .
<Coord System:>	Output	The coordinate system currently attached to the selected <Job:>.
<Codelist:>	Choicelist	No codes are stored in the selected job. All codelists from Main Menu: Manage...\Codelists can be selected.
	Output	Codes have already been stored in the selected job. If codes had been copied from a System RAM codelist, then the name of the codelist is displayed. If codes have not been copied from a System RAM codelist but typed in, then the name of the active job is displayed.

Field	Option	Description
<Config Set:>	Choicelist	The active configuration set. All configuration sets from Main Menu: Manage...\Configuration Sets can be selected.
<Reflector:>	Choicelist	The reflector currently set in the selected configuration set. All reflectors from Main Menu: Manage...\Reflectors can be selected.
<Add. Constant:>	Output	The additive constant stored with the chosen reflector.

Next step

CONT (F1) accepts the changes and accesses **SETS Sets of Angles Menu**.

SETS Sets of Angles Menu



CONT (F1)

To select the highlighted option and to continue with the next screen.

SHIFT CONF (F2)

To configure the Sets of Angles program. Accesses **SETS Configuration**. Refer to "45.2.2 Configuring Sets of Angles".



Description of Sets of Angles Menu options

SETS menu options	Description	Refer to chapter
Manage Points List	To create, edit and manage a points list of the target points for the survey.	45.2.3
Measure New Points	To define the target points and to measure the first set.	45.2.4
Measure Sets	To measure the second set and any further sets.	45.2.5
Calculate Angles	To calculate horizontal/vertical angles and their residuals.	45.2.6
Calculate Distances	To calculate distances and their residuals.	45.2.6
Compute Points	To compute average coordinates using all measurements.	45.2.7
End Sets of Angles	To end the Sets of Angles program.	

Next step

IF the Sets of Angles application program	THEN
is to be accessed	highlight the relevant option and press CONT (F1) . Refer to stated chapters above.
is to be configured	CONF (F2) . Refer to "45.2.2 Configuring Sets of Angles".
is to be ended	highlight End Sets of Angles and CONT (F1) .

45.2.2

Configuring Sets of Angles

Access

Select **Main Menu: Programs...\Sets of Angles. CONT (F1)**. In **SETS Sets of Angles Begin** press **CONF (F2)** to access **SETS Configuration, Parameters** page.

OR

Press **PROG**. Highlight **Sets of Angles. CONT (F1)**. In **SETS Sets of Angles Begin** press **CONF (F2)** to access **SETS Configuration, Parameters** page.

OR

Press **SHIFT CONF (F2)** in **SETS Sets of Angles Menu**.

SETS Configuration, Parameters page

This screen consists of the **Parameters** page, the **Tolerances** page and the **Logfile** page. The explanations for the softkeys given below are valid for all pages, unless otherwise stated

18:37
SETS
Configuration
Parameters | Tolerances | Logfile
MeasMethod : A'A'B'B' |<|>
Display Mask : <None> |<|>
Stop For : All Messages |<|>
Time Out : No Time Out |<|>
Re-Measure : Never |<|>
Timer Monit. : No |<|>
CONT [] [] PAGE

CONT (F1)

To accept changes and return to the screen from where this screen was accessed.

DEFLT (F5)

Available for default configuration sets. To recall the default settings.

PAGE (F6)

To change to another page on this screen.

SHIFT ABOUT (F5)

To display information about the program name, the version number, the date of the version, the copyright and the article number.

Description of fields

Field	Option	Description
<MeasMethod:>	$A^I A^{II} B^{II} B^I$ $A^I A^{II} B^I B^{II}$ $A^I B^I A^{II} B^{II}$ $A^I B^I B^{II} A^{II}$ $A^I B^I C^I D^I$	- Determines the order in which the target points are to be measured. - The target points are measured in face I and face II. - point A I - point A II - point B II - point B I ... - The target points are measured in face I and face II. - point A I - point A II - point B I - point B II ... - The target points are measured in face I and face II. - point A I - point B I ... point A II - point B II ... - The target points are measured in face I and face II. - point A I - point B I ... point B II - point A II ... - The target points are only measured in face I. - point A I - point B I - point C I - point D I ...
<Display Mask:>	Choicelist	The user defined display mask to be shown in SETS Select Points - Survey . All display masks of the active configuration set defined in CONFIGURE Display Settings can be selected.
<Stop For:>	Choicelist All Messages	To define what action is taken when a message dialog appears during a measurement set. All message dialogs are displayed as per normal and are closed as defined by the settings in <Time Out:>.

Field	Option	Description
	Tol Exceed Only Never	Only the message dialog relating to the exceeding of tolerances is displayed and is closed as defined by the settings in <Time Out:>. • No message dialogs are displayed except for specific warnings. • Specific warnings which affect the instrument and it's ability to continue with the monitoring process will be displayed and will remain on the screen. These include the overheating of the instrument, low battery levels, unavailable space on the CompactFlash card.
<Time Out:>	No Time Out 1 sec to 60 sec	To define the time delay for the automatic closing of message dialogs during a measurement set. This choicelist is not available when <Stop For: Never>. No Time Out There is no automatic closure of message dialogs. When a message dialog appears, it is only closed by pressing YES (F4). 1 sec to 60 sec All message dialogs are automatically closed as defined by these individual time settings.
<Re-Measure:>	Choicelist Never	To define the action if a target point cannot be measured. Never The target point is skipped and the next target point in the list is measured.

Field	Option	Description
	Automatic	The measurement to the target point is repeated automatically.  The option for <ATR Settings> is also changed for the repeated measurement. If the option is changed, it is applied to all following sets.
	Manual	The measurement to the target point can be repeated manually or the target point can be skipped.
<Timer Monit.:>	Yes No	This input field is only available when Monitoring is registered through the licence key. Automatic monitoring of target points is activated. Automatic monitoring of target points is not activated. The Sets of Angles application will apply.

Next step

PAGE (F6) changes to the **Tolerances** page.

SETS Configuration, Tolerances page

Description of fields

Field	Option	Description
<Use Tolerances:>	Yes or No	The entered horizontal, vertical and distance tolerances are checked during the measurements to verify accurate pointing and measurements.
<Hz Tolerance:>	User input	Tolerance for horizontal directions.

SETS
Configuration,
Logfile page

Field	Option	Description
<V Tolerance:>	User input	Tolerance for vertical directions
<Dist Tolerance:>	User input	Tolerance for distances.

Next step

PAGE (F6) changes to the **Logfile** page.

Description of fields

Field	Option	Description
<Write Logfile:>	Yes or No	To generate a logfile when the application program is exited. A logfile is a file to which data from an application program is written to. It is generated using the selected <Format File:> .
<File Name:>	Choicelist	Available for <Write Logfile: Yes> . The name of the file to which the data should be written. A logfile is stored in the \DATA directory of the active memory device. The data is always appended to the file. Opening the choicelist accesses XX Logfiles where a name for a new logfile can be created and an existing logfile can be selected or deleted.

Field	Option	Description
<Format File:>	Choicelist	Available for <Write Logfile: Yes>. A format file defines which and how data is written to a logfile. Format files are created using LGO. A format file must first be transferred from the CompactFlash card to the System RAM before it can be selected. Refer to "24 Tools...\Transfer Objects..." for information on how to transfer a format file. Opening the choicelist accesses XX Format Files where an existing format file can be selected or deleted.

Next step

PAGE (F6) changes to the first page on this screen.

45.2.3

Managing the Points List

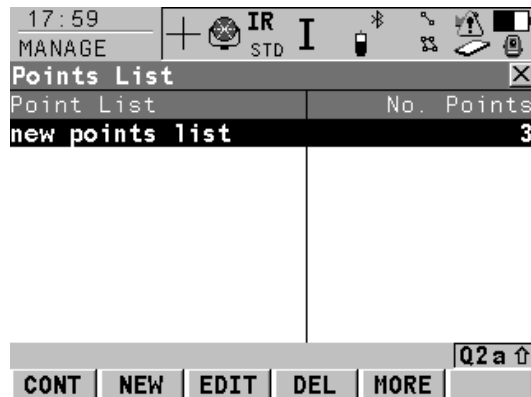
Description

A points list of the target points for the survey can be created, edited and managed. New points are always added from the fixpoint job, as defined in the Sets of Angles Begin screen.

Access

Highlight **Manage Points List** in **SETS Sets of Angles Menu** and **CONT (F1)**.

MANAGE Points List



CONT (F1)

To return to the Sets of Angles Menu.

NEW (F2)

To create a new points list.

EDIT (F3)

To edit an existing points list.

DEL (F4)

To delete an existing points list.

MORE (F5)

To display additional information.

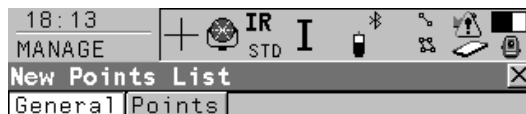
SHIFT HOME (F2)

To move the focus to the top of all the lists.

SHIFT END (F3)

To move the focus to the end of all the lists.

MANAGE
New Points List,
General page



Points List : **new points list**

Auto Survey : **No**  

Auto Sort Pts: **Yes**  



STORE (F1)

To store the new points list.

Description of fields

Field	Option	Description
<Points List:>	User input	The name of the points list.
<Auto Survey:>	Yes or No	To automatically survey the target points (the instrument will automatically turn and measure the target point). For instruments with ATR.
<Auto Sort Pts:>	Yes or No	To automatically sort the target points (the instrument will work in a clockwise direction and find the shortest path to move between the target points).

MANAGE

Select Points, Points page

18:21
MANAGE

Select Points

General Points

Point	Point Code
0001	-----
0002	-----

STORE ADD ADD1 REMOV MORE PAGE

Q2 a ↑

STORE (F1)

To store the points to the list.

ADD (F2)

To add points from the fixpoint job to the list.

ADD 1 (F3)

To add one point from the fixpoint job to the list.

REMOV (F4)

To remove the highlighted point from the list.
The point itself is not deleted.

MORE (F5)

To display additional information.

45.2.4

Measuring the New Points

Description

The points to be used for Sets of Angles can be selected and the first set measured. The measurement settings of the first measurement to each point are used for all further sets.

Access

Highlight **Measure New Points** in **SETS Sets of Angles Menu** and **CONT (F1)**.

SETS

Define Points for Set

20:12

IR STD I

Define Points for Set

Pts Measured : 0

Point ID : 0001

Reflector Ht : 1.250 m

Auto Survey : Off

Reflector : Leica Circ Prism

Add. Constant: 0.0 mm

Q2a

CONT DONE

CONT (F1)

To measure the entered point and to access **SETS Select Points - Survey**.

DONE (F5)

To finish selection of points and access **SETS Sets of Angles Menu** for further steps.

SHIFT GETPT (F4)

To select points stored in the database.

SHIFT INDIV (F5) and SHIFT RUN (F5)

To change between entering an individual point ID different to the defined ID template and the running point ID according to the ID template. Refer to "16.1 ID Templates" for more information on point ID templates.

Description of fields

Field	Option	Description
<Auto Survey:>	On or Off	For instruments with ATR and <Auto Survey: On> ATR search and ATR measurements are done to specified targets in additional sets.

Next step

IF points	THEN
are to be measured	CONT (F1) to access SETS Select Points - Survey .
are to be taken from the database	SHIFT GETPT (F4) to access SETS Data: Job Name .
are not to be selected	DONE (F5) to access SETS Sets of Angles Menu .

SETS

Select Points - Survey, Sets page

18:33
SETS
Select Points - Survey

Sets Map

Point ID : 0001
Reflector Ht : 1.250 m
Hz : 200.0004 g
V : 300.0002 g
Slope Dist : 75.015 m
ΔHz : -0.0001 g
ΔV : -0.0004 g
ΔSlope : 0.000 m

Q2 a ↑
ALL DIST REC POSIT PAGE

ALL (F1)

To measure and store angles and distance and to return to **SETS Define Points for Set**.

DIST (F2)

To measure a distance.

REC (F3)

To store data and to return to **SETS Define Points for Set**.

POSIT (F5)

To position the instrument to the selected target point.

PAGE (F6)

To change to another page on this screen.

Description of fields

The fields are the same as in **SETS Set XX of XX, Pt XX of XX**.

Next step

ALL (F1) to measure and store and to return to **SETS Define Points for Set**.

Select points step-by-step

The step-by-step description explains how to measure points if **<MeasMethod: A'B'B''A''>** and **<Auto Survey: On>** are set.

Step	Description
1.	SETS Define Points for Set
2.	Is a point to be selected from the database?

Step	Description
	• If yes, continue with step 3. • If no, continue with step 5.
3.	SHIFT GETPT (F4) to access SETS Data: Job Name .
4.	SETS Data: Job Name Highlight the desired point and CONT (F1) to access SETS Select Points . Continue with step 6.
5.	Type in <Point ID:> if new or different point ID is required.
6.	CONT (F1) to access SETS Select Points - Survey .
7.	SETS Select Points - Survey ALL (F1) to measure and store angles and distance and return to SETS Define Points For Set .
8.	Repeat step 2. to step 7. until all points are selected
9.	DONE (F5) to end selection of points.



If **<Auto Survey: On>**, instruments with ATR automatically measure the selected points in the second face of the first set.

45.2.5

Measuring the Sets

Description

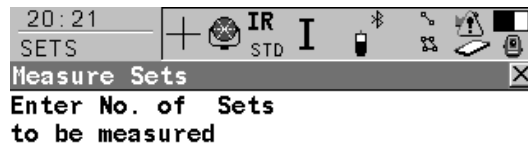
The selected points from **SETS Measure New Points** are used for measuring further sets. The settings of measurements are taken from the first measurement to each target.

Access

Highlight **Measure Sets** in **SETS Sets of Angles Menu** and **CONT (F1)**.

SETS

Measure Sets



No. of Sets : 1

No. of Pts : 4



CONT (F1):

Opens **SETS Point Measurement - Survey** to measure the points. For **<Auto Survey: On>** measurements are done automatically.

Description of fields

Field	Option	Description
<No. of Sets:>	User input	The number of sets to measure with the target points. There is a maximum of 99 sets allowed.
<No. of Pts:>	Output	The number of target points.

SETS

Set XX of XX,
Pt XX of XX,
Sets page

Next step

CONT (F1) to measure further sets of the defined points.

16:39
SETS
Set 2 of 2, Pt 1 of 3
Sets Map
Point ID : 0001
Reflector Ht : 1.250 m
Hz : 0.0005 g
V : 100.0008 g
Slope Dist : 75.015 m
ΔHz : -0.0002 g
ΔV : -0.0002 g
ΔSlope : 0.000 m
Q2 a ↑
ALL DIST REC SKIP DONE PAGE

ALL (F1)

To measure and store angles and distances and to increment to next point.

DIST (F2)

To measure a distance.

REC (F3)

To store data and to increment to next point.

SKIP (F4)

To skip measuring the displayed point and continue with the next point.

DONE (F5)

To end the sets of angles measurements and to return to **SETS Sets of Angles Menu**.

PAGE (F6)

To change to another page on this screen.

SHIFT POSIT (F5)

To position the instrument to the selected target point.

Description of fields

Field	Option	Description
<Δ Hz:>	Output	Difference between the current horizontal angle and the horizontal angle to this target when selected.

Field	Option	Description
<Δ V:>	Output	Difference between the current vertical angle and the horizontal angle to this target when selected.
<Δ Slope:>	Output	Difference between the current slope distance to the target and the slope distance to this target when selected.

Next step

ALL (F1) to measure further sets of the selected points.



- Motorised instruments point automatically in the direction of the targets.
- Instruments with ATR and **<Auto Survey: On>** measure the targets automatically.

Measure sets step-by-step

Step	Description
1.	Refer to " Select points step-by-step" for information on how to select points.
2.	SETS Measure Sets <No. of Sets:> enter the number of sets to be measured.
3.	CONT (F1) to access SETS Set XX of XX, Pt XX of XX, Sets page. • motorised instruments measure the targets automatically. • non motorised instruments guide to the next point to be measured; follow the instructions given.
4.	SETS Set XX of XX, Pt XX of XX, Sets page. ALL (F1) to measure and record.

Step	Description
	SKIP (F4) to skip the measurement of a point. Sets with incomplete measurements are not stored.
5.	Repeat step 4. until all sets are measured.
6.	DONE (F5) or automatic after all sets are measured to access SETS Sets of Angles Menu . Calculations can be done now.



For the calculation two entire sets must be measured. Horizontal and vertical angles and distances can be calculated individually.

45.2.6

Calculations - Calculating Angles and Distances in Two Faces

Description

For two and more sets measured with angles and distances in two faces calculations can be done for angles and distances. For sets measured in one face the results can be viewed but no calculations are done. Refer to "45.2.9 Calculations - Viewing Results in One Face" for more information.

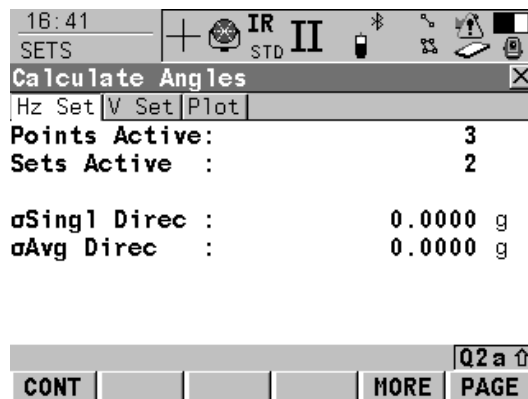
Access

Highlight **Calculate Angles** in **SETS Sets of Angles Menu** and **CONT (F1)**.

SETS

Calculate XX,
XX Set page

The softkeys are the same for vertical angles, horizontal angles and for distances.



CONT (F1)

To access **SETS Sets of Angles Menu**.

MORE (F5)

To view results of calculation.

PAGE (F6)

To change to another page on this screen.

Description of fields

Field	Option	Description
<Points Active:>	Output	Number of active points which are set to On in the Use column and used for calculation.
<Sets Active:>	Output	Number of active sets which are set to On in the Use column and used for calculation.
< σ Singl Direc:>	Output	Standard deviation of a single horizontal or vertical direction.
< σ Singl Dist:>	Output	Standard deviation of a single distance.
< σ Avg Direc:>	Output	Standard deviation of the average horizontal or vertical direction.
< σ Avg Dist:>	Output	Standard deviation of the average distance.

Next step

IF	THEN
calculations are to be exited	CONT (F1) to access SETS Sets of Angles Menu .
results are to be viewed	MORE (F5) to access SETS View XX Results .

SETS
Calculate XX,
Plot page

The functionality and softkeys available are described in the MapView chapter. Refer to "35.6 Plot Mode - MapView Screen Area" for information functionality.

45.2.7

Calculations - Calculating Points

Access

Highlight **Compute Points** in **SETS Sets of Angles Menu** and **CONT (F1)**.

SETS

Compute Points, General page

Description of keys

Key	Description
STORE (F1)	The number of selected points having been measured.
PAGE (F6)	To change to another page on this screen. The functionality and softkeys available are described in the MapView chapter. Refer to "35.6 Plot Mode - MapView Screen Area" for information functionality.
SHIFT QUIT	To exit the application.

Description of fields

Field	Option	Description
<No. of points active:>	Output	The number of selected points having been measured.
<No. of sets active:>	Output	The number of sets having been measured.
<Store points to job:>	Choicelist	The calculated points will be stored in this job. The original points are not copied to this job.

Field	Option	Description
		The working job is selected: If a measurement triplet with the same point ID measured outside the application exists in the job, then the point can be stored with a pre-/suffix or it can be disabled from the calculation. A job other than the working job is selected: The point is stored with class CTRL. The angles and distances are stored as point results to the point in the database.
<Store Point ID with:>	Prefix	Adds the setting for <Prefix/suffix:> in front of the original point IDs.
	Suffix	Adds the setting for <Prefix/suffix:> at the end of the original point IDs.
<Prefix/suffix:>	User input	The identifier with up to four characters is added in front of or at the end of the ID of the calculated points.

SETS

Compute Points, Plot page

The functionality and softkeys available are described in the MapView chapter. Refer to "35.6 Plot Mode - MapView Screen Area" for information functionality.

45.2.8

Calculations - Viewing Angle and Distance Results in Two Faces

Access

Press **MORE (F5)** in **SETS Calculate Angles** or **SETS Calculate Distances**

SETS

View XX Results

18:42			IR	II					
SETS			STD						
View Angle Results									
Set	Use	Hz	Σr	V	Σv				
1	Yes	-0.0000g		0.0000g					
2	Yes	0.0000g		-0.0000g					
						Q2 a ↑			
CONT		EDIT	USE						

CONT (F1)

To access **SETS Calculate XX**.

EDIT (F3)

To access **SETS View Residuals in Set XX**.

USE (F4)

To set **Yes** or **No** in the **Use** column for the highlighted set.

Description of columns

Column	Description
Set	Displays the numbers of all sets measured.
Use	For Yes : The selected set is used for calculations. For No : The selected set is not used for calculations.
Hz Σr	Shows the calculated Σr in Hz of the selected set. Σr is the sum of the difference between the reduced average direction and each sets directions. For sets not used for calculation ----- is shown.

Column	Description
V Σr	Shows the calculated Σr in V of the selected set. Σr is the sum of the difference between the average V angles and each sets V angles. For sets not used for calculation ----- is shown.

Next step

IF	THEN
results of a single set are to be edited	EDIT (F3) to access SETS View Residuals in Set XX .
results are to be exited	CONT (F1) to access SETS Calculate XX .
the setting for use is to be changed	USE (F4) to change between Yes and No for the highlighted set.

SETS

View Residuals in Set XX

18:43

SETS

IR

STD

II

View Residuals in Set 1

Point ID	Use	Resd1 Hz	Resd1 V
0001	Yes	0.0000g	0.0001g
0002	Yes	0.0000g	-0.0000g
0003	Yes	-0.0000g	0.0000g

Q2 a ↑

CONT

USE

MORE

CONT (F1)

To access **SETS View XX Results**.

USE (F4)

To set **Yes** or **No** in the **Use** column for the highlighted point.

MORE (F5)

To view additional information.

Description of columns when calculating angles

Column	Description
Point ID	- This column is always visible. - Point ID of the measured points in the order they were defined and measured in SETS Measure New Points truncated to six digits from the right.
	The following three columns appear together. By pressing MORE (F5) these columns are replaced with other columns.
Use	- For Yes: The selected point is used for calculations in all sets. - For No: The selected point is not used for calculations in all sets.
Resd1 Hz	Residual in the Hz value of the selected point within the single set.

Column	Description
Resdl V	Residual in the V value of the selected point within the single set.
	The following two columns appear together. By pressing MORE (F5) these columns are replaced with other columns.
Avg Hz	Reduced Average Hz value of the point in all active sets.
Avg V	Average V value of the point in all active sets.
	The following two columns appear together. By pressing MORE (F5) these columns are replaced with other columns.
Mean Hz	Mean Hz value of the point within the single set.
Mean V	Mean V value of the point within the single set.

Description of columns when calculating distances

Column	Description
Point ID	- This column is always visible. - Point ID of the measured points in the order they were defined and measured in SETS Measure New Points truncated to six digits from the right.
	The following three columns appear together. By pressing MORE (F5) these columns are replaced with other columns.
Use	- For Yes: The selected point is used for calculations in all sets. - For No: The selected point is not used for calculations in all sets.
Resdl SD	Residual in the distance value of the point within the single set.

Column	Description
Avg SD	Average distance value of the point in all active sets.
	The following column appears. By pressing MORE (F5) this column is replaced with other columns.
Mean SD	Mean distance value of the point within the single set.

Next step

IF	THEN
additional information is to be viewed	MORE (F5) to show additional information.
residuals are to be exited	CONT (F1) to access SETS View XX Results .
the setting for use is to be changed	USE (F4) to change between Yes and No for the highlighted point.

45.2.9

Calculations - Viewing Results in One Face

Access

Highlight **Calculate XX** in **SETS Sets of Angles Menu** and press **CONT (F1)**.

SETS

View Single Face Results

12:01	+		IR	I	Bluetooth	Wi-Fi	USB	QR
SETS			STD					
View Single Face Results								
Point ID	σ Hz		Avg Hz					
501	0.0001g		0.0003g					
502	0.0001g		100.0004g					
503	0.0002g		200.0002g					
504	0.0003g		300.0004g					
Q2 a ↑								
CONT				MORE				

CONT (F1)

To access **SETS Sets of Angles Menu**.

MORE (F5)

To view additional columns.

Description of columns

Column	Description
Point ID	Point ID of the measured points in the order they were defined and measured in SETS Measure New Points truncated to six digits from the right.
σ Hz	Standard deviation of all Hz readings to the point.
Mean Hz	Mean value of all Hz readings to the current point.
σ V	Standard deviation of all V readings to the current point.

Column	Description
Mean V	Mean value of all V readings to the current point.
σ Dist	Standard deviation of all distance measurements to the current point.
Mean SD	Mean value of all distance measurements to the current point.

Next step

IF	THEN
other columns are to be viewed	MORE (F5) to view additional columns.
viewing results is to be exited	CONT (F1) to access SETS Sets of Angles Menu . Refer to "45.2.1 Accessing Sets of Angles".

Description

- Monitoring is a module integrated within the Sets of Angles application program.
- Monitoring uses a timer to enable repeated and automated angle and distances measurements to pre-defined target points at defined intervals. The ability to configure the handling of message dialogs during measurement sets is also enabled.

Important aspects

- For monitoring, instruments must be motorised.

Access

- Monitoring is licence protected and is only activated through a licence key. The licence key can be entered manually or loaded from the CompactFlash card.
- Refer to "45.2.1 Accessing Sets of Angles" for details on accessing Monitoring.

Monitoring preparation

- This step-by-step description is an example on preparing a set for monitoring.
- Refer to "45.2 Sets of Angles" for a complete description of the Sets of Angles program.

Step	Description
1.	From Main Menu: Programs... select Sets of Angles .
1.	Press CONT (F1) to access the SETS Sets of Angles Begin screen.
2.	Set station coordinates and station orientation - SETUP (F3) .
3.	Configure Sets of Angles for monitoring - CONF (F2) . For the Parameters page: • <MeasMethod: A B A > (for example purposes only). • <Display Mask: None> (for example purposes only). • <Stop For: All Messages> (for example purposes only).

Step	Description
	• <Time Out: 10 secs> (for example purposes only). • <Timer Monit.: Yes> (this option must be selected for monitoring). This will enable the access to the SETS Define Monitoring Timer screen.
4.	Press CONT (F1) to access the SETS Sets of Angles Menu screen.
5.	Select Measure New Points .
6.	Press CONT (F1) to access the SETS Define Points for Set screen
7.	Enter details of the target point as required. For each target point, ensure that <Auto Survey: On> is set. This will enable the automated measurement and recording of the target point in the other face and the automated measurement and recording of all target points during monitoring.
8.	Press CONT (F1) to access the SETS Select Points - Survey screen.
9.	Measure and record the measurement to the target point as required.
10.	Continue with steps 7/8/9 until all target points for the first measurement set have been measured and recorded.
11.	Press DONE (F5) to complete the selection of the target points for the first measurement set in one face and to begin the measurement of the target points in the other face. On completion the SETS Sets of Angles Menu screen will be accessed.
12.	Select Measure Sets .
13.	Press CONT (F1) to access the SETS Define Monitoring Timer screen. Refer to "SETS Define Monitoring Timer" for information about the screen.

SETS

Define Monitoring Timer

Description

- This screen enables the entry of dates, times, intervals and the handling of message dialogs during a measurement set. When all required information is entered press **CONT** (F1) to begin the monitoring process.

16:49
SETS

Define Monitoring Timer

Begin Date : 23.11.05
Begin Time : 07:00:00
End Date : 23.11.05
End Time : 09:30:00

Interval : 000:30:00

Stop For : All Messages
Time Out : 1 sec

CONT

CONT (F1)

To begin the monitoring process.

Description of fields

- The format of all date and time input fields is defined in **CONFIGURE Units and Formats**.
- The format of the interval input field is hh:mm:ss.

Field	Option	Description
<Begin Date:>	User Input	Start date for monitoring.
<Begin Time:>	User Input	Start time for monitoring.
<End Date:>	User Input	End date for monitoring.

Field	Option	Description
<End Time:>	User Input	End time for monitoring.
<Interval:>	User Input	The time between the start of each scheduled measurement set.
<Stop For:>	Choicelist	- To define what action is taken when a message dialog appears during a measurement set. - The setting for this input field has already been defined in the configuration. Here, it can be changed if required, before starting the monitoring process.
<Time Out:>	Choicelist	- To define the time delay for the automatic closing of message dialogs during a measurement set. This choicelist is not available when <Stop For: Never>. - The setting for this input field has already been defined in the configuration. Here, it can be changed if required, before starting the monitoring process.

Monitoring interval

Description

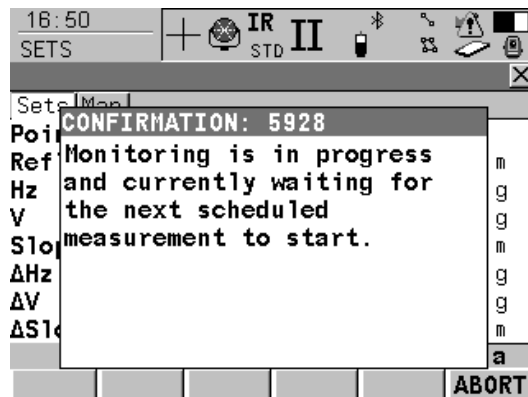
- The times and dates entered define the time frame for the monitoring.
- The time interval defines the starting time for each measurement set which is from **<Begin Time:>** to the next **<Begin Time:>**.

Example

- Data - 3 target points; 4 measure sets; Begin Date: 20.04.2002; Begin Time: 14:00:00; End Date 23.04.2002; End Time 14:00:00; Interval 30 min
- Results - The time taken to measure 4 sets of 3 target points in both faces is 10 minutes. The measurements will start at 14:00:00 on 20.04.2002. At 14:10:00 the first measurement set is complete. The instrument will wait until 14:30:00 for the next scheduled measurement set.

Monitoring in progress

This screen displays a notice that monitoring is in progress.



ABORT (F6)

To stop the monitoring process and return to the **SETS Sets of Angles Menu** screen.

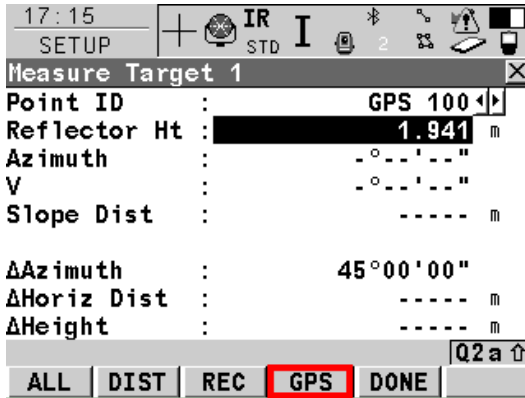
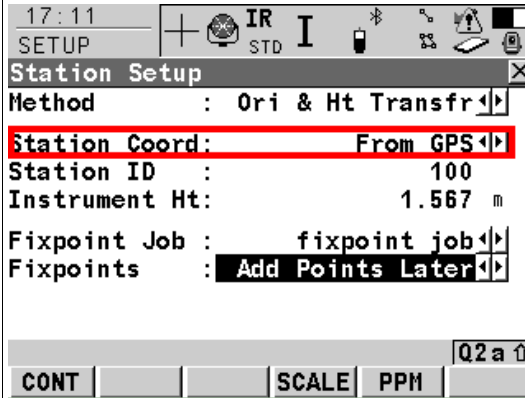
Calculations

Refer to "45.2 Sets of Angles" for information about calculations and the viewing of results.

46.1

Overview

Description

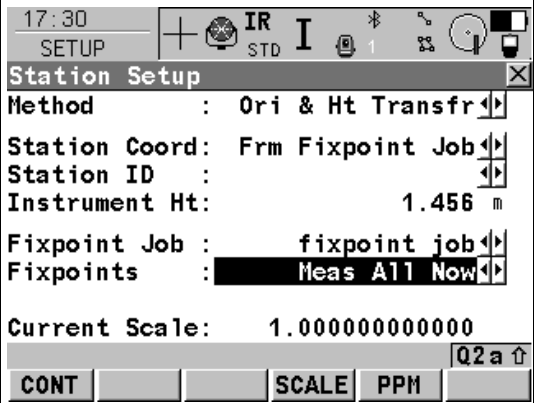
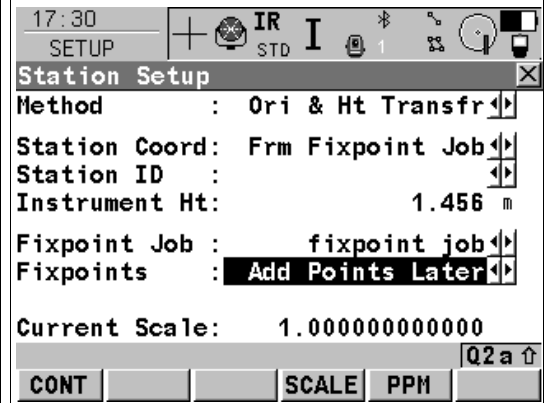
Setup	
The Setup program is used when setting up a TPS station, to determine the TPS station coordinates (with TPS and/or GPS measurements) and setting the TPS orientation.	
Setup with GPS, using SmartPole	Setup with GPS, using SmartStation
SmartPole enables target points to be determined from GPS measurements, which can then be used as control points for the TPS station setup.	SmartStation enables TPS station coordinates (position and height) to be determined from GPS measurements.
	

Setup methods

Setup Method	"Standard" setup type	"On-the-Fly" setup type	Methods for TPS1200+/ TS30/TM30	Methods for SmartPole	Methods for SmartStation
Set Azimuth	✓		✓		✓
Known Backsight Point	✓		✓	✓	✓
Orientation & Height Transfer	✓	✓	✓	✓	✓
Resection	✓	✓	✓	✓	
Resection Helmert	✓	✓	✓	✓	
Local Resection	✓		✓		

- Each setup method requires different input data and a different number of target points.
- All setup methods are described in "46.6 Setup Methods".

Setup types

"Standard" setup	"On-the-Fly" setup
This type of setup is the traditional type. The user must always measure all setup points consecutively to complete the setup. The TPS station coordinates and TPS orientation must be set before measuring survey points.	This setup allows the user to measure setup points and survey points as they work or "on the fly". The TPS station coordinates and TPS orientation do not have to be set before measuring survey points. This can be done at anytime during the survey.
Fixpoints=Meas All Now must be set.	Fixpoints=Add Points Later must be set.
	
	This setup can only be used when measuring survey points. When staking out points, the TPS station coordinates and TPS orientation must first be set.

Incomplete setups

- For a "Standard" setup, the user must always measure all setup points consecutively to complete the setup. This type of setup is always regarded as a complete setup.
- For an "On-the-Fly" setup, the setup points can be measured together with the survey points. It is not necessary to complete the setup before measuring survey points. In this state, this type of setup is regarded as an incomplete setup.

An incomplete setup can be accessed in the following ways:	
1.	When pressing SETUP (F3) in the Begin screen of a program (other than Setup), a message is displayed to notify that the setup is incomplete. It is then possible to: a) start Setup and continue to measure additional fixpoints, or OK (F4) b) start Setup and create a new station setup, or NEW (F2) c) leave Setup and continue with the existing program ABORT (F6)
2.	When pressing CONT (F1) in the Begin screen of any program, a message is displayed to notify that the setup is incomplete. It is then possible to: a) continue with the existing program[*], or CONT (F1) b) start Setup and create a new station setup, or NEW (F3) c) start Setup and continue to measure additional fixpoints. SETUP (F6)
3.	Assigning the function FUNC Continue Open Setup to the User Menu or a Hot Key.

* The Setup Reminder screen (if it has been set) is not displayed in this instance.
In the Survey program, Setup can be accessed by **SETUP (F5)**.

Properties of setup points

TPS Points

The properties stored with a TPS point are:

Type	Station	Target
Class	REF	MEAS or NONE
Sub class	TPS	TPS
Source	Setup (setup method)	Setup (setup method)
Instrument source	TPS	TPS

GPS points (only applicable when using SmartPole or SmartStation)

The properties stored with a GPS point are:

Type	Station	Station
Class	MEAS	NAV
Sub class	GPS Fixed / GPS Code only	GPS Code only
Source	Setup (setup method)	Setup (setup method)
Instrument source	GPS	GPS

Access

Select **Main Menu: Programs...\Setup**.

OR

Press **PROG**. Highlight **Setup**. **CONT (F1)**.

Refer to "36.2 Accessing the Programs Menu" for details on the **PROG** key.

OR

Press **USER** (configuring the User Menu to include the Setup program).

Refer to "2.2 USER Key" for details on the **USER** key.

OR

Press **SETUP (F3)** in the **Begin** screen of another program (other than Setup).

SETUP

Station Setup Begin

19:15
SETUP

Station Setup Begin

Job : measure job

Coord System : <None>

Codelist : <None>

Config Set : configure set

Reflector : Leica Circ Prism

Add. Constant: 0.0 mm

CONT CONF CSYS

CONT (F1)

To accept changes and access the subsequent screen. The chosen settings become active.

CONF (F2)

To configure the Setup application program. Accesses **SETUP Configuration**. Refer to "46.3 Configuring Setup".

CSYS (F6)

To select a different coordinate system.

Description of fields

Field	Option	Description
<Job:>	Choicelist	The active job. All jobs from Main Menu: Manage...\Jobs can be selected.
<Coord System:>	Output	The coordinate system currently attached to the selected <Job:>. A coordinate system is required for a station setup with GPS.
<Codelist:>	Choicelist	No codes are stored in the selected job. All codelists from Main Menu: Manage...\Codelists can be selected.
	Output	Codes have already been stored in the selected job. If codes had been copied from a System RAM codelist, then the name of the codelist is displayed. If codes have not been copied from a System RAM codelist but typed in, then the name of the active job is displayed.
<Config Set:>	Choicelist	The active configuration set. All configuration sets from Main Menu: Manage...\Configuration Sets can be selected.
<Reflector:>	Choicelist	The reflector currently set in the selected configuration set. All reflectors from Main Menu: Manage...\Reflectors can be selected.
<Add. Constant:>	Output	The additive constant stored with the chosen reflector.

Next step

IF the Setup application program	THEN
is to be accessed	CONT (F1) to accept the changes and continue.
is to be configured	CONF (F2) . Refer to "46.3 Configuring Setup".

46.3

Configuring Setup

Access

Select **Main Menu: Programs...\Setup**.

In SETUP Station Setup Begin press **CONF (F2)** to access **SETUP Configuration**.

OR

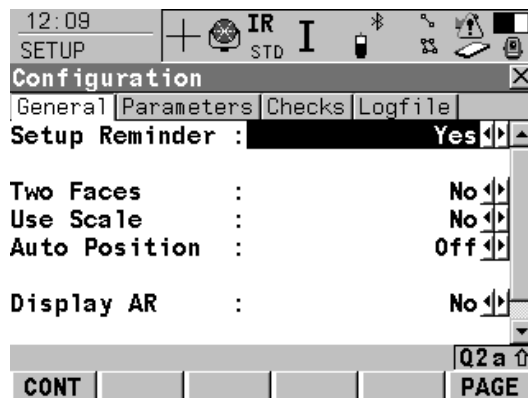
Press **PROG**. Highlight **Setup**. **CONT (F1)**.

In SETUP Station Setup Begin press **CONF (F2)** to access **SETUP Configuration**.

OR

Press **SHIFT CONF (F2)** in **SETUP Station Setup**.

SETUP Configuration, General page



CONT (F1)

To accept changes and return to the screen from where this screen was accessed.

PAGE (F6)

To change to another page on this screen.

SHIFT ABOUT (F5)

To display information about the program name, the version number, the date of the version, the copyright and the article number.

Description of fields

Field	Option	Description
<Setup Reminder:>	Choicelist	Current instrument setup details can be displayed to remind the user to either keep the current instrument setup or to create a new instrument setup. Refer to "46.6.1 Setup Reminder" for details.
	Yes	Whenever CONT (F1) is pressed in a Begin screen, the current setup information is displayed.
	No	Whenever CONT (F1) is pressed in a Begin screen, the current setup information is not displayed and the program continues as normal.
<Two Faces:>	Choicelist	Defines if the instrument measures the second face automatically after storing the first.
	Yes	After storing a measurement with ALL (F1) or REC (F3) motorised instruments change face automatically, non-motorised instruments access SETUP Telescope Positioning . The measurements of face I and face II are averaged on the base of face I. The averaged value is stored.
	No	No automatic measurement in two faces.  For the setup methods <Method: Set Azimuth> or <Method: Known BS Point> the selected option in the field <Two Faces:> is ignored. For these setup methods, measurements are not made in two faces.

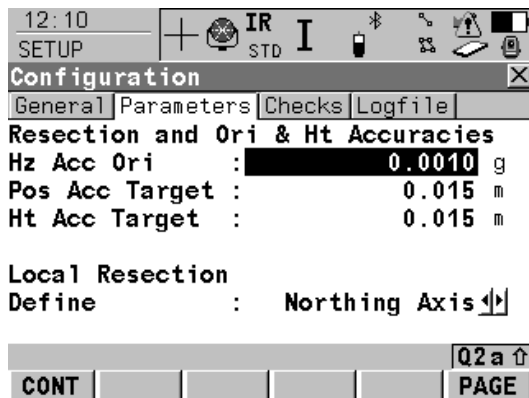
Field	Option	Description
<Use Scale:>	Choicelist	The appearance of the SETUP Results screen differs with this setting.
	Yes	The calculated scale factor and ppm value from the resection and orientation and height transfer calculation are displayed in the SETUP Results, Sigma page. The ppm value may be set in the system as the geometric ppm value. In SETUP Station Setup the <Current Scale:> is displayed and PPM (F5) is available.
	No	The calculated scale factor from the resection calculation is displayed in the SETUP Results, Sigma page but cannot be set as the geometric ppm value.
<Auto Position:>	2D	Instrument positions horizontally to the point.
	3D	Instrument positions horizontally and vertically to the point.
	Off	Instrument does not position to the point.
<Display AR:>	Choicelist	To set the direction to the backsight point to zero.
	Yes	Sets <AR: 0.0000> towards the backsight point. If set in the current display mask, <AR:> displays the horizontal angle difference between the backsight point and the measured point. This has no effect on the set orientation.

Field	Option	Description
	No	Does not set a value for <AR:>. If the display mask is configured to display <AR:> in the Survey application program, the value is identical to the azimuth.  If <Set Angle Right: Yes> and more than one backsight point is used, the behaviour is as for <Set Angle Right: No>.
<Antenna:>	Choicelist	Applicable when the SmartAntenna is connected. Opening the choicelist accesses MANAGE Antennas . The default antenna is the SmartAntenna.

Next step

PAGE (F6) changes to the **Parameters** page.

SETUP Configuration, Parameters page



12:10 SETUP

Configuration

General Parameters Checks Logfile

Resection and Ori & Ht Accuracies

Hz Acc Ori : 0.0010 g

Pos Acc Target : 0.015 m

Ht Acc Target : 0.015 m

Local Resection

Define : Northing Axis

CONT Q2 a ↑ PAGE

CONT (F1)

To accept changes and return to the screen from where this screen was accessed.

PAGE (F6)

To change to another page on this screen.

SHIFT ABOUT (F5)

To display information about the program name, the version number, the date of the version, the copyright and the article number.

Description of fields

Field	Option	Description
When Method=Resections, Ori & Ht Transfer, the following fields apply:		
<Hz Acc Ori:>	User input	For Resection or Orientation and Height Transfer. Limit for the standard deviation of the orientation for resection and orientation and height transfer.
<Pos Acc Target:>	User input	For Resection or Orientation and Height Transfer. Position accuracy of the target point for resection and orientation and height transfer.
<Ht Acc Target:>	User input	For Resection or Orientation and Height Transfer. Height accuracy of the target point for resection and orientation and height transfer.
When Method=Local Resection, the following fields apply:		
<Define:>	Choicelist	For Local Resection. To define the positive North or positive East axis.
	Northing Axis	The second point measured defines the direction of the positive North axis.
	Easting Axis	The second point measured defines the direction of the positive East axis.
When Method=Resection Helmert, the following fields apply:		
<Weighting:>	1/Distance or 1/Distance²	To change the distance weighting that is used in the calculation of the station height in the resection.

SETUP Configuration, Checks page

Next step

PAGE (F6) changes to the **Checks** page.



Known Backsight Checks

Pos Check : **Yes**

Pos Limit : 0.015 m

Height Check : **Yes**

Height Limit : 0.015 m



CONT (F1)

To accept changes and return to the screen from where this screen was accessed.

PAGE (F6)

To change to another page on this screen.

SHIFT ABOUT (F5)

To display information about the program name, the version number, the date of the version, the copyright and the article number.

Description of fields

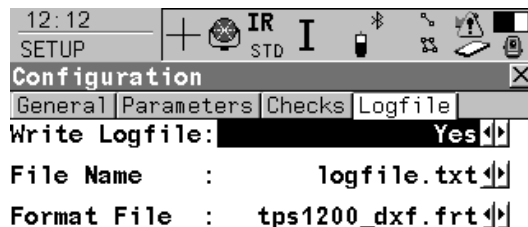
Field	Option	Description
When Method=Known BS Point, the following fields apply:		
<Pos Check:>	Yes or No	Allows a check to be made on the horizontal coordinate difference between the existing and the measured known backsight point. If the defined <Pos Limit:> is exceeded, the setup can be repeated, skipped or stored.

Field	Option	Description
<Pos Limit:>	User input	Available for <Pos Check: Yes>. Sets the maximum horizontal coordinate difference accepted in the position check.
<Height Check:>	Yes or No	Allows a check to be made on the vertical difference between the existing and the measured known backsight point. If the <Height Limit:> is exceeded, the stakeout can be repeated, skipped or stored.
<Height Limit:>	User input	Available for <Height Check: Yes>. Sets the maximum vertical difference accepted in the height check.

Next step

PAGE (F6) changes to the **Logfile** page.

SETUP Configuration, Logfile page



CONT (F1)

To accept changes and return to the screen from where this screen was accessed.

PAGE (F6)

To change to another page on this screen.

SHIFT ABOUT (F5)

To display information about the program name, the version number, the date of the version, the copyright and the article number.



Description of fields

Field	Option	Description
<Write Logfile:>	Yes or No	To generate a logfile when the application program is exited. A logfile is a file to which data from an application program is written to. It is generated using the selected <Format File:>.
<File Name:>	Choicelist	Available for <Write Logfile: Yes>. The name of the file to which the data should be written. A logfile is stored in the \DATA directory of the active memory device. The data is always appended to the file.

Field	Option	Description
		Opening the choicelist accesses Logfiles where a name for a new logfile can be created and an existing logfile can be selected or deleted.
<Format File:>	Choicelist	Available for <Write Logfile: Yes>. A format file defines which and how data is written to a logfile. Format files are created using LGO. A format file must first be transferred from the CompactFlash card to the System RAM before it can be selected. Refer to "24 Tools...\Transfer Objects..." for information on how to transfer a format file. Opening the choicelist accesses Format Files where an existing format file can be selected or deleted.

Next step

PAGE (F6) changes to the first page on this screen.

Access step-by-step

	Description
1.	Access SETUP Station Setup Begin .
2.	SETUP Station Setup Begin Check the settings and ensure that a coordinate system other than <None> or WGS84 is selected and attached to the active job.
3.	CONT (F1) to access SETUP Station Setup .
4.	SETUP Station Setup - Choose one of the following setup methods: <Method: Set Azimuth> or <Method: Known BS Point> or <Method: Ori & Ht Transfr>. - These are the only methods applicable for a setup with SmartStation. - All setup methods are described in "46.6 Setup Methods".
	<Station Coord: From GPS> . Ensure that the SmartAntenna is connected and the interface is set. <Station ID:> Enter the instrument station. <Instrument Ht:> Enter the height of the instrument station.
5.	CONT (F1) to access SETUP New Station Point . If a coordinate system has not been selected:

	Description
	• LOCAL (F5) to access SETUP SmartStation One Pt OneStep to enter local coordinates for the setup point and a name for the local coordinate system. • CSYS (F6) to access SETUP Coordinate Systems to select an existing coordinate system. In this screen the creating and editing of coordinate systems is also available.
6.	SETUP New Station Point • OCUPY (F1) To start the point occupation. • STOP (F1) To end the point occupation. • STORE (F1) To store the point information.

SETUP New Station Point

Overview of the screen

Important features about this screen:

- Upon entering **SETUP New Station Point** SmartStation switches into GPS mode.
- The display mask for **SETUP New Station Point** is fixed and is not configurable.
- A coordinate system for the setup is required and should be attached to the active job.
- If not already on, SmartAntenna is automatically turned on upon entry to the screen.
- Some of the screen icons change from TPS specific to GPS specific.
- The occupation/storing behaviour is dependent on the configuration settings.

11:40
SETUP

New Station Point

Station ID : 2
Instrument Ht: 1.567 m
3D CQ : 0.010 m
Time at Point: 00:00:09
RTK Positions: 10

STORE

To start logging of static observations. The position mode icon changes to the static icon. **(F1)** changes to **STOP**.

To end logging of static observations when enough data is collected. When **<Auto STOP: Yes>** in **CONFIGURE Point Occupation Settings**, logging of static observations ends automatically as defined by the stop criteria. The position mode icon changes to the moving icon. **(F1)** changes to **STORE**.

To store the measured point. When **<Auto STORE: Yes>** in **CONFIGURE Point Occupation Settings**, the measured point is stored automatically. **(F1)** changes to **OCUPY**. It may happen that a point with the same point ID exists in the job.

To dial the number of the reference station configured in the active configuration set and to hang up immediately after the survey is completed. Available for GPS real-time devices of type digital cellular phone or modem. Available for **<Auto CONEC: No>** in **CONFIGURE GSM Connection**.

SHIFT INIT (F4)

To select an initialisation method and to force a new initialisation. Available for configuration sets allowing phase fixed solutions.

Description of fields

Field	Option	Description
<Station ID:>	Output	Station ID as entered in SETUP Station Setup .
<Instrument Ht:>	Output	Instrument height as entered in SETUP Station Setup . SmartAntenna offset is automatically added but not displayed.
<3D CQ:>	Output	The current 3D coordinate quality of the computed position.
<Time at Point:>	Output	The time from when the point is occupied until point occupation is stopped.
<RTK Positions:>	Output	The number of GPS real-time positions recorded over the period of point occupation.
<Msd PP Obs:>	Output	The number of static observations recorded over the period of point occupation. Available only when the recording of static observations is configured. Refer to "22.6 Logging of Raw Obs" for details.

Next step

STOP (F1) to end the point occupation,

STORE (F1) to store the point and then return to **SETUP Set Stn & Ori - Setup Method**.

Access step-by-step

	Description
1.	Access SETUP Station Setup Begin .
2.	SETUP Station Setup Begin Check the settings and ensure that a coordinate system other than <None> or WGS84 is selected and attached to the active job.
3.	CONT (F1) to access SETUP Station Setup .
4.	SETUP Station Setup - Choose one of the following setup methods: <Method: Known BS Point> or <Method: Ori & Ht Transfr>, or <Method: Resection> or <Method: Resection Helmert>. - These are the only methods applicable for a setup with SmartPole. - All setup methods are described in "46.6 Setup Methods".
5.	<Station Coord:> If available, select the source for the instrument station coordinates <Station ID:> Enter/Select the instrument station <Instrument Ht:> Enter the height of the instrument station <Fixpoint Job:> Select the fixpoint job of the control/target points
6.	<Fixpoints:> If available, select the method for measuring the control/target points. Select Meas All Now if a "Standard" setup is required.

	Description
	Select Add Points Later if an “On-the-Fly” setup is required.
	Steps 7. and 8. do not relate to <Method: Known BS Point> .
7.	CONT (F1) to access SETUP Measure Target 1 .
8.	SETUP Measure Target 1 Refer to "46.6.4 Orientation and Height Transfer" for details on all fields and keys.
9.	GPS (F4) to access SETUP Survey Survey .
10.	SETUP Survey Survey This is the GPS Survey screen within the Setup program. The target points can be measured with GPS, which can then be used as fixpoints for the station setup. • OCUPY (F1) To start the point occupation. • STOP (F1) To end the point occupation. • STORE (F1) To store the point information.

SETUP Survey Survey

Overview of the screen

Important features about this screen:

- Upon entering **SETUP** Survey Survey SmartPole switches into GPS mode.
- The display mask for **SETUP** Survey Survey is configurable.
- A coordinate system for the setup is required and should be attached to the active job.
- If not already on, SmartAntenna is automatically turned on upon entry to the screen.
- Some of the screen icons change from TPS specific to GPS specific.
- The occupation/storing behaviour is dependent on the configuration settings.

Screen display

17:15
SETUP

Survey: new job

Survey Code Annot Map

Indiv Pt ID : GPS 001

Antenna Ht : 2.000 m

RTK Positions: 5

3D CQ : 0.007 m

Q2 a ↑

STORE NEAR PAGE

OCCUPY (F1)

Refer to "46.4 Setup with SmartStation".

STOP (F1)

Refer to "46.4 Setup with SmartStation".

STORE (F1)

Refer to "46.4 Setup with SmartStation".

NEAR (F2)

To find the nearest reference station with the connected device. Coordinates of these stations must be known.

SHIFT CONEC (F3) and SHIFT DISCO (F3)

Refer to "46.4 Setup with SmartStation".

SHIFT INIT (F4)

Refer to "46.4 Setup with SmartStation".

Description of fields

Field	Option	Description
<Indiv Pt ID:>	User input	An Individual Pt ID is used by default. This enables the user to give the target point a different point ID.
<Antenna Ht:>	User input	The antenna height.
<RTK Positions:>	Output	The number of GPS real-time positions recorded over the period of point occupation.

Field	Option	Description
<3D CQ:>	Output	The current 3D coordinate quality of the computed position.
<Msd PP Obs:>	Output	The number of static observations recorded over the period of point occupation. Available only when the recording of static observations is configured. Refer to "22.6 Logging of Raw Obs" for details.

Next steps

- **STORE (F1)** to store the point and then return to SETUP Measure Target. Refer to "46.6.4 Orientation and Height Transfer" for details on all fields and keys.
 - **ALL (F1)** to measure and store this same point with the TPS station. (The GPS target point which was previously stored, is automatically suggested as the target point to measure with the TPS station. This is then the first target point for the station setup).
 - **GPS (F4)** to measure additional target points with GPS.
 - **DONE (F5)** to temporarily exit the Setup program. (This is applicable when Add Points Later is set. In this state, this type of setup is regarded as an incomplete setup. The setup can be continued and completed at a later time). This key is replaced by CALC (F5) when sufficient data is available.
 - **CALC (F5)** to compute the setup results (This is applicable when at least two target points have been measured and stored).
 - **SET (F1)** to set the TPS station and TPS orientation in the SETUP Results screen. This setup is now complete. It is still possible to add additional points to the setup to improve the setup results. Refer to "46.7.2 Additional Information".

46.6

46.6.1

Setup Methods

Setup Reminder

Description

- When activated, the setup reminder function displays a screen which enables the user to check the current station setup details before proceeding with the survey. When this screen appears, three options are available to the user:
 - 1. To keep the current station setup and proceed with the survey.
 - 2. To create a new station setup.
 - 3. To check the backsight point.
- The setup reminder function is available to every application program, except:
 - Alignment Tool Kit
 - Determine Coordinate System
 - Setup
 - Traverse

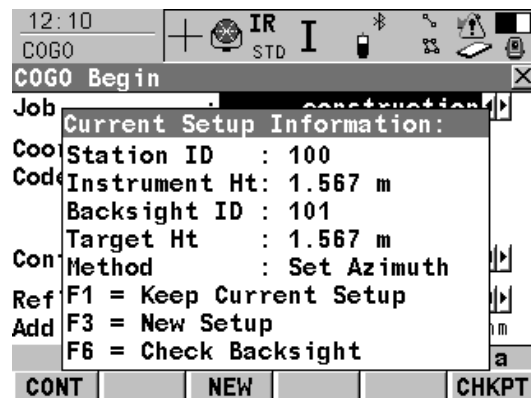
Access

When the setup reminder function is activated (refer to "46.3 Configuring Setup"), the current station setup details are displayed whenever **CONT (F1)** is pressed in a **Begin** screen in an application program.

Setup Reminder screen

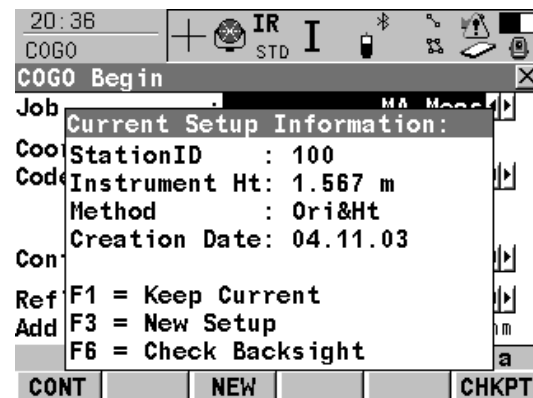
Reminder for setup method

- Set Azimuth
- Known BS Point



Reminder for setup method

- Ori & Ht Transfer
- Resection
- Resection Helmert
- Local Resection



Description of softkeys

Softkey	Description
CONT (F1)	To continue with the existing program.
NEW (F3)	To start the Setup program and create a new station setup.
CHKPT (F6)	To open the Check Recorded Pt/Backsight Pt screen.

46.6.2

Set Azimuth

Requirements

- For TPS1200+/TS30/TM30 the position coordinates of the station point are required. The instrument is set up and oriented to either a known or unknown target point, to which a true or assumed azimuth is set.
- For SmartStation the position coordinates of the station are unknown and are determined with GPS real-time. The instrument is set and oriented to either a known or unknown target point, to which a true or assumed azimuth is set.

Updating Hz measurements

- A station setup using this setup method is always automatically flagged with an 'update later' attribute. Therefore, all angle measurements taken from that station are always automatically updated.

Access step-by-step

- This screen can be accessed from the **SETUP Station Setup** screen or by pressing **SETAZ (F5)** in the **SURVEY Survey** screen. The step-by-step description is for access from the **SETUP Station Setup** screen.
- Refer to the stated chapter for more information on screens.

	Description	Refer to chapter
1.	Press PROG to access the Programs menu.	
2.	Select and activate Setup to move to the first screen.	
3.	Press CONT (F1) to access SETUP Station Setup .	
4.	<Method:> Ensure that Set Azimuth is selected. <Station Coord:> Select the source for the instrument station coordinates. <Station ID:> Enter/Select the instrument station.	

	Description	Refer to chapter
	<Instrument Ht:> Enter the height of the instrument station. <Fixpoint Job:> Select the fixpoint job of the control/target points.	
5.	The geometric scale correction is displayed. The correction displayed depends upon the options chosen in CONFIGURE TPS Corrections, GeoPPM page: • if <Calc Scale: Automatically>, <Computd Scale:> is displayed. • if <Calc Scale: Manually>, <Current Scale:> is displayed.	17.4
6.	Press CONT (F1) to access SETUP Set Stn & Ori - Set Azimuth .	

SETUP

Set Stn & Ori - Set Azimuth, Setup page

12:02
 SETUP
 Set Stn & Ori - Set Azimuth
 Setup BS Info Stn Info
 Backsight ID : 101
 Reflector Ht : 1.567 m
 Aim at point and enter Azimuth
 Azimuth : 100.0001 g
 Horiz Dist : 99.988 m
 SET DIST Az=0 FREE PAGE

SET (F1)

To set the station and orientation and exit the Setup application program.

DIST (F2)

To measure a distance to the point being used to set the azimuth.

A distance measurement is **NOT** required when setting the Station and the Orientation **SET (F1)**. Checking is **NOT** performed on the distance measurement when setting the Station and the Orientation **SET (F1)**.

Az=0 (F4)

Available on the **Setup** page. To set <Azimuth: 0> and running. This value is not set to the system until **SET (F1)** is pressed.

HOLD (F5) or FREE (F5)

Available on the **Setup** page and if **<ATR: Off>**. **HOLD (F5)** freezes the current **<Azimuth:>** value, making it possible to set the **<Azimuth:>** value first, turn the instrument to the desired direction and release the **<Azimuth:>** value using **FREE (F5)**.

PAGE (F6)

To change to another page on this screen.

SHIFT INDIV (F5) and SHIFT RUN (F5)

Available on the **Setup** page. To change between entering an individual backsight point ID different to the defined ID template and the running point ID according to the ID template. Refer to "16.1 ID Templates" for more information on point ID templates.

Description of fields

Field	Option	Description
<Backsight ID:>	User input	Point ID of the backsight point according to the point ID template.
<Reflector Ht:>	User input	The default reflector height as defined in the active configuration set is suggested.

Field	Option	Description
<Azimuth:>	User input	The current system azimuth value. If a different azimuth is typed in and ENTER is pressed or if Az=0 (F4) is pressed, this azimuth value is displayed in the field and updated with the telescope movement. The value is not set to the system until SET (F1) is pressed.
<Horiz Dist:>	Output	Press (F2) to measure a distance to the target point being used to set the azimuth.

Next step

IF	THEN
the next page is to be accessed	PAGE (F6) changes to the BS Info page.
the station and orientation is to be set	SET (F1) to set the station and orientation.

SETUP

Set Stn & Ori -
Set Azimuth,
BS Info page

12:03
SETUP
Set Stn & Ori - Set Azimuth
Setup BS Info Stn Info
Backsight ID : 101
Code : bs
Code Desc : backsight

SET (F1)

To set the station and orientation and exit the Setup application program.

PAGE (F6)

To change to another page on this screen.

SET PAGE Q2 a ↑

Description of fields

Field	Option	Description
<Backsight ID:>	Output	Backsight ID as entered in SETUP Station Setup .
<Code:>	Choicelist	The code for the backsight point.
<Code Desc:>	Output	A short description of the code.

Next step

IF	THEN
the next page is to be accessed	PAGE (F6) changes to the Stn Info page.
the station and orientation is to be set	SET (F1) to set the station and orientation.

SETUP

Set Stn & Ori -
Set Azimuth,
Stn Info page

12:04
SETUP
Set Stn & Ori - Set Azimuth
Setup BS Info Stn Info
Station ID : 100
Instrument Ht: 1.567 m
Code : st
Code Desc : station
Stn Easting : 100.000 m
Stn Northing : 100.000 m
Stn Height : 100.000 m
Current Scale: 1.000000000000
Q2 a ↑
SET PAGE

SET (F1)

To set the station and orientation and exit the Setup application program.

PAGE (F6)

To change to another page on this screen.

Description of fields

Field	Option	Description
<Station ID:>	Output	Station ID as selected in SETUP Station Setup .
<Instrument Ht:>	User input	The instrument height.
<Code:>	Choicelist	The code for the station point.
<Code Desc:>	Output	A short description of the code.
<Stn Easting:>	Output	The easting coordinate for the setup station.
<Stn Northing:>	Output	The northing coordinate for the setup station.
<Stn Height:>	Output	The height of the setup station.

Field	Option	Description
<Current Scale:>	Output	The geometric scale correction is displayed. The correction displayed depends upon the options chosen in CONFIGURE TPS Corrections, GeoPPM page. Refer to "17.4 TPS Corrections" for details.

Next step

IF	THEN
the next page is to be accessed	PAGE (F6) changes to the Setup page.
the station and orientation is to be set	SET (F1) to set the station and orientation.

Set azimuth step-by-step

Application: Set up the instrument over a known point with orientation to a point with known azimuth.

Settings: Set <Automation: ATR> in **CONFIGURE EDM & ATR Settings**.

- The following table explains the most common settings.
- Refer to the stated chapter for more information on screens.

	Description	Refer to chapter
1.	Access SETUP Set Stn & Ori - Set Azimuth .	46.6.2
2.	SETUP Set Stn & Ori - Set Azimuth, Setup page <Azimuth:> The azimuth to the backsight point.	

	Description	Refer to chapter
	<Backsight ID:> The point ID of the backsight point. <Reflector Ht:> The current reflector height. Aim at the reflector on the backsight point.	
3.	SET (F1) to set the station and orientation and return to Main Menu .	

46.6.3

Known Backsight Point

Requirements

- For TPS1200+/TS30/TM30 the position coordinates of the station point are required. The instrument is set up and oriented to a known backsight target.
- For SmartStation the position coordinates of the station are unknown and are determined with GPS real-time. The instrument is set up and oriented to a known backsight target.

Access step-by-step

Refer to the stated chapter for more information on screens.

	Description	Refer to chapter
1.	Press PROG to access the Programs menu.	
2.	Select and activate Setup to move to the first screen.	
3.	Press CONT (F1) to access SETUP Station Setup .	
4.	<Method:> Ensure that Known BS Point is selected. <Station Coord:> Select the source for the instrument station coordinates. <Station ID:> Enter/Select the instrument station. <Instrument Ht:> Enter the height of the instrument station. <Fixpoint Job:> Select the fixpoint job of the control/target points.	
5.	The geometric scale correction is displayed. The correction displayed depends upon the options chosen in CONFIGURE TPS Corrections, GeoPPM page: • if <Calc Scale: Automatically>, <Computd Scale:> is displayed. • if <Calc Scale: Manually>, <Current Scale:> is displayed.	17.4

	Description	Refer to chapter
6.	Press CONT (F1) to access SETUP Set Stn & Ori - Known BS Point .	

SETUP Set Stn & Ori - Known BS Point, Setup page

18:44		+ IR STD I		Bluetooth		GPS		Battery	
SETUP									
Set Stn & Ori - Known BS Point									
Setup BS Info Stn Info									
Backsight ID :		100							
Reflector Ht :		1.941 m							
Calc Azimuth :		45°00'00"							
Calc HDist :		141.421 m							
ΔHoriz Dist :		----- m							
ΔHeight :		----- m							
Q2 a ↑									
SET		DIST		GPS		MORE		PAGE	

SET (F1)

To set the station and orientation and exit the Setup application program.

DIST (F2)

To measure the distance to the backsight point.

GPS (F4) (Applicable when using **SmartPole**)

To enter the GPS Survey screen (the same screen as for SmartRover) and measure a point with GPS. The antenna height is automatically converted from the reflector height.

Press **STORE (F1)** to store the point and leave the GPS Survey screen. The point is stored to the **<Job:>** and copied to the **<Fixpoint Job:>**, where it can be used as a backsight.

Press **ESC** or **SHIFT QUIT (F6)** to leave the GPS Survey screen.

MORE (F5)

Available on the **Setup** page. Toggles between the displayed values. As default the Δ values for azimuth, horizontal distance and height are shown. If **MORE (F5)** is pressed, the display changes to the measured values of azimuth, horizontal distance and height.

PAGE (F6)

To change to another page on this screen.

Description of fields

Field	Option	Description
<Baksight ID:>	Choicelist	Baksight point ID. All 3D and 2D points from <Fixpoint Job:> can be selected.
<Reflector Ht:>	User input	The default reflector height as defined in the active configuration set is suggested.
<Calc Azimuth:>	Output	Displays the calculated azimuth from the selected station to the baksight point.
<Calc HDist:>	Output	Displays the calculated horizontal distance between the selected station and baksight point.
< Δ Horiz Dist:>	Output	The difference between the calculated horizontal distance from station to baksight point and the measured distance.

Field	Option	Description
< ΔHeight: >	Output	The difference between the coordinate height of the backsight point and the measured height of the backsight point. If the backsight point is a 2D point, this field shows -----.
< Horiz Dist: >	Output	Displayed after a distance was measured with DIST (F2) and after MORE (F5) was pressed. The measured horizontal distance to the backsight point. Shows ----- before DIST (F2) .
< Height: >	Output	Displayed after a distance was measured with DIST (F2) and after MORE (F5) was pressed. The measured height of the backsight point. Shows ----- before DIST (F2)

Next step

IF	THEN
the next page is to be accessed	PAGE (F6) changes to the BS Info page.
the station and orientation is to be set	SET (F1) to set the station and orientation.

SETUP
Set Stn & Ori -
Known BS Point,
BS Info page

12:24
 SETUP
 Set Stn & Ori - Known BS Point
 Setup BS Info Stn Info
 Backsight ID : 101
 Code : <None>
 Code Desc : -----
 BS Easting : 175.000 m
 BS Northing : 100.000 m
 BS Height : 100.000 m
 Q2 a ↑
 SET PAGE

SET (F1)

To set the station and orientation and exit the Setup application program.

PAGE (F6)

To change to another page on this screen.

Description of fields

Field	Option	Description
<Backsight ID:>	Output	Backsight ID as entered in SETUP Station Setup .
<Code:>	Choicelist	The code for the backsight point.
<Code Desc:>	Output	A short description of the code.
<BS Easting:>	Output	The easting coordinate for the backsight point.
<BS Northing:>	Output	The northing coordinate for the backsight point.
<BS Height:>	Output	The height of the backsight point.

Next step

IF	THEN
the next page is to be accessed	PAGE (F6) changes to the Stn Info page.
the station and orientation is to be set	SET (F1) to set the station and orientation.

SETUP Set Stn & Ori - Known BS Point, Stn Info page

This screen has the same functionality as **SETUP Set Stn & Ori - Set Azimuth, Stn Info page**. Refer to "46.6.2 Set Azimuth" for further information. Refer to "7.5.3 Editing a Code" for further information on coding.

Next step

IF	THEN
the next page is to be accessed	PAGE (F6) changes to the Setup page.
the station and orientation is to be set	SET (F1) to set the station and orientation.

Requirements

- For TPS1200+/TS30/TM30 the position coordinates of the station point are required. The instrument is set up and oriented to one or more known backsight targets.
- For SmartStation the position coordinates of the station are unknown and are determined with GPS real-time. The instrument is set up and oriented to one or more known backsight targets.
- For TPS1200+/TS30/TM30 and SmartStation the orientation is determined by sighting to one or more known target points (maximum of ten target points). Only angles or both angles and distances may be measured. The height of the station point can also be derived from the target points.

Access step-by-step

- Refer to the stated chapter for more information on screens.

	Description	Refer to chapter
1.	Press PROG to access the Programs menu.	
2.	Select and activate Setup to move to the first screen.	
3.	Press CONT (F1) to access SETUP Station Setup .	
4.	<Method:> Ensure that Ori & Ht Transfr is selected. <Station Coord:> Select the source for the instrument station coordinates. <Station ID:> Enter/Select the instrument station. <Instrument Ht:> Enter the height of the instrument station. <Fixpoint Job:> Select the fixpoint job of the control/target points.	
5.	<Fixpoints:> Select the method for measuring the control/target points.	

	Description	Refer to chapter
	Select Meas All Now if a "Standard" setup is required. Select Add Points Later if an "On-the-Fly" setup is required.	46.2 46.2
6.	The geometric scale correction is displayed. The correction displayed depends upon the options chosen in CONFIGURE TPS Corrections, GeoPPM page: • if <Calc Scale: Automatically>, <Computd Scale:> is displayed. • if <Calc Scale: Manually>, <Current Scale:> is displayed.	17.4
7.	Press CONT (F1) to access SETUP Measure Target .	

SETUP Measure Target

18:21

SETUP

Measure Target 1

Point ID : 100

Reflector Ht : 1.941 m

Azimuth : -° -' -"

V : -° -' -"

Slope Dist : ----- m

ΔAzimuth : 45°00'00"

ΔHoriz Dist : ----- m

ΔHeight : ----- m

Q2 a ↑

ALL DIST REC GPS DONE

ALL (F1)

To measure and store the distances and angles made to the control points. After storing the measurement data to the <Job>, the next <Point ID> in the job is displayed. The instrument positions to the point if enough data is available.

DIST (F2)

To measure and display distances.

REC (F3)

Records displayed values to the current job. A distance measurement is not necessary before pressing **REC (F3)**. After storing the measurement data to the <Job:>, the next <Point ID:> in the job is displayed. The instrument positions to the point if enough data is available.

GPS (F4) (Applicable when using SmartPole)

To enter the GPS Survey screen (the same screen as for SmartRover) and measure a point with GPS. The antenna height is automatically converted from the reflector height.

Press **STORE (F1)** to store the point and leave the GPS Survey screen. The point is stored to the <Job:> and copied to the <Fixpoint Job:>, where it can be used as a target for the setup. Press **ESC** or **SHIFT QUIT (F6)** to leave the GPS Survey screen.

CALC (F5)

Available when sufficient data (when two or more points have been measured) is available for calculation. Runs the setup calculation and accesses **SETUP Results**.

DONE (F5) (Applicable to Add Points Later)

To temporarily exit the Setup program. The station setup will be incomplete but can be continued and completed at a later time. This softkey is replaced by **CALC (F5)** when sufficient data is available.

SHIFT FIND (F2)

Available once sufficient data is available for calculation. Accesses **SETUP Find Target** to guide the reflector to the selected target point. Refer to "46.8 Finding a Target Point" for information on this screen.

SHIFT POSIT (F4)

Available once sufficient data is available for calculation. To position the instrument to the selected target point.

Description of fields

Field	Option	Description
<Point ID:>	Choicelist	The point ID of the target point to be measured. All points from <Fixpoint Job:> can be selected, except class NONE .
<Reflector Ht:>	User input	The default reflector height as defined in the active configuration set is suggested.
<Azimuth:>	Output	The current horizontal angle.
<V:>	Output	The current vertical angle.
<Slope Dist:>	Output	The measured slope distance after DIST (F2) was pressed.

Field	Option	Description
<ΔAzimuth:>	Output	Displays the difference between the calculated azimuth and the current horizontal angle. If <Method: Resection>, displays ----- until sufficient data for calculation is available.
<ΔHoriz Dist:>	Output	The difference between the calculated and the measured horizontal distance.
<ΔHeight:>	Output	The difference between the given and the measured height of the target point.

Next steps

IF	THEN
more target points are to be measured	ALL (F1) to measure and store distances and angles, or REC (F3) to store the current measurement, or GPS (F4) to measure a point with GPS.
the program is to be temporarily exited	DONE (F5) to temporarily exit the Setup program. The station setup will be incomplete but can be continued and completed at a later time.
sufficient target points were measured	CALC (F5) to access SETUP Results . Refer to "46.7 Setup Results" for more information.



A maximum of ten target points can be measured and used for the calculation. When the maximum number of points was measured, the **SETUP Results** screen is accessed auto-

atically after **ALL (F1)**. In the **SETUP Additional Information** screen measured target points can be deleted and the **SETUP Measure Target** screen can be reaccessed to measure new target points.

46.6.5

Resection/Resection Helmert

Requirements

For TPS1200+/TS30/TM30 the coordinates of the station point are unknown. The coordinates and orientation are determined by sighting to one or more known target points (maximum of ten target points). Only angles or both angles and distances may be measured. For a resection, least squares or robust calculations are used. For a resection Helmert, Helmert calculations are used.

Access step-by-step

Refer to the stated chapter for more information on screens.

	Description	Refer to chapter
1.	Press PROG to access the Programs menu.	
2.	Select and activate Setup to move to the first screen.	
3.	Press CONT (F1) to access SETUP Station Setup .	
4.	< Method: > Select either Resection or Resection Helmert . < Station ID: > Enter the instrument station. < Instrument Ht: > Enter the height of the instrument station. < Fixpoint Job: > Select the fixpoint job of the control/target points.	
5.	< Fixpoints: > Select the method for measuring the control/target points. Select Meas All Now if a "Standard" setup is required. Select Add Points Later if an "On-the-Fly" setup is required.	46.2 46.2
6.	Press CONT (F1) to access SETUP Measure Target .	
7.	SETUP Measure Target	46.6.4

	Description	Refer to chapter
8.	ALL (F1) or REC (F3) or GPS (F4) (to measure a point with GPS).	
9.	Refer to "46.6.4 Orientation and Height Transfer" for details on fields/keys.	

46.6.6

Local Resection

Description

- This method can be used to calculate the two or three-dimensional local coordinates for the instrument station and the orientation of the horizontal circle from distance and angular measurements to two target points.
- The first target point always defines the origin of the local coordinate system. The second target point, in conjunction with the first target point, always defines the local direction of North or East (depending on the configuration settings).
- For Resection and/or Resection Helmert, refer to "46.6.5 Resection/Resection Helmert".

Requirements

Important features:

- all coordinates calculated are local coordinates.
- the first target point always defines the origin of the local coordinate system (North=0, East=0, Height=0 (optional))
- The second target point, in conjunction with the first target point, always defines the local direction of North or East.

Access step-by-step

- The following table explains the most common settings.
- Refer to the stated chapter for more information on screens.

	Description	Refer to chapter
1.	Press PROG to access the Programs menu.	
2.	Select and activate Setup to move to the first screen.	
3.	Press CONT (F1) to access SETUP Station Setup .	
4.	<Method:> Ensure that Local Resection is selected.	

	Description	Refer to chapter
	<Station ID:> Enter the instrument station. <Instrument Ht:> Enter the height of the instrument station. <Stn Ht From:> Select the source for the instrument station height. <Station Ht:> Enter the elevation of the instrument station.	
5.	Press CONT (F1) to access SETUP Measure Target .	

SETUP Station Setup

19:08
SETUP

Station Setup

Method : Local Resection

Station ID : 100

Instrument Ht: 1.567 m

Stn Ht From : User Entered

Station Ht : 455.220 m

CONT SCALE PPM Q2 a ↑

CONT (F1)

To accept all settings and continue. The chosen settings are activated and the next screen **SETUP Measure Target** is displayed.

SCALE (F4)

To display the geometric corrections used with the measurements. Refer to "17.4 TPS Corrections".

PPM (F5)

To display the atmospheric corrections used with the measurements. Refer to "17.4 TPS Corrections".

SHIFT CONF (F2)

To configure the application program SETUP. The screen **SETUP Configuration** is displayed. Refer to "46.3 Configuring Setup".

SHIFT INDIV (F5) and SHIFT RUN (F5)

To change between successive numbering **<Station ID>** and individual numbering **<Indiv Pt ID>**, entering an individual backsight point ID different to the defined ID template and the running point ID according to the ID template. Refer to "16.1 ID Templates" for more information on point ID templates.

Description of fields

Field	Option	Description
<Method:>	Choicelist	<Method: Local Resection>
<Station ID:>	User input	The station ID of the instrument station.
<Instrument Ht:>	User input	Instrument height.
<Stn Ht From:>	Choicelist User Entered or Target 1 Ht Diff	Only available when <Method: Local Resection> . For <Stn Ht From: User Entered> the height value of the station will be entered by the user and used to calculate the height of the measured points. For <Stn Ht From: Target 1 Ht Diff> the first measured point will be given Height=0 and the height of the station will be calculated relative to this point.
<Station Ht:>	Output	Only available when <Stn Ht From: User Entered> . The elevation of the instrument station.

Local resection step-by-step

- The following table explains the most common settings.
- Refer to the stated chapter for more information on screens.

	Description	Refer to chapter
6.	CONT (F1) to access SETUP Measure Target 1 .	
7.	SETUP Measure Target 1 Choose a target point and type in a reflector height. Aim correctly at the reflector.	46.6.4
8.	ALL (F1) to record the measurement.	
9.	SETUP Measure Target 2 Choose a target point and type in a reflector height. Aim correctly at the reflector.	46.6.4
10.	ALL (F1) to record the measurement and to access SETUP Results .	
11.	SETUP Results, Stn Coords page	46.7
12.	SET (F1) to store the selected setup data and exit the application program.	

INFO (F4)

To display additional information about the accuracy of the measured target points and to delete inconsistent measurements in the **SETUP Additional Information** screen.

DONE (F5) (Applicable to **Add Points Later**)

To temporarily exit the Setup program. The station setup will be incomplete but can be continued and completed at a later time.

SURVY (F5) (Applicable to **Meas All Now**)

To access **SETUP Measure Target** and to measure more target points.

PAGE (F6)

To change to another page on this screen.

SHIFT ELL H (F2) or **SHIFT ORTH (F2)**

Changes between the ellipsoidal and the orthometric height.

SHIFT 3 PAR (F2) or **SHIFT 4 PAR (F2)**

Switches between a 3 parameter and 4 parameter helmert calculation. The results are immediately updated.

SHIFT OTHER (F5)

Available if two solutions were calculated.
Changes between these solutions.

Description of fields

Field	Option	Description
<Station ID:>	User input	Station ID of the current station set up.

Field	Option	Description
<No. of Points:>	Output	Number of points used in calculation.
<Set:>	Choicelist E, N, Ht, Ori, E, N, Ht or E, N, Ori Ht,Ori, Ht or Ori	The selected options are set and stored in the system. All other values are taken from the current system setup. Available for <Method: Resection> and <Method: Resection Helmert> . Available for <Method: Ori & Ht Transfr> .
<Instrument Ht:>	Output	The current instrument height.
<Stn Easting:>	Output	For <Method: Ori & Ht Transfr> Easting is displayed either from fixpoint job or system, as selected. For <Method: Resection> and <Method: Resection Helmert> the calculated Easting is displayed.
<Stn Northing:>	Output	For <Method: Ori & Ht Transfr> Northing is displayed either from fixpoint job or system, as selected. For <Method: Resection> and <Method: Resection Helmert> the calculated Northing is displayed.
<Stn Height:>	Output	The calculated Height is displayed.
<New Azimuth>	Output	New oriented azimuth with running angle as telescope moves.

SETUP
Results,
Sigma page

Next step

PAGE (F6) changes to the **Sigma** page.

Description of fields

Field	Option	Description
< σ Easting:>	Output	Available for <Method: Resection> and <Method: Resection Helmert>. Standard deviation of the calculated station Easting.
< σ Northing:>	Output	Available for <Method: Resection> and <Method: Resection Helmert>. Standard deviation of the calculated station Northing.
< σ Height:>	Output	Standard deviation of the calculated station Height.
< Δ Height:>	Output	Delta height, the difference between original and calculated height.
< σ Hz Orient:>	Output	Standard deviation of the calculated orientation.
<Calc Scale:>	Output	Calculated scale factor from resection or orientation and height transfer.
<Calc ppm:>	Output	Available for <Use Scale: Yes>. ppm from calculated scale. ppm=(scale*1000000)-1.
<Current Scale:>	Output	The geometric scale correction is displayed. The correction displayed depends upon the options chosen in CONFIGURE TPS Corrections, GeoPPM page. Refer to "17.4 TPS Corrections" for details.

SETUP
Results,
Stn Code page

Next step

PAGE (F6) changes to the **Stn Code** page.

The functionality of the **Stn Code** page is similar to **MANAGE New Point, Code** page. Refer to "6.3.2 Creating a New Point" for more information on keys.

Description of fields

Field	Option	Description
<Point Code:>	Choicelist	The thematical code for the point. Available for <Themadc Codes: With Codelist>. All point codes from the job codelist can be selected. The attributes are shown as output, input or choicelist fields depending on their definition.
	User input	Available for <Themadc Codes: Without Codelist>. Codes can be typed in but not selected from a codelist. A check is performed to see if a point code of this name already exists in the job. If so, the according attributes are shown.
<Code Desc:>	Output	Available for <Themadc Codes: With Codelist>. The description of the code.
<Attribute n:>	User input	Available for <Themadc Codes: Without Codelist>. Up to eight attribute values are available.

Next step

PAGE (F6) changes to the **Plot** page.

46.7.2

Additional Information

Description

- The **SETUP Additional Information** screen displays information about the accuracy of the measured target points and allows exclusion of measurements that are not to be used in the calculation.
- Additional measurements can be made and measurements can be deleted.

Access

Press **INFO (F4)** in the **SETUP Results** screen.

SETUP

Additional Information, Status page

17:18	+	IR	STD	I	Bluetooth	Wi-Fi	GPS	QR
SETUP								
Additional Information								
Status	Plot							
Point ID	Use	ΔHz [g]						
0002	3D	0.0000						
0003	3D	0.0000						
0004	3D	-0.0000						
0005	3D	-0.0000						
								Q2 a ↑
RECLC		USE	REMOV	MORE	PAGE			

RECLC (F1)

To recalculate the station data and update all values after target points have been deleted or excluded from the calculation. Returns to the **SETUP Results** screen.

USE (F3)

To decide whether or not to use a target point in the calculation. Changes the value in the **Use** column.

REMOV (F4)

To delete a point from the list of measured target points and exclude it from the Setup calculation.

MORE (F5)

To change between displaying **Δ Hz**, **Δ Distt**, **Δ Height**, **Δ East** and **Δ North** in the fourth column.

SHIFT SURVY (F5)

Accesses the **SETUP Measure Target** screen to measure more target points.

PAGE (F6)

To change to an other page on the screen. Refer to "35 MapView Interactive Display Feature" for more information.

Description of columns

Column	Description
!	The ! indicates that the delta value of either measured horizontal angle, distance or height exceeds the calculation limit.
Point ID	The point ID of the measured target points.
Use	Indicates if and how a target point is used in the station calculation. Choices are 3D , 2D , 1D and NO .
ΔHz	Can be displayed by pressing MORE (F5) . Difference between calculated and measured horizontal angle for the target points. If a target point does not have coordinates, ----- are displayed. Differences exceeding the defined limit are indicated by a *.

Column	Description
ΔDist	Can be displayed by pressing MORE (F5) . Difference between calculated and measured distance from the station to the target points. If a target point does not have coordinates, ----- are displayed. Differences exceeding the defined limit are indicated by a *.
ΔHeight	Can be displayed by pressing MORE (F5) . Difference between calculated and measured height of the target points. If a target point does not have a height coordinate, ----- are displayed. Differences exceeding the defined limit are indicated by a *.
ΔEast	Can be displayed by pressing MORE (F5) . Difference between fixpoint and measured point, calculated from new station coordinates.
ΔNorth	Can be displayed by pressing MORE (F5) . Difference between fixpoint and measured point, calculated from new station coordinates.

Next step

PAGE (F6) changes to the **Plot** page.

SETUP Results, Plot page

Refer to "35.6 Plot Mode - MapView Screen Area" for details on the keys on the **Plot** page.

Next step

PAGE (F6) changes to the first page on this screen.

Next steps

IF	THEN
more target points are to be measured	SHIFT SURVY (F5) to access the SETUP Measure Target screen.
point measurements are to be accepted	RECLC (F1) to recalculate the station data and return to the SETUP Results screen.

46.7.3

Local Resection Calculation

Description

- This screen is displayed after the local resection calculation.
- After the station is set, all following measurements will be related to this new station and orientation.

Access

Press **ALL (F1)** in the **SETUP Measure Target 2** screen.

SETUP Results, Stn Coords page

17:20
SETUP
Results
Stn Coords | Stn Code | Plot
Station ID : 0001
No. of Points: 2
Set : E, N, Ht, Ori
Instrument Ht: 1.255 m
Stn Easting : 53.044 m
Stn Northing : 53.044 m
Stn Height : 455.220 m
New Azimuth : 350.0000 g
SET PAGE

SET (F1)

To set data selected in **<Set:>** and to store all setup data and exit the application program.

PAGE (F6)

To change to an other page on the screen.

Description of fields

Field	Option	Description
<Station ID:>	User input	Station ID of the current station set up.
<No. of Points:>	Output	Number of points used in calculation.

Field	Option	Description
<Set:>	Output	The displayed options are set and stored in the system. All other values are taken from the current system setup.
<Instrument Ht:>	Output	The current instrument height.
<Stn Easting:>	Output	The calculated Easting.
<Stn Northing:>	Output	The calculated Northing.
<Stn Height:>	Output	The calculated Height.
<New Azimuth>	Output	New oriented azimuth with running angle as telescope moves.

Next step

PAGE (F6) changes to the **Stn Code** page.

SETUP Results, Stn Code page

The functionality of the **Stn Code** page is similar to **MANAGE New Point, Code** page. Refer to "6.3.2 Creating a New Point" for more information on keys.

Description of fields

Field	Option	Description
<Point Code:>	Choicelist	The thematical code for the offset point. Available for <Themadc Codes: With Codelist>. All point codes from the job codelist can be selected. The attributes are shown as output, input or choicelist fields depending on their definition.

Field	Option	Description
	User input	Available for <Thematc Codes: Without Codelist> . Codes can be typed in but not selected from a codelist. A check is performed to see if a point code of this name already exists in the job. If so, the according attributes are shown.
<Code Desc:>	Output	Available for <Thematc Codes: With Codelist> . The description of the code.
<Attribute n:>	User input	Available for <Thematc Codes: Without Codelist> . Up to eight attribute values are available.

Next step

PAGE (F6) changes to the **Stn Plot** page.

SETUP Results, Stn Plot page

Refer to "35.6 Plot Mode - MapView Screen Area" for information on the keys on the **Plot** page.

Next step

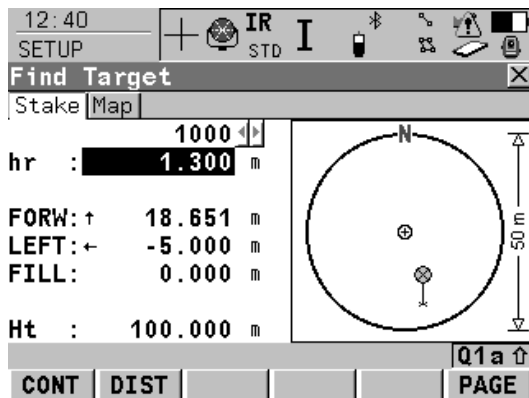
PAGE (F6) changes to the first page on this screen.

Finding a Target Point

- The **SETUP Find Target** screen can be accessed, to guide the reflector to the selected target point.
- The screen is only available if the Stakeout application is available on the instrument.
- The functionality of this screen is similar to a stakeout routine and is intended to help find hidden survey bench marks or reference points.

Press **SHIFT FIND (F2)** in **SETUP Measure Target** once enough data is available to roughly calculate the new orientation.

This screen is shown with **<Stake Mode: Ortho from Stn>**. For graphics/symbols being displayed the settings are **<Symbols: From Station>** and **<Graphics: From Station>**. Refer to "47.4.1 Elements of the Graphical Display in the Stakeout" for information on elements of the graphic.



Exits **SETUP Find Target** and returns to **SETUP Measure Target**.

To measure and display distances. Updates all output fields in the screen.

Description of fields

Field	Option	Description
<Point ID:>	Output	The point ID of the target point to be measured.
<Reflector Ht:>/ <hr:>	Output	The default reflector height as defined in the active configuration set is suggested.
<Go FORWARD:>/ <FORW:> or <Go BACKWARD:>/ <BACK:>	Output	The horizontal distance from the current reflector position to the target point along the line from the station to the current reflector position. Field is <Go FORWARD:> when the reflector has to be moved towards the instrument and <Go BACKWARD:> when the reflector has to be moved away from the instrument. Shows ----- before the first distance measurement with DIST (F2) .
<Go RIGHT:>/ <RGHT:> or <Go LEFT:>/ <LEFT:>	Output	Horizontal distance from the current reflector position to the target point orthogonal to the line from the station to the current reflector position. Field is <Go RIGHT:> when the target point is to the right of that line and <Go LEFT:> when the reflector is to the left of that line. Shows ----- before the first distance measurement with DIST (F2) .

Field	Option	Description
<FILL:> or <CUT:>	Output	The height difference between the target point and the measured point. Field is <CUT:> when the measured point is higher than the target point and <FILL:> if the measured point is lower than the target point. Shows ----- before the first distance measurement with DIST (F2) or if the target point is a 2D point.
<Height> or <Ht:>	Output	The measured height of the current position. Shows ----- before the first distance measurement with DIST (F2) or if the target point is a 2D point.

Next step

CONT (F1) to return to the **SETUP Measure Target** screen.

47.1

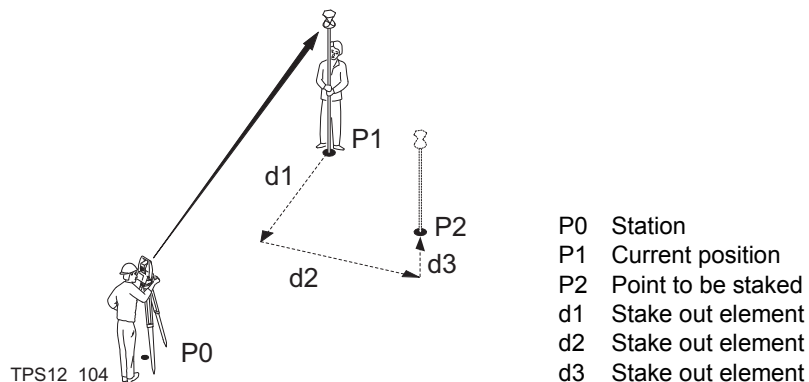
Overview

Description

The Stakeout application program is used to place marks in the field at predetermined points. These predetermined points are the points to be staked. The points to be staked may

- have been uploaded to a job on the instrument using LGO.
- already exist in a job on the instrument.
- have been uploaded from an ASCII file to a job on the instrument using **Main Menu: Convert...Import ASCII/GSI Data to Job.**
- be typed in.

Diagram



Stakeout modes	Points can be staked using different modes: • Polar mode. • Orthogonal to station mode. • Orthogonal from station mode.
	The points to be staked must exist in a job on the active memory device or can be typed in.
Coordinate system	Points cannot be staked if the active coordinate system is different to that in which the points to be staked are stored. For example, the points to be staked are stored in WGS 1984 and the active coordinate system is <None> .
Point types	It is possible to stake: • Position only points. • Height only points. • Points with full sets of coordinates.
Height types	Height type of the point to be staked: Orthometric OR ellipsoidal Height type computed for current position: Orthometric OR ellipsoidal depending on the • configured transformation, • availability of a geoid model, • height type of the point to be staked. If possible, the height type of the point to be staked is computed for the current position.
Height source	Heights can be taken into account from • the vertical component of a coordinate triplet. • a Digital Terrain Model. DTM Stakeout must be activated via a licence key. Refer to "28 Tools...\Licence Keys" for information on how to type in or upload the licence key. If activated, the height of the points to be staked can be edited in the field.

Coding of staked points

Codes can be attached to staked points. Refer to "8 Coding" for information on coding. The behaviour of the coding functionality depends on the

- selected **<Stakeout Job:>** as the job with the points to be staked.
- selected **<Job:>** as the active job.
- definition of a display mask with input fields for coding and attributes.

IF <Stakeout Job:> and <Job:>	AND a display mask for point codes and attributes	THEN
are identical	is used	the point code and attributes attached to the point to be staked are suggested for the staked point. They can be changed.
are identical	is not used	the staked point is stored with the point code and attributes attached to the point to be staked.
are not identical	is used	<Point Code: <None>> is suggested. It can be changed and attributes can be entered. After a point has been stored with a code different to <Point Code: <None>> then the last used point code is suggested the next time.
are not identical	is not used	the staked point is stored with <Point Code: <None>> .

It may happen that the codes and/or attributes of the staked point and the point to be staked do not match. In this case, a screen opens where they can be corrected. Refer to "8.6 Code and Attribute Mismatch" for information on solving a code and/or attribute mismatch.

Properties of staked points

The properties stored with staked points are:

- Class: **MEAS**
 - Sub class: **Stakeout**
 - Source: **Stakeout**
 - Instrument source: **TPS**
-

Averaging of staked points

The principles for averaging are identical to those of the Survey application program. Refer to "6.3.4 Mean Page" for information on averaging.

Access

Select **Main Menu: Programs...\Stakeout**.

OR

Press **PROG**. Highlight **Stakeout**. **CONT (F1)**. Refer to "36.2 Accessing the Programs Menu" for information on the **PROG** key.

OR

Press a hot key configured to access the screen **STAKEOUT Stakeout Begin**. Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

OR

Press **STAKE (F5)** from another application program, for example COGO.

STAKEOUT Stakeout Begin

11:55

STAKEOUT

Stakeout Begin

Stakeout Job : stake job

Job : measure job

Coord System : <None>

Codelist : <None>

Config Set : stakeout

Reflector : Leica Circ Prism

Add. Constant: 0.0 mm

Q2a ↑

CONT CONF SETUP CSYS

CONT (F1)

To accept changes and access the subsequent screen. The chosen settings become active.

CONF (F2)

To configure Stakeout application program. Accesses **STAKEOUT Configuration**. Refer to "47.3 Configuring Stakeout".

SETUP (F3)

To set up station. Accesses **SETUP Station Setup**.

CSYS (F6)

To select a different coordinate system. Not available for **<Use Auto CrdSys: Yes>** configured in **CONFIGURE Additional Rover Settings**. Refer to "22.1.1 Configuration of Real-Time".

Description of fields

Field	Option	Description
<Stakeout Job:>	Choicelist	The job containing the points to be staked. All jobs from Main Menu: Manage...\Jobs can be selected.
<Job:>	Choicelist	The active job. All jobs from Main Menu: Manage...\Jobs can be selected. Determines the active coordinate system. Points which are staked out are stored in this job. The original points to be staked are not copied to this job. The data from this job is shown in MANAGE Data: Job Name .
<Coord System:>	Output	The coordinate system currently attached to the selected <Job:> . Cannot be edited for <Use Auto CrdSys: Yes> configured in CONFIGURE Additional Rover Settings . Refer to "22.1.1 Configuration of Real-Time".
<Codelist:>	Choicelist	No codes are stored in the selected job. All codelists from Main Menu: Manage...\Codelists can be selected.

Field	Option	Description
	Output	Codes have already been stored in the selected <Job:> . If codes had been copied from a System RAM codelist, then the name of the codelist is displayed. If codes have not been copied from a System RAM codelist but typed in, then the name of the active job is displayed.
<DTM Job:>	Choicelist	Available for <Use DTM: DTM only> and <Use DTM: DTM & Stake Job> in STAKEOUT Configuration, Heights page. To select a DTM to be staked and to select the active DTM layer to be used. Heights are then staked out relative to the selected DTM. Refer to "47.4.5 Staking Out a DTM".
<Config Set:>	Choicelist	The active configuration set. All configuration sets from Main Menu: Manage...\Configuration Sets can be selected.
<Reflector:>	Choicelist	The reflector currently set in the selected configuration set. All reflectors from Main Menu: Manage...\Reflectors can be selected.
<Add. Constant:>	Output	The additive constant stored with the chosen reflector.

Next step

IF the Stakeout application program	THEN
is to be accessed	CONT (F1) accepts the changes and accesses Stakeout application program. Refer to "47.4 Staking Out".
is to be configured	CONF (F2) . Refer to "47.3 Configuring Stakeout".

Access

Select **Main Menu: Programs...\Stakeout**. In **STAKEOUT Stakeout Begin** press **CONF (F2)** to access **STAKEOUT Configuration**.

OR

Press **PROG**. Highlight **Stakeout**. **CONT (F1)**. In **STAKEOUT Stakeout Begin** press **CONF (F2)** to access **STAKEOUT Configuration**.

OR

Press **SHIFT CONF (F2)** in **STAKEOUT XX Stakeout**.

STAKEOUT Configuration, General page

This screen consists of the **General** page, the **Checks** page, the **Heights** page and the **Logfile** page. The explanations for the softkeys given below are valid for all pages, unless otherwise stated.

18:18
STAKEOUT

Configuration

General | Checks | Heights | Logfile

Orientate : From Station

To :

Stake Mode : Orthogonal

Visual Guides: Arrows&Graphics

Message Line : Off

Display Mask : Survey

Closest Point: No

Q2 a ↑

CONT DMASK PAGE

CONT (F1)

To accept changes and return to the screen from where this screen was accessed.

DMASK (F3)

Accesses **CONFIGURE Define Display Mask** n. Available for **<Display Mask:>** being highlighted on **General** page. Refer to "16.2 Display Settings".

PAGE (F6)

To change to another page on this screen.

SHIFT ABOUT (F5)

To display information about the program name, the version number, the date of the version, the copyright and the article number.

Description of fields

Field	Option	Description
<Orientate:>		The reference direction to be used to stakeout points. The stakeout elements and the graphical display shown in the Stakeout application program are based on this selection.
	From Station	The direction of the orientation is from the instrument to the point to be staked.
	To Station	The direction of the orientation is from the point to be staked to the instrument.
	From North	The direction of the orientation is from the North direction to the point to be staked.
	To North	The direction of the orientation is from the point to be staked to the North direction.
	To Arrow	The direction of the orientation is from the current position to the point to be staked. The graphical display shows an arrow pointing in the direction of the point to be staked.

Field	Option	Description
	To Last Point	Timewise the last recorded point. If no points are yet staked, <Orientate: To North> is used for the first point to be staked.
	To Point(Stake)	A point from <Stakeout Job:> selected in STAKEOUT Stakeout Begin .
	To Point(Store)	A point from <Job:> selected in STAKEOUT Stakeout Begin .
	To Line(Stake)	The direction of the orientation is parallel to a reference line from <Stakeout Job:> selected in STAKEOUT Stakeout Begin . Open the listbox to create, edit or delete a reference line.
	To Line(Store)	The direction of the orientation is parallel to a reference line from <Job:> selected in STAKEOUT Stakeout Begin . Open the listbox to create, edit or delete a reference line.
<To:>	Choicelist	Available for <Orientate: To Point(Stake)> , <Orientate: To Point(Store)> , <Orientate: To Line(Stake)> and <Orientate: To Line(Store)> . To select the point or line to be used for orientation. Refer to "6.2 Accessing Data Management" for information on creating, editing and deleting a known point. Refer to "43.4 Starting Reference Line" for information on creating, editing and deleting a line.
<Stake Mode:>		The method of staking out.

Field	Option	Description
	Polar	The direction from the orientation reference, the horizontal distance and the cut/fill is displayed.
	Orthogonal	The distance forwards to/backwards from the point, the distance right/left to the point and the cut/fill is displayed.
<Visual Guides:>	Off	Arrows and/or a graphical display in STAKEOUT XX Stakeout . help finding the point to be staked. Neither arrows nor a graphical display are shown.
	Arrows	Upon pressing DIST (F2) arrows are shown.
	Graphics	A graphical display is shown. Refer to "47.4.1 Elements of the Graphical Display in the Stakeout"..
	Arrows&Graphics	Upon pressing DIST (F2) arrows are shown. A graphical display is always shown.
<Message Line:>	Off	For each point which is selected for staking, angle and distance information is momentarily displayed in the message line. No information is displayed in the message line.
	Dist From Stn	The delta Hz angle that the instrument should turn to the point and the distance from the instrument to the point is momentarily displayed in the message line.
	Dist Frm Last Pt	The delta Hz angle that the instrument should turn to the point and the distance from the last staked point is momentarily displayed in the message line.

Field	Option	Description
<Display Mask:>	Choicelist	The user defined display mask to be shown in STAKEOUT XX Stakeout . All display masks of the active configuration set defined in CONFIGURE Display Settings can be selected.
<Closest Point:>	Yes	The order of the points suggested for staking out. After staking and storing a point, the next point suggested for staking out is the point closest to the point which was staked. If there are many points in <Stakeout Job:>, the search may take a few seconds.
	No	After staking and storing one point, the next point suggested for staking out is the subsequent one in <Stakeout Job:>.
<Auto Position:>	2D	Instrument positions horizontally to the point to be staked.
	3D	Instrument positions horizontally and vertically to the point to be staked.
	Off	Instrument does not position to the point to be staked.
<Update Angle:>	Yes	Angles are updated with telescope movement after a distance was measured.

Field	Option	Description
	No	Angles and stakeout values are updated after a distance measurement. Then all values are frozen until the next distance is taken. When <Automation: LOCK:> and locked to a target the values do not change.
<Store Pt ID:>	Same as Stake Pt Prefix Suffix	The manually occupied staked points are stored with the same point ID's as the points to be staked. Adds the setting for <Prefix/Suffix:> in front of the original point ID's. Adds the setting for <Prefix/Suffix:> at the end of the original point ID's.
<Prefix/Suffix:>	User input	Available for <Store Pt ID: Prefix> and <Store Pt ID: Suffix> . The identifier with up to four characters is added in front of or at the end of the ID of the manually occupied staked point.

Next step

PAGE (F6) changes to the **Checks** page. Refer to paragraph "STAKEOUT Configuration, Checks page".

Description of fields

Field	Option	Description
<Pos Check:>	Yes or No	Allows a check to be made on the horizontal coordinate difference between the staked point and the point to be staked. If the defined <Pos Limit:> is exceeded, the stakeout can be repeated, skipped or stored.
<Pos Limit:>	User input	Available for <Pos Check: Yes> . Sets the maximum horizontal coordinate difference accepted in the position check.
<Height Check:>	Yes or No	Allows a check to be made on the vertical difference between the staked point and the point to be staked. If the defined <Height Limit:> is exceeded, the stakeout can be repeated, skipped or stored.
<Height Limit:>	User input	Available for <Height Check: Yes> . Sets the maximum vertical difference accepted in the height check.
<Beep near Pt:>	Yes or No	The instrument beeps when the horizontal radial distance from the current position to the point to be staked is equal to or less than defined in <Dist from Pt:> .
<Dist from Pt:>	User input	Available for <Beep near Pt: Yes> . The horizontal radial distance from the current position to the point to be staked when a beep should be heard.

STAKEOUT Configuration, Heights page

Next step

PAGE (F6) changes to the **Heights** page. Refer to paragraph "STAKEOUT Configuration, Heights page".

Description of fields

Field	Option	Description
<Height Offset:>	User input	Allows a constant height offset to be applied to the height of the points or DTM being staked.
<Edit Height:>	Yes	The field <D Ht:> for the design height is displayed in STAKEOUT Orthogonal Stakeout, Stake page and STAKEOUT Polar Stakeout, Stake page. The design height is the height of the point to be staked. The value for <D Ht:> can be changed.
	No	The field <Ht:> for the height of the current position is displayed in STAKEOUT Orthogonal Stakeout, Stake page and STAKEOUT Polar Stakeout, Stake page. The value for <Ht:> cannot be changed.
<Use DTM:>		Available if DTM Stakeout has been activated via a licence key. Refer to "28 Tools...\Licence Keys" for information on how to type in or upload the licence key. Available unless STAKEOUT Configuration, Heights page was accessed while being within the Stakeout application program.
	No	No DTM file is used. The positions and heights of points in the selected <Stakeout Job:> are staked out.

STAKEOUT Configuration, Logfile page

Field	Option	Description
	DTM only	Activates the stakeout of heights without positions. Heights relative to the selected <DTM Job:> are staked out.
	DTM & Stake Job	The positions of points in the selected <Stakeout Job:> are staked out. Heights to be staked out are taken from <DTM Job:> .

Next step

PAGE (F6) changes to the **Logfile** page. Refer to paragraph "STAKEOUT Configuration, Logfile page".

Description of fields

Field	Option	Description
<Write Logfile:>	Yes or No	To generate a logfile when the application program is exited. A logfile is a file to which data from an application program is written to. It is generated using the selected <Format File:> .
<File Name:>	Choicelist	Available for <Write Logfile: Yes> . The name of the file to which the data should be written. A logfile is stored in the \DATA directory of the active memory device. The data is always appended to the file.

Field	Option	Description
		Opening the choicelist accesses XX Logfiles where a name for a new logfile can be created and an existing logfile can be selected or deleted.
<Format File:>	Choicelist	Available for <Write Logfile: Yes>. A format file defines which and how data is written to a logfile. Format files are created using LGO. A format file must first be transferred from the CompactFlash card to the System RAM before it can be selected. Refer to "24 Tools...\Transfer Objects..." for information on how to transfer a format file. Opening the choicelist accesses XX Format Files where an existing format file can be selected or deleted.

Next step

PAGE (F6) changes to the first page on this screen.

47.4

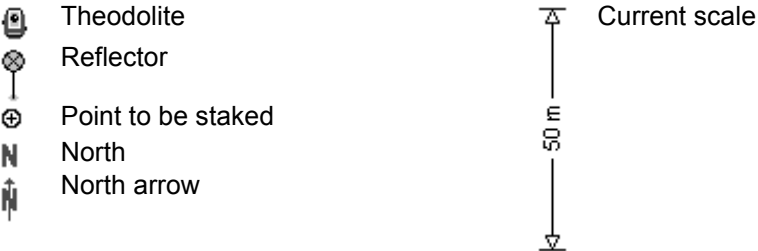
47.4.1

Description

Staking Out
Elements of the Graphical Display in the Stakeout

A graphical display provides a guide to find the point to be staked out. The elements of the graphical display used within the Stakeout application program screens are explained in this chapter. Some of the elements depend on the selection for <Visual Guides:> in **STAKEOUT Configuration, General** page. Other elements are commonly displayed. The **Map** page provides an interactive display of the data. Refer to "35.5 Map Mode" for information on the functionality and softkeys available.

Elements of graphical display

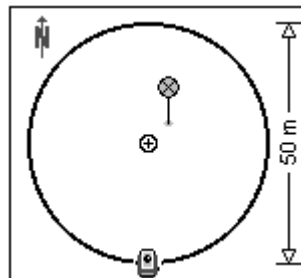


For <Visual Guides: Off> no graphical display is shown on the screen.

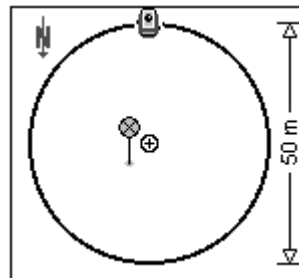
Graphical display

For scale >1000 m the circle is displayed in grey.

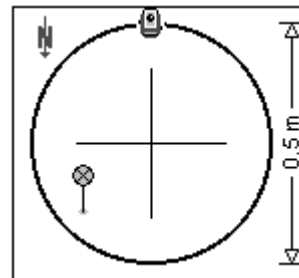
From Station or North



To Station or North



For scale 0.5 m



47.4.2

Manual Entry of Points to be Staked

Description



Manual entry of points step-by-step

Manual entry of points to be staked can be used to input angle and distance values.

It is possible to type in angles and distances independent of the used **<Stake Mode>**.

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Set up and orient the instrument.	46
2.	Start the Stakeout application program.	
3.	STAKEOUT Stakeout Begin Check the settings.	
4.	CONT (F1) to access STAKEOUT XX Stakeout .	47.4
5.	STAKEOUT XX Stakeout SHIFT MSTAK (F3) to access STAKEOUT Manual Entry .	
6.	STAKEOUT Manual Entry Enter the values of the point to be staked.	
7.	STAKE (F1) to access STAKEOUT XX Stakeout .	
	The point is created and the coordinates of the point are remembered allowing the point to be staked out.	
8.	STAKEOUT XX Stakeout	

Step	Description	Refer to chapter
	Check the reflector height.	
9.	Continue with step 9. from paragraph "Stake out in orthogonal from station mode step-by-step".	

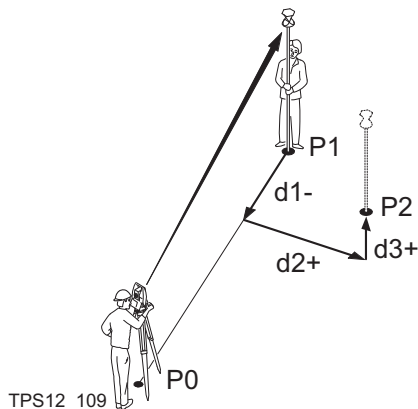
47.4.3

Staking Out in Orthogonal Mode

Description

Points can be staked out using orthogonal values to guide to the point to be staked. Values are relative to the line defined by station and current position. The stakeout elements are a horizontal distance forwards/backwards, a horizontal distance right/left and a cut/fill. The values are calculated between the current position and the point to be staked. The values are calculated either from the station to the point or from the point to the station depending on the setting of **<Stake Mode:>**.

Orthogonal from and to station



- P0 Station
- P1 Current position
- P2 Point to be staked
- d1 **<Go FORWARD:>** ↓ ↑ or **<Go BACK:>** ↑ ↓
- d2 **<Go RIGHT:>** → or **<Go LEFT:>** ←
- d3 **<CUT:>** or **<FILL:>**



<Stake Mode: Ortho from Stn> is configured in **STAKEOUT Configuration, General** page. Refer to "47.3 Configuring Stakeout".

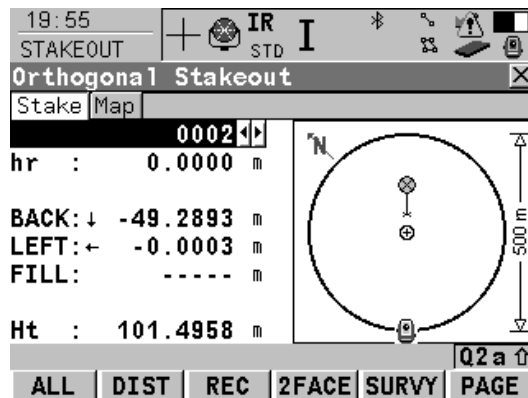
Access

Refer to "47.2 Accessing Stakeout" to access **STAKEOUT Orthogonal Stakeout**.

STAKEOUT

Orthogonal Stakeout, Stake page

The pages shown are those from a typical configuration set. An additional page is available when a user defined display mask is used.



ALL (F1)

To measure a distance and store distance and angles.

DIST (F2)

To measure a distance.

REC (F3)

To store angles and distance. Distance must be measured before.

2FACE (F4)

To take a measurement in Face I and Face II. The point stored is an average of the two measurements.

When using instruments fitted with ATR, the point is automatically measured in both faces, the resulting point is stored and the instrument is returned to the first face.

This hotkey is only available for <EDM Mode: Standard> and <EDM Mode: Fast> and in the Survey, Reference Line and Stakeout programs.

SURVY (F5)

To access Survey application program to measure points independent from the Stakeout application program. To return to Stakeout application program, press **SHIFT QUIT (F6)** or **ESC**.

PAGE (F6)

To change to another page on this screen.

SHIFT CONF (F2)

To configure stakeout. Refer to "47.3 Configuring Stakeout".

SHIFT POS2D (F3)

To position the telescope (X,Y) onto the point to be staked.

SHIFT POS3D (F4)

To position the telescope (X,Y,Z) onto the point to be staked.

SHIFT MSTAK (F5)

To enter angle and distance values to stake out a point. Refer to "47.4.2 Manual Entry of Points to be Staked".

Description of fields

Field	Option	Description
<Point ID:>	Choicelist	The point ID of the point to be staked. Accesses STAKEOUT Data: Job Name where points are shown according to sort and filter settings and staked points are indicated by  .

Field	Option	Description
<Reflector Ht:> or <hr:>	User input	The default reflector height as defined in the active configuration set is suggested.
<Go FORWARD:> or <FORW:>	Output	The horizontal distance along the line defined by station and reflector from the current position to the point to be staked. ↓ or ↑ to move towards the station depending on <Symbols:>.
<Go BACK:> or <BACK:>	Output	The horizontal distance in reverse direction from the line defined by station and reflector from the current position to the point to be staked. ↑ or ↓ to move away from the station depending on <Symbols:>.
<Go RIGHT:> or <RGHT:>	Output	The direction depends on <Stake Mode:>. The horizontal distance orthogonal to the right of the line defined by station and reflector from the current position to the point to be staked. → to move to the right of the line defined in <Symbols:>, ← to move to the left of the line defined in <Symbols:>.
<Go LEFT:> or <LEFT:>	Output	The direction depends on <Stake Mode:>. The horizontal distance from the current position to the point to be staked orthogonal to the left of the line defined by station and reflector. ← to move to the left of the line defined in <Symbols:>, → to move to the right of the line defined in <Symbols:>.

Field	Option	Description
<CUT:>	Output	The negative height difference from the height of the current position to the height of the point to be staked. The value for <Height Offset:> configured in STAKEOUT Configuration, Heights page is taken into account. Move down.
<FILL:>	Output	The positive height difference from the height of the current position to the height of the point to be staked. The value for <Height Offset:> configured in STAKEOUT Configuration, Heights page is taken into account. Move up.
<Height:> or <Ht:>	Output	Available for <Edit Height: No> in STAKEOUT Configuration, Heights page. The height of the current position is displayed as orthometric height. If the orthometric height cannot be displayed, the local ellipsoidal height is displayed. If it is not possible to display the local ellipsoidal height, the WGS 1984 height is displayed. The value for <Height Offset:> configured in STAKEOUT Configuration, Heights page is taken into account.

Field	Option	Description
<Design Ht:> or <D Ht:>	User input	Available for <Edit Height: Yes> in STAKEOUT Configuration, Heights page. The design height, which is the height of the point to be staked, is displayed as orthometric height. If the orthometric height cannot be displayed, the local ellipsoidal height is displayed. If it is not possible to display the local ellipsoidal height, the WGS 1984 height is displayed. The value for <Height Offset:> configured in STAKEOUT Configuration, Heights page is not taken into account. Changing the value for <D Ht:> changes the values displayed for <CUT:> and <FILL:>.

Next step

PAGE (F6) changes to the **Map** page. Refer to paragraph "STAKEOUT Orthogonal Stakeout, Map page".

STAKEOUT Orthogonal Stakeout, Map page

The **Map** page provides an interactive display of the data. Refer to "35 MapView Interactive Display Feature" for information on the functionality and softkeys available.

Next step

PAGE (F6) changes to the first page on this screen.

Stake out in orthogonal from station mode step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Set up and orient the instrument.	46
	<Automation: LOCK> and <EDM Mode: Tracking> are configured in CONFIGURE EDM & ATR Settings .	17.1
2.	Start the Stakeout application program.	47.2
3.	STAKEOUT Stakeout Begin Check the settings.	47.2
4.	CONF (F2) to access STAKEOUT Configuration, General page.	
5.	STAKEOUT Configuration, General page <Stake Mode: Ortho from Stn>	47.3
	This step-by-step instruction uses typical settings in all other fields on all pages in STAKEOUT Configuration .	47.3
6.	CONT (F1) to access STAKEOUT Stakeout Begin .	
7.	CONT (F1) to access STAKEOUT Orthogonal Stakeout .	
8.	STAKEOUT Orthogonal Stakeout, Stake page Check the suggested point ID and the reflector height.	
9.	DIST (F2) .	
10.	Move to the point to be staked either by following the range information in the fields <FORW:> , <BACK:> , <RGHT:> and <LEFT:> or the graphical display.	

Step	Description	Refer to chapter
	When the value is at or nearly zero, the current position is the point to be staked.	
11.	Hold the reflector steady over the marker.	
12.	REC (F1) stores distance and angles.	
	For <Pos Check: Yes> and/or <Height Check: Yes> in STAKEOUT Configuration, Checks page, a check is made on the horizontal and/or vertical coordinate distance from the staked point to the point to be staked. If either of the configured difference limits are exceeded, STAKEOUT Difference Limit Exceeded is accessed.	47.4.6
13.	Are more points to be staked? • If yes, continue with step 14. • If no, continue with step 16.	
14.	STAKEOUT Orthogonal Stakeout, Stake page According to sort and filter settings, the subsequent point in <Stakeout Job:> is suggested for staking out.	
15.	Repeat steps 8. to 13.	
16.	SHIFT QUIT (F6) to return to the screen from where STAKEOUT Stakeout Begin was accessed.	

**Stake out in orthogonal
to station mode
step-by-step**

The steps are identical to those of staking out in orthogonal from station mode. Follow the instructions in paragraph "Stake out in orthogonal from station mode step-by-step" using **<Stake Mode: Ortho to Stn>**. The values are calculated from the point to the station.

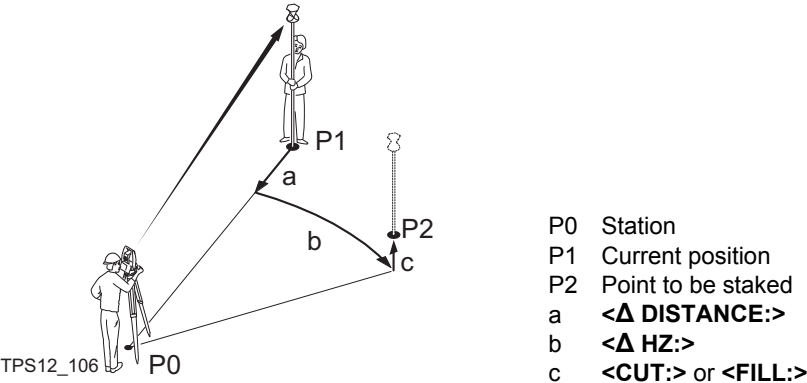
47.4.4

Staking Out in Polar Mode

Description

The stakeout elements are a direction from the station, a horizontal distance and a cut/fill. The range information is calculated from the current position to the point to be staked in reference to the station.

Diagram



<Stake Mode: Polar> is configured in **STAKEOUT Configuration, General** page. Refer to "47.3 Configuring Stakeout".

Access

Refer to "47.2 Accessing Stakeout" to access **STAKEOUT Polar Stakeout**.

**STAKEOUT
Polar Stakeout,
Stake page**

The pages shown are those from a typical configuration set. An additional page is available when a user defined display mask is used.
The keys are identical with those in **STAKEOUT Orthogonal Stakeout, Stake** page. Refer to "47.4.3 Staking Out in Orthogonal Mode" for information on the keys.

Description of fields

Field	Option	Description
<Point ID:>	Choicelist	The point ID of the point to be staked. Accesses STAKEOUT Data: Job Name where points are shown according to sort and filter settings and staked points are indicated by  .
<Reflector Ht:> or <hr:>	User input	The default reflector height as defined in the active configuration set is suggested.
<Δ HZ:>	Output	The difference of the horizontal angle from the point to be staked to the current position.  For <Orientate: From Station> and <Orientate: To Station> the value is calculated and displayed permanently. For other orientation methods, the distance must be measured before the value can be displayed.
<Δ DISTANCE:> or <Δ D:>	Output	The difference of the horizontal distance from the point to be staked to the current position along the line defined by current position and station.
<CUT:>	Output	The negative height difference from the height of the current position to the height of the point to be staked. The value for <Height Offset:> configured in STAKEOUT Configuration, Heights page is taken into account. Move down.

Field	Option	Description
<FILL:>	Output	The positive height difference from the height of the current position to the height of the point to be staked. The value for <Height Offset:> configured in STAKEOUT Configuration, Heights page is taken into account. Move up.
<Height:> or <Ht:>	Output	Available for <Edit Height: No> in STAKEOUT Configuration, Heights page. The height of the current position is displayed as orthometric height. If the orthometric height cannot be displayed, the local ellipsoidal height is displayed. If it is not possible to display the local ellipsoidal height, the WGS 1984 height is displayed. The value for <Height Offset:> configured in STAKEOUT Configuration, Heights page is taken into account.
<Design Ht:> or <D Ht:>	User input	Available for <Edit Height: Yes> in STAKEOUT Configuration, Heights page. The design height, which is the height of the point to be staked, is displayed as orthometric height. If the orthometric height cannot be displayed, the local ellipsoidal height is displayed. If it is not possible to display the local ellipsoidal height, the WGS 1984 height is displayed. The value for <Height Offset:> configured in STAKEOUT Configuration, Heights page is not taken into account.

Field	Option	Description
		Changing the value for <D Ht:> changes the values displayed for <CUT:> and <FILL:> .

Next step

PAGE (F6) changes to the **Map** page. Refer to paragraph "STAKEOUT Orthogonal Stakeout, Map page".

STAKEOUT Polar Stakeout, Map page

The **Map** page provides an interactive display of the data. Refer to "35 MapView Interactive Display Feature" for information on the functionality and softkeys available.

Next step

PAGE (F6) changes to the first page on this screen.

Stake out in polar mode step-by-step

The steps are identical to those of staking out in orthogonal mode. Refer to "47.4.3 Staking Out in Orthogonal Mode". Follow the instructions in paragraph "Stake out in orthogonal from station mode step-by-step" using **<Stake Mode: Polar>**. The values are displayed as **<Δ HZ:>** and **<Δ DISTANCE:>**.

47.4.5

Staking Out a DTM

Description

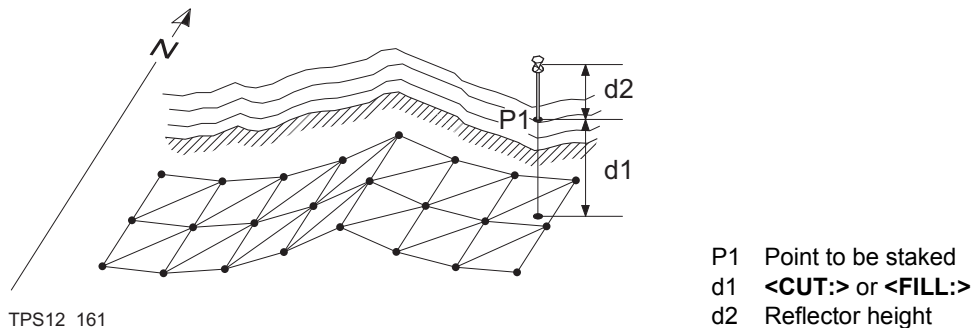
With the Stakeout application program a **D**igital **T**errain **M**odel can be staked. The heights of the current positions are compared against those of a selected DTM job. The height differences are calculated and displayed.

Staking a DTM may be used for

- staking out where the DTM represents the surface to be staked.
- quality control purposes where the DTM represents the final project surface.

DTM jobs are created in LGO. DTM jobs are stored in the \DBX directory on the active memory device.

Diagram



Access

Refer to "47.2 Accessing Stakeout" to access **STAKEOUT XX Stakeout**.

Stake out a DTM step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
	DTM Stakeout must be activated via a licence key.	28
	The DTM job to be used must be stored in the \DBX directory on the active memory device.	
1.	Start the Stakeout application program.	47.2
2.	STAKEOUT Stakeout Begin CONF (F2) to access STAKEOUT Configuration .	
3.	PAGE (F6) until the Heights page is active.	
4.	STAKEOUT Configuration, Heights page <Use DTM: DTM only>	47.3
	<Use DTM: DTM & Stake Job> is not covered in this step-by-step instruction. The stake out procedure is identical as described for the selected <Stake Mode:> . The heights to be staked are taken from the selected <DTM Job:> defined in STAKEOUT Stakeout Begin .	47.3
	This step-by-step instruction uses typical settings in all other fields on all pages in STAKEOUT Configuration . The selection for <Stake Mode:> is irrelevant since no positions are staked.	47.3
5.	CONT (F1) to access STAKEOUT Stakeout Begin .	
6.	STAKEOUT Stakeout Begin <DTM Job:> Select a DTM job.	47.2

Step	Description	Refer to chapter
	Check the other settings.	
7.	CONT (F1) to access STAKEOUT DTM Stakeout .	
8.	STAKEOUT DTM Stakeout, Stake page Check the suggested reflector height.	
9.	DIST (F2) .	
10.	STAKEOUT DTM Stakeout, Stake page <CUT:> or <FILL:> The negative or positive height difference from the current position to the equivalent point in the selected DTM job is calculated and displayed. Height offsets apply for whole DTM.	
11.	Mark the current position.	
12.	REC (F1) to store distance and angles.	
	For <Height Check: Yes> in STAKEOUT Configuration, Checks page, a check is made on the vertical coordinate distance from the staked point to the point to be staked. If the configured difference limit is exceeded, STAKEOUT Difference Limit Exceeded is accessed.	47.4.6
13.	Are more heights to be staked? • If yes, move to the next position and repeat steps 8. to 13. • If no, continue with step 14.	
14.	SHIFT QUIT (F6) to return to the screen from where STAKEOUT Stakeout Begin was accessed.	

47.4.6

Stakeout Difference Limit Exceeded

Description

If configured a check is made on the horizontal and/or vertical coordinate distance from the staked point to the point to be staked when storing a staked point. Refer to "47.3 Configuring Stakeout" for information on configuring the check and the limits.

Access

The screen shown below is accessed automatically when the staked point is stored if either of the configured difference limits are exceeded.

STAKEOUT Difference Limit Exceeded

The availability of the fields depends on the configured **<Stake Mode:>** and **<Use DTM:>**. For example for **<Use DTM: DTM only>**, position relevant fields are unavailable.

The limits that have been exceeded are shown in bold and indicated by a !.

12:14		STAKEOUT		IR STD		I		Bluetooth		Wi-Fi		GPS		Battery	
Difference Limit Exceeded															
Point ID	:	0001													
Store ID	:	0001													
BACK	:	!	0.868 m												
LEFT	:	!	5.211 m												
FILL	:	!	0.534 m												
2D-Diff	:	!	5.282 m												
3D-Diff	:		5.309 m												
															Q2 a ↑
BACK		STORE	SKIP												

BACK (F1)

To return to **STAKEOUT XX Stakeout** without storing the point. Staking out of the same point continues.

STORE (F3)

To accept the coordinate differences, store the point information and return to **STAKEOUT XX Stakeout**.

SKIP (F4)

To return to **STAKEOUT XX Stakeout** without storing the point. According to filter and sort settings the subsequent point in **<Stakeout Job:>** is suggested for staking out.

Description of fields

Field	Option	Description
<Point ID:>	Output	The point ID of the point to be staked.
<Store ID:>	User input	The unique number which is used to store the staked point. Allows a different point ID to be typed in if needed.
<Δ EASTING:>	Output	The difference of the Easting coordinate between the the point to be staked and the current position.
<Δ NORTHING:>	Output	The difference of the Northing coordinate between the point to be staked and the current position.
<Δ HZ:>	Output	The difference of the horizontal angle to the point to be staked and the current position.
<Δ DISTANCE:>	Output	The difference of the horizontal distance to the point to be staked and the current position.
<FORWARD:>	Output	The horizontal distance from the current position to the point to be staked along the line defined by station and reflector.
<BACK:>	Output	The horizontal distance from the current position to the point to be staked in the reverse direction of the line defined by station and reflector.
<RIGHT:>	Output	Horizontal distance from the current position to the point to be staked orthogonal to the right of the line defined by station and reflector.

Field	Option	Description
<LEFT:>	Output	Horizontal distance from the current position to the point to be staked orthogonal to the left of the line defined by station and reflector.
<CUT:>	Output	The negative height difference from the height of the staked point to the height of the point to be staked.
<FILL:>	Output	The positive height difference from the height of the staked point to the height of the point to be staked.
<2D-Diff:>	Output	Displays the horizontal difference from the staked point to the point to be staked.
<3D-Diff:>	Output	Displays the spatial difference from the staked point to the point to be staked.

Next step

IF the exceeded difference limit	THEN
is not to be accepted	BACK (F1) to stake the same point again.
is to be accepted	STORE (F3) to store the point and to stake out the next point.
is not to be accepted but cannot be improved	SKIP (F4) to skip staking this point and to stake out the next point.

48.1

Accessing Survey

Access

Select **Main Menu: Survey**.

OR

Select **Main Menu: Programs...\Survey**

OR

Press a hot key configured to access the screen **SURVEY Survey Begin**.

Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

OR

Press **PROG**. Highlight **Survey. CONT (F1)**.

Refer to "36.2 Accessing the Programs Menu" for details on the **PROG** key.

SURVEY

Survey Begin

11:40
SURVEY

IR STD I

Survey Begin

Job : active job

Coord System : <None>

Codelist : <None>

Config Set : survey

Reflector : Leica Circ Prism

Add. Constant: 0.0 mm

Q2a ↑

CONT CONF SETUP CSYS

CONT (F1)

To accept changes and access the subsequent screen. The chosen settings become active.

CONF (F2)

To configure SmartCodes, auto points and remote point measurements. Accesses **SURVEY Configuration**. Refer to "49 Survey - Auto Points" and to "50 Survey - Remote Point" for information on the fields and keys.

SETUP (F3)

To set up station. Accesses **SETUP Station Setup**.

CSYS (F6)

To select a different coordinate system. Not available for <Use Auto CrdSys: Yes> configured in **CONFIGURE Additional Rover Settings**. Refer to "22.1 Real-Time Mode".

Description of fields

Field	Option	Description
<Job:>	Choicelist	The active job. All jobs from Main Menu: Manage...\Jobs can be selected.

Field	Option	Description
<Coord System:>	Output	The coordinate system currently attached to the selected <Job:>. Not available for <Use Auto CrdSys: Yes> configured in CONFIGURE Additional Rover Settings . Refer to "22.1.1 Configuration of Real-Time".
<Codelist:>	Choicelist	No codes are stored in the selected job. All codelists from Main Menu: Manage...\Codelists can be selected.
	Output	Codes have already been stored in the selected <Job:>. If codes had been copied from a System RAM codelist, then the name of the codelist is displayed. If codes have not been copied from a System RAM codelist but typed in, then the name of the active job is displayed.
<Config Set:>	Choicelist	The active configuration set. All configuration sets from Main Menu: Manage...\Configuration Sets can be selected.
<Reflector:>	Choicelist	The active reflector. All reflectors from Main Menu: Manage...\Reflectors can be selected.
<Add. Constant:>	Output	The additive constant stored with the chosen reflector.

Next step

CONT (F1) to access **SURVEY Survey: Job Name**, where measurements can be performed with **ALL (F1)** or **DIST (F2)** and/or **REC (F3)**.

Description

The Survey application program is used for point measurement. Coordinates for points can be measured and stored using **ALL (F1)**, **DIST (F2)** and **REC (F3)**. Refer to TPS1200+/TS30/TM30 System Field Manual for an example on surveying with default settings.

Access step-by-step

The table describes the main access to **SURVEY Survey: Job Name**. Access is possible from other screens where individual point measurements are needed, for example from **COGO Inverse** with **SURVY (F5)**.

Step	Description
1.	Refer to "48.1 Accessing Survey" to access SURVEY Survey Begin .
2.	SURVEY Survey Begin CONT (F1) to access SURVEY Survey: Job Name .

SURVEY
Survey: Job Name,
Survey page

The fields shown are those from a typical configuration set. The screen described consists of the **Survey** page and the **Map** page. The explanations for the softkeys given below are valid for the **Survey** page. Refer to "35 MapView Interactive Display Feature" for information on the keys on the **Map** page.

The fields and functionality of this screen vary slightly when accessed from other application programs where individual point measurements are needed.

11:41		IR STD I		Bluetooth, USB, etc.	
SURVEY					
Survey: active job					
Survey		Offset		Code Map	
Point ID	:	0001			
Reflector Ht	:	1.250 m			
Hz	:	55.0002 g			
V	:	37.0004 g			
Horiz Dist	:	65.333 m			
Ht Diff	:	99.466 m			
					Q2 a ↑
ALL	DIST	REC		SETAZ	PAGE

ALL (F1)

To measure and store distances and angles.

STOP (F1)

Available if **<EDM Mode: Tracking>** and **DIST (F2)** was pressed. Stops the distance measurements. **(F1)** changes back to **ALL**.

DIST (F2)

To measure and display distances. Available unless **<EDM Mode: Tracking>** and/or **<Log Auto Pts: Yes>**, after the tracking or logging is started.

REC (F3)

To record data.

If **<EDM Mode: Tracking>** and/or **<Log Auto Pts: Yes>**, records measured point and continues tracking.

REMOT (F4)

Available if **<Use Remote Pt: Yes>** is set in the **SURVEY Configuration, Remote Pt** page. To access **SURVEY Survey Remote Point**.

SETAZ (F5)

To access the **SETUP Set Stn & Ori - Set Azimuth** screen to set the horizontal angle. Refer to "46.6.2 Set Azimuth" for information on the **SURVEY Set Stn & Ori - Set Azimuth** screen.

SETUP (F5) (Applicable to Add Points Later)

Available when the setup is incomplete.

TEST (F5)

To access the **SURVEY EDM Test Signal/Frequency** screen. Available for **<EDM Mode: Tracking>** and/or **<Log Auto Pts: Yes>**, after the tracking or logging is started.

SHIFT CONF (F2)

To configure auto points and remote point measurements. Accesses **SURVEY Configuration**. When **SHIFT AVGE (F2)** or **SHIFT ABS (F2)** are active, this key is not available. Refer to "49 Survey - Auto Points" and to "50 Survey - Remote Point" for information on the fields and keys.

SHIFT AVGE (F2)

To check the residuals for the averaged point. Available for **<Averaging Mode: Average>** and for more than one measured coordinate triplet recorded for the same point. Refer to "6.3.4 Mean Page".

SHIFT ABS (F2)

To check the absolute difference between the measurements. Available for **<Averaging Mode: Absolute Diffs>** and for more than one measured coordinate triplet recorded for the same point. Refer to "6.3.4 Mean Page".

SHIFT 2FRec (F3)

To aim manually at the target and only record the angle measurement (Hz/V) in Face I and Face II. The point stored is an average of the two measurements.

This hotkey is only available in the Survey program for **<EDM Type: Reflector (RL)>** or **<EDM Type: Reflctrless (IR)>** if **<Automation: None>**.

SHIFT 2FAII (F4)

To take a measurement in Face I and Face II. The point stored is an average of the two measurements.

When using instruments fitted with ATR, the point is automatically measured in both faces, the resulting point is stored and the instrument is returned to the first face.

This hotkey is only available in the Survey program for **<EDM Type: Reflector (RL)>** or **<EDM Type: Reflctrless (IR)>**.

SHIFT INDIV (F5) and SHIFT RUN (F5)

To change between entering an individual point ID different to the defined ID template and the running point ID according to the ID template. Refer to "16.1 ID Templates".

Description of fields

Field	Option	Description
<Point ID:>	User input	The identifier for measured points. The configured point ID template is used. The ID can be changed: - To start a new sequence of point ID's overtype the point ID. - For AN individual number independent of the ID template SHIFT INDIV (F5). SHIFT RUN (F5) changes back to the next ID from the configured ID template. Refer to "16.1 ID Templates".
<Reflector Ht:>	User input	The last used reflector height is suggested when accessing the Survey application program. An individual reflector height can be typed in.
<Hz:>	Output	The current horizontal angle.
<V:>	Output	The current vertical angle.
<Horiz Dist:>	Output	The horizontal distance after DIST (F2) was pressed. No distance is displayed when accessing the screen and after REC (F3) or ALL (F1) .
<Ht Diff:>	Output	The height difference between station and measured point after DIST (F2) . Displays ----- when accessing the screen and after REC (F3) or ALL (F1) .
<Easting:>	Output	Easting coordinate of the measured point.
<Northing:>	Output	Northing coordinate of the measured point.
<Height:>	Output	Elevation of the measured point.

Next step

PAGE (F6) changes to another page on this screen.

49.1

Overview

Description

- Auto points is used to automatically measure and store points at a specific rate. Additionally, individual auto points can be stored outside the defined rate. Auto points logged between starting and stopping logging of auto points form one chain. A new chain is formed each time logging of auto points is started.
- Auto points can be collected in the Survey application program. An **Auto** page is visible when logging of auto points is active.
- Up to two offset points related to one auto point can be logged. The offset points can be both to the left or right and they can be coded independently of each other and of the auto points. Refer to "49.4 Offset Points of Auto Points".

Coding of auto points

Coding of auto points is similar to coding of measured points. Refer to "8 Coding" for information on coding.

The differences are:

- Thematical coding: Always available.
- Free coding: Always available.
- Quick coding: Not available.
- Codes of auto points overwrite the codes of points existing in the active job with the same point ID but with a different code as the auto point.
- Codes of auto points can be changed when no auto points are being logged.
- Up to three attributes can be stored with a code

Properties of auto points

The properties stored with auto points are:

- Class: **MEAS**
- Sub class: **TPS**
- Source: **Survey (Auto)** or **Survey (Auto Of)**
- Instrument source: **TPS**

Averaging of auto points

An average is never calculated for auto points even if a measured point of class **MEAS** already exists with the same point ID.

49.2

Configuring Auto Points

Access

Select **Main Menu: Survey**. In **SURVEY Survey Begin** press **CONF (F2)** to access **SURVEY Configuration**.

OR

In **SURVEY Survey: Job Name** press **SHIFT CONF (F2)** to access **SURVEY Configuration**.

SURVEY Configuration, Auto Points page

The settings on this page activate the logging of auto points and define the method of logging.

17:23
SURVEY

Configuration

SCode Auto Points Remote Pt

Log Auto Pts : Yes
Log By : Time
Log Every : 1.0s

EDM Mode : SynchroTrack

CONT (F1)

To accept changes and return to the screen from where this screen was accessed.

DMASK (F3)

Available for <Log Auto Pts: Yes>. To configure what is viewed in the **Auto** page in the Survey application program. Refer to paragraph "SURVEY Configure Auto Pts Display Mask".

PAGE (F6)

To change to another page on this screen.

CONT DMASK PAGE

Description of fields

Field	Option	Description
<Log Auto Pts:>	Yes	Activates logging of auto points.  All other fields on the screen are active and can be edited with this setting.
	No	Deactivates logging of auto points and all fields on this screen.
<Log By:>	Time	Auto points are stored according to a time interval.
	Distance	The difference in distance from the last stored auto point, which must be reached before the next auto point is measured. The auto point is stored with the next available measured position.
	Height Diff	The height difference from the last stored auto point, which must be reached before the next auto point is measured. The auto point is stored with the next available measured position.
	Dist or Ht	Before the next auto point is measured, either the difference in distance or the difference in height must be reached. The auto point is stored with the next available measured position.

Field	Option	Description
	Stop & Go	An auto point is stored when the position of the reflector does not move more than the distance configured in <Stop Position:> within the <Stop Time:>. Once a point has been stored, the position from the point just stored must change more than the distance configured in <Stop Position:> before he routine starts again.
	User Decides	An auto point is stored upon pressing REC (F3) in SURVEY Survey: Job Name, Auto page. In the beginning, the chain to which the auto points should be assigned must be started with START (F1). In the end, the chain must be closed with STOP (F1).
<Log Every:>	User input	Available when: • <Log By: Time> • <Log By: Distance> • <Log By: Height Diff>. User input when: • <Log By: Distance> • <Log By: Height Diff> • <Log By: Dist or Ht> • <Log By: Stop & Go>.

Field	Option	Description
	For <Log By: Time> from 0.1s to 60.0s	For <Log By: Time> . The time interval before the next auto point is logged.
<Min Distance:>	User input	Available for <Log By: Dist or Ht> . The value for the difference in distance before the next auto point is logged.
<Min Height:>	User input	Available for <Log By: Dist or Ht> . The value for the height difference before the next auto point is logged.
<Stop Position:>	User input	Available for <Log By: Stop & Go> . The maximum distance within which the position is considered stationary.
<Stop Time:>	User input	Available for <Log By: Stop & Go> . The time while the position must be stationary until an auto point is stored.
<EDM Mode:>	Tracking SynchroTrack	Continuous distance measurement with 0.3 s measuring time and 5 mm + 2 ppm accuracy. When the logging of auto points has started, TRK is displayed as an icon. Available only for <EDM Type: Reflector (IR)> .

Field	Option	Description
		This is the measurement mode for the interpolation of angle measurements in IR LOCK Tracking mode. In difference to normal IR LOCK Tracking mode, where angle measurements are only assigned to certain distance measurements, SynchroTrack will perform a linear interpolation between the previous and following angle measurement, based upon the timestamp of the EDM measurement. When the logging of auto points has started, SYNC is displayed as an icon.

Next step

IF the display mask	THEN
is not to be configured	CONT (F1) closes the screen and returns to the screen from where SURVEY Configuration, Auto Points page was accessed.
is to be configured	DMASK (F3) . Refer to paragraph "SURVEY Configure Auto Pts Display Mask".

SURVEY Configure Auto Pts Display Mask

12:29 SURVEY

Configure Auto Pts Display Mask

Fixed Lines: 1

1st Line : Point ID (auto)

2nd Line : Reflector Height

3rd Line : Line Space Half

4th Line : Msd Auto Points

5th Line : Code (auto)

6th Line : Code Desc

7th Line : Line Space Half

Q2 a

CONT CLEAR DEFLT

CONT (F1)

To accept changes and return to the screen from where this screen was accessed.

CLEAR (F4)

To set all fields to <XX. Line: Line Space Full>.

DEFLT (F5)

Available if the active configuration set is a default configuration set. To recall the default settings.

Description of fields

Field	Option	Description
<Fixed Lines:>	From 0 to 5	Defines how many lines do not scroll in SURVEY Survey: Job Name, Auto page when that display mask is used.
<1st Line:>	Output	Fixed to <1st Line: Point ID (auto)>.
<2nd Line:> to <16th Line:>	Add. Constant Angle Right Annotation 1-4	Output field for the additive constant of the currently selected reflector. Output field for the angle right. Input field for comments to be stored with the point.

Field	Option	Description
	Attrib (free) 01-20	Output field for attributes for free codes.
	Attrib (pt) 01-03	Input field for attributes for point codes.
	Azimuth	Output field for the azimuth.
	Code (auto)	Choicelist or input field for auto point codes.
	Code (free)	Output field for free codes.
	Code Desc	Output field for the description of codes.
	Code Desc (free)	Output field for the description of free codes.
	Code Type	Output field for the description of point codes.
	EDM Mode	Output field displaying the current EDM mode.
	EDM Type	Output field displaying the current EDM type.
	Easting	Output field for the Easting coordinate of the measured point.
	Height	Output field for the height coordinate of the measured point
	Height Diff	Output field for the height difference between station and reflector.
	Horiz Dist	Output field for the horizontal distance calculated from the measured slope distance and the vertical angle.

Field	Option	Description
	Hz-Angle	Output field for the horizontal angle.
	Line Space Full	Insert full line space.
	Line Space Half	Insert half line space.
	Linework	Choicelist with instructions how the software should flag a line/area. Refer to "9 Linework".
	Msd Auto Points	Output field for the number of auto points logged after pressing START (F1) in SURVEY Survey: Job Name, Auto page. Counting starts from 0 every time START (F1) is pressed.
	Northing	Output field for the North coordinate of the measured point.
	Offset Cross	Input field for the horizontal distance offset for the measured point, perpendicular to the line of sight.
	Offset Height	Input field for the height offset of the measured point.
	Offset Length	Input field for the horizontal distance offset, in the direction of line of sight.
	Reflector	Output field for the chosen reflector.
	Reflector Height	Input field for the reflector height.
	SD-Last Rec	Output field for the last recorded distance.

Field	Option	Description
	Slope Dist	Output field for the measured slope distance.
	Time at Point	Output field for the time from when the point is occupied until point occupation is stopped. Appears in the display mask during the point occupation.
	V-Angle	Output field for the vertical angle.

Next steps

Step	Description
1.	CONT (F1) closes the screen and returns to SURVEY Configuration, Auto Points page.
2.	CONT (F1) returns to the screen from where SURVEY Configuration, Auto Points page was accessed.

49.3

Auto Points

Requirements

<Log Auto Pts: Yes> in **SURVEY Configuration, Auto Points** page.

Access step-by-step

Step	Description
1.	Refer to "48.1 Accessing Survey" to access SURVEY Survey Begin .
2.	SURVEY Survey Begin Check the settings.
3.	CONT (F1) to access SURVEY Survey: Job Name .
4.	PAGE (F6) until the Auto page is visible.

SURVEY Survey: Job Name, Auto page

The **Auto** page of a typical configuration set is explained. Before logging of auto points has started, the page appears as shown below:

10:01 SURVEY

Survey: active job

Survey | Offset | Code | Auto | Map

Auto Pt ID : Auto0038

Reflector Ht : 1.250 m

Hsd Auto Pts : 34

Code (Auto) : <None>

Code Desc : -----

Slope Dist : 119.000 m

Hz : 55.0002 g

STOP REC OFST1 OFST2 PAGE

START (F1)

To start logging of auto points and offset points if configured or, for <Log By: User Decides> to start the chain to which the auto points should be assigned. The first auto point is stored.

<EDM Mode: Tracking> becomes active. For <EDM Type: Reflector (IR)> instrument locks onto reflector. For <EDM Type: Long Range (LO)> <EDM Type: Reflector (IR)> is set and instrument locks onto the reflector.

STOP (F1)

To end recording of auto points and offset points if configured or, for **<Log By: User Decides>**, to end the chain to which the auto points are assigned..

REC (F3)

Available for **STOP (F1)**. To store an auto point at any time.

OFST1 (F4)

To configure recording of the first type of offset points. Refer to "49.4 Offset Points of Auto Points".

OFST2 (F5)

To configure recording of a second type of offset points. Refer to "49.4 Offset Points of Auto Points".

PAGE (F6)

To change to another page on this screen.

SHIFT CONF (F2)

To configure auto points. Refer to "49.2 Configuring Auto Points".

SHIFT QUIT (F6)

To exit the Survey application program. Point information logged until pressing **SHIFT QUIT (F6)** is saved in the database.

Description of fields

Field	Option	Description
<Auto Pt ID:>	User input	Available unless <Auto Pts: Time & Date> in CONFIGURE ID Templates . The identifier for auto points. The configured ID template for auto points is used. The ID can be changed. To start a new sequence of point ID's overtype the point ID.
	Time and Date	Available for <Auto Pts: Time & Date> in CONFIGURE ID Templates . The current local time and date is used as identifier for auto points.
<Reflector Ht:>	User input	The default reflector height as defined in the active configuration set is suggested.
<Msd Auto Pts:>	Output	Available after pressing START (F1) and before pressing STOP (F1) . The number of auto points measured since START (F1) has been pressed.
<Code (Auto):>		The thematical code for the auto point.  If a point code is selected then any open line/area is closed. The occupied point is stored with the selected code idependently of any line/area.

Field	Option	Description
		- If a line code is selected then any open line is closed and a new line with the selected code is created. The line ID is defined by the configured line ID template. The occupied point is assigned to that line. The line stays open until it is closed manually or another line code is selected. - If an area code is selected then the behaviour is as for lines.
	Choicelist	Available for <Thematc Codes: With Codelist> . The setting for <Show Codes:> in CONFIGURE Coding & Linework determines if either all codes or only point codes are available. The attributes are shown as output, input or choicelist fields depending on their definition.
	User input	Available for <Thematc Codes: Without Codelist> . Codes can be typed in but not selected from a codelist. A check is performed to see if a code of this name already exists in the job. If so, the according attributes are shown. Configure a display mask with a choicelist for code types to define if a point, line or area code is typed in.
<Code Desc:>	Output	The description of the code.

Field	Option	Description
<Slope Dist:>	Output	The measured slope distance. When START (F1) is pressed, <EDM Mode: Tracking> is set and the slope distance is constantly updated.
<Hz:>	Output	The current horizontal angle.
<V:>	Output	The current vertical angle.

Next step

IF	THEN
auto points are to be logged	START (F1) . Then, for <Log By: User Decides>, REC (F3) whenever an auto point is to be stored.
offset points are to be configured	OFST1 (F4) or OFST2 (F5) . Refer to "49.4 Offset Points of Auto Points".

49.4

49.4.1

Offset Points of Auto Points

Overview

Description

Offset points

- can be created with auto points when auto points are stored to the DB-X.
- can be to the left or to the right of auto points.
- are automatically computed with the logging of auto points, if configured.
- form a chain relative to the chain of auto points to which they are related. Subsequently computed chains are independent from each other.
- can be coded independently of auto points.
- have the same time of when they were stored as the auto points to which they are related.
- have the same coding functionality, properties and averaging functionality as auto points. Refer to "49.1 Overview".

Up to two offset points can be related to one auto point.

The screens for the configuration of offset points are identical except for the title **Auto Points - Offset 1** and **Auto Points - Offset 2**. For simplicity, the title **Auto Points - Offset** is used in the following description.

Computation of offset points

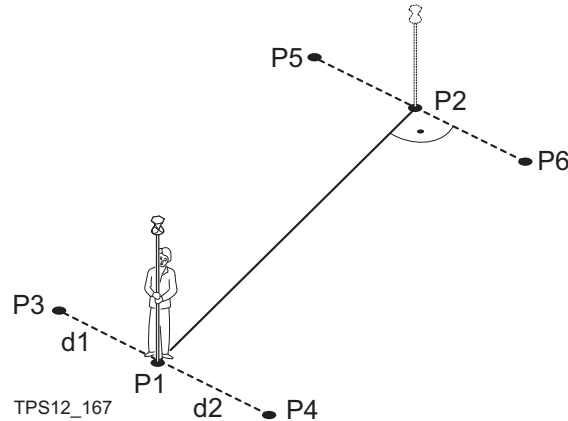
The computation of offset points depends on the number of auto points in one chain.

One auto point

No offset points are computed or stored.

Two auto points

The configured offsets are applied perpendicular to the line between two auto points.



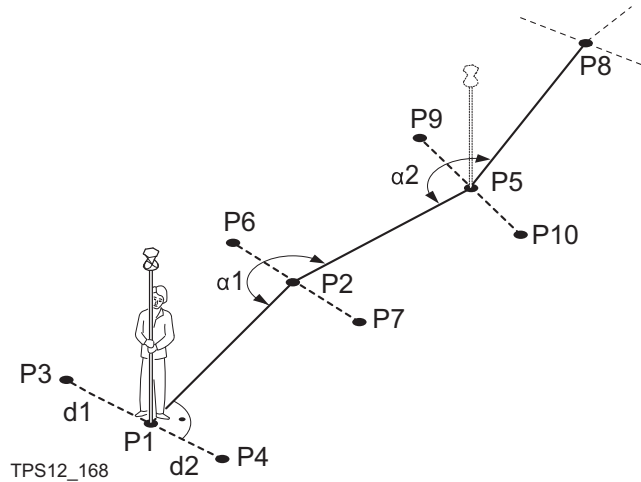
- P1 First auto point
- P2 Second auto point
- P3 First offset point for P1
- P4 Second offset point for P1
- P5 First offset point for P2
- P6 Second offset point for P2
- d1 Horizontal offset to the left
- d2 Horizontal offset to the right

Three or more auto points

The first offset points are computed perpendicular to the line between the first and the second auto point.

The last offset point is computed perpendicular to the line between the last auto point and the one before.

All other offset points are computed on a bearing. The bearing is half of the angle between the last and the next measured auto point.



- P1 First auto point
- P2 Second auto point
- P3 First offset point for P1
- P4 Second offset point for P1
- P5 Third auto point
- P6 First offset point for P2
- P7 Second offset point for P2
- P8 Fourth auto point
- P9 First offset point for P5
- P10 Second offset point for P5
- d1 Horizontal offset to the left
- d2 Horizontal offset to the right
- α_1 Angle between P1 and P5
- α_2 Angle between P2 and P8

49.4.2

Configuring Offset Points

Access step-by-step

Step	Description
1.	Refer to "48.2 Surveying Points" to access SURVEY Survey: Job Name .
2.	PAGE (F6) until the Auto page is active.
3.	OFST1 (F4) or OFST2 (F5) to access SURVEY Auto Points - Offset .

SURVEY

Auto Points - Offset, General page

10:09 SURVEY

Auto Points - Offset 1

General Code

Store Offset1: Yes

Horiz Offset : 1.000 m

Height Offset: 0.000 m

Identifier : 051

Prefix/Suffix: Suffix

CONT OFST2 PAGE

CONT (F1)

To accept changes and return to the screen from where this screen was accessed.

OFST2 (F2) and OFST1 (F2)

To switch between configuring offset point type one and two.

PAGE (F6)

To change to another page on this screen.

Description of fields

Field	Option	Description
<Store Offset1:> and <Store Offset2:>	Yes	Activates logging of offset points.  All other fields in the screen are active and can be edited with this setting.
	No	Deactivates logging of offset points and all fields in this screen.
<Horiz Offset:>	User input	The horizontal offset between -1000 m and 1000 m at which the offset point is collected.
<Height Offset:>	User input	The height offset between -100 m and 100 m from the related auto point.
<Identifier:>	User input	The identifier with up to four characters is added in front of or at the end of the ID of the auto point. This ID is then used as the point ID for the related offset point. This could support an automatic workflow into CAD packages including setting symbols and stringing lines.
<Prefix/Suffix:>	Prefix	Adds the setting for <Identifier:> in front of the auto point ID.
	Suffix	Adds the setting for <Identifier:> at the end of the auto point ID.

Next step

PAGE (F6) changes to the **Code** page.

SURVEY Auto Points - Offset, Code page

The setting for **<Themadc Codes:>** in **CONFIGURE Coding & Linework** determines the availability of the fields and softkeys.

10:10
SURVEY
Auto Points - Offset 1
General Code
Point Code : c1
Code Desc : centre line

Q2 a ↑
CONT NEW-A LAST DEFLT PAGE

CONT (F1)

To accept changes and return to the screen from where this screen was accessed.

NEW-A (F2)

Available for **<Themadc Codes: With Codelist>**. To create additional attributes for the selected **<Point Code:>**.

NAME (F3) or VALUE (F3)

Available for **<Themadc Codes: With Codelist>**. Available for attributes for which an attribute name can be typed in. To highlight **<Attribute n:>** or the field for the attribute value. The name of **<Attribute n:>** can be edited and an attribute value can be typed in.

LAST (F4)

Available for **<Themadc Codes: With Codelist>**. To recall the last used attribute values for the selected code.

DEFLT (F5)

Available for **<Themadc Codes: With Codelist>**. To recall the default attribute values for the selected code.

PAGE (F6)

To change to another page on this screen.

Description of fields

Field	Option	Description
<Point Code:>	Choicelist	The thematical code for the offset point. Available for < Themadc Codes: With Codelist >. The setting for < Show Codes:> in CONFIGURE Coding & Linework determines if either all codes or only point codes are available. The attributes are shown as output, input or choicelist fields depending on their definition.
<Code:>	User input	The thematical code for the offset point. Available for < Themadc Codes: Without Codelist >. Codes can be typed in but not selected from a codelist. A check is performed to see if a point code of this name already exists in the job. If so, the according attributes are shown.
<Code Desc:>	Output	Available for < Themadc Codes: With Codelist >. The description of the code.
<Attribute n:>	User input	Available for < Themadc Codes: Without Codelist >. Up to three attribute values can be stored.

Next step

IF	THEN
offset point configuration is finished	CONT (F1) to return to SURVEY Survey: Job Name .

IF	THEN
a second offset point is to be configured	PAGE (F6) and then OFST2 (F2) or OFST1 (F2) to change to SURVEY Auto Points - Offset for the second point.

Example for offset point ID's

The offset point ID is a combination of the auto point ID and an identifier as prefix or suffix. The right most part of the auto point ID is incremented within the point ID. The auto point ID is truncated from the left if the length of the auto point ID plus identifier prefix or suffix is greater than 16 characters.

Auto point ID	Identifier	Prefix/Suffix	Offset point ID
Auto1234 Auto1235	OS1	Prefix	OS1Auto1234 OS1Auto1235 ...
Auto1234 Auto1235	OS1	Suffix	Auto1234OS1 Auto1235OS1 ...



Refer to "16.1 ID Templates" for more information on point ID's.

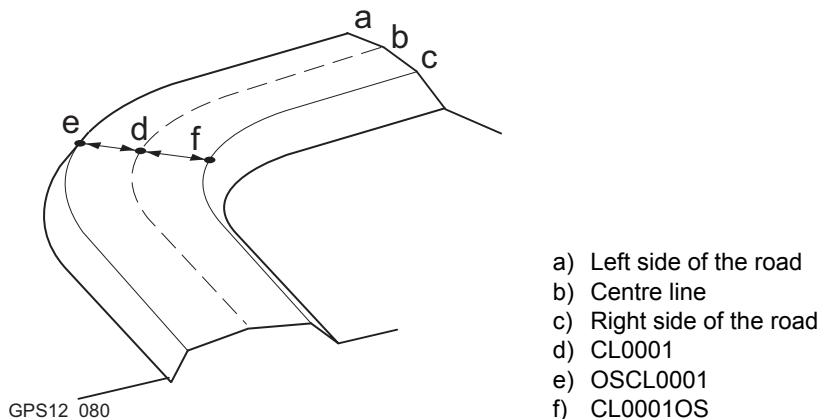
49.4.3

Working Example

Description

Application:	Pick up points along the centre line, to the right and to the left of a road.
Goal:	Points are to be picked up automatically every 5 m while walking along the centre line. The points to the right and to the left of the road are to be picked up automatically with those of the centre line. The auto point ID's are CL0001, CL0002,.... The offset point ID's are OSCL0001, OSCL0002,... for the right side of the road and CL0001OS, CL0002OS,... for the left side. The offset to the right and to the left is 3 m. The height difference is -0.3 m to the right and 0.3 m to the left.

Diagram



- a) Left side of the road
- b) Centre line
- c) Right side of the road
- d) CL0001
- e) OSCL0001
- f) CL0001OS



- The default display mask for **SURVEY Survey: Job Name, Auto** page is used.
- **<Distance Unit: Metres (m)>** in **CONFIGURE Units & Formats, Units** page.
- An ID template for the auto points is configured. Refer to "16.1.6 Working Example" for information on how to configure ID templates.

Field procedure step-by-step

Step	Description
1.	Main Menu: Survey.
2.	SURVEY Survey Begin Select a job, a reflector and a configuration set with the settings mentioned above.
3.	CONF (F2) to access SURVEY Configuration.
4.	SURVEY Configuration, Auto Points page

Step	Description
5.	<Log Auto Pts: Yes> <Log By: Distance> <Log Every: 5.0000> CONT (F1) to return to SURVEY Survey Begin .
6.	CONT (F1) to access SURVEY Survey: Job Name .
7.	PAGE (F6) until the Auto page is active.
8.	OFST1 (F4) to configure the offset points for the right side of the road.
9.	SURVEY Auto Points - Offset 1, General page <Store Offset1: Yes> <Horiz Offset: 3.0000> <Height Offset: -0.3000> <Identifier: OS> <Prefix/Suffix: Prefix>
10.	OFST2 (F2) to configure the offset points for the left side of the road.
11.	SURVEY Auto Points - Offset 2, General page <Store Offset2: Yes> <Horiz Offset: -3.0000> <Height Offset: 0.3000> <Identifier: OS> <Prefix/Suffix: Suffix>

Step	Description
12.	CONT (F1) closes the screen and returns to SURVEY Survey: Job Name, Auto page.
13.	SURVEY Survey: Job Name, Auto page START (F1) starts logging of auto points and offset points.
14.	Walk along the centre line of the road as far as points need to be picked up.
	OFST1 (F4) to change the offset or the height difference between the auto points on the centre line and the right side of the road.
	OFST2 (F5) to change the offset or the height difference between the auto points on the centre line and the left side of the road.
15.	STOP (F1) ends recording of auto points and offset points.
	The stopping measuring auto points is indicated in the EDM icon.
16.	After finishing the survey, import the data into a CAD package. If the offset point ID's or codes fulfill the requirements of the CAD package, the offset points to the right and to the left of the road are automatically strung together.

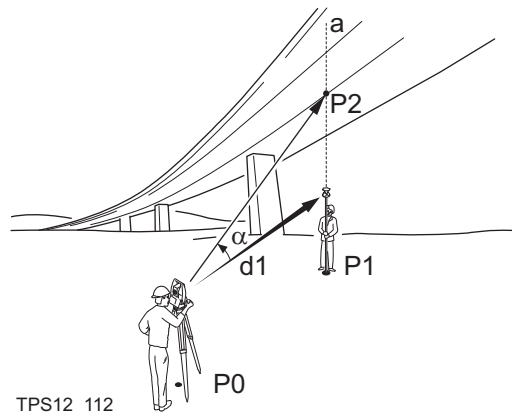
50.1

Overview

Description

Remote point is used to determine the 3D coordinates of inaccessible points, for example on bridges. The horizontal distance to a base point directly underneath or above the remote point is measured. Then the instrument is aimed at the remote point. The coordinates of the remote point are calculated with the distance measured to the base point and the angles measured to the remote point.

Diagram



TPS12_112

- P0 Instrument station
- P1 Base point
- P2 Remote point
- d1 Horizontal distance to the base point
- α Vertical angle between base point and remote point
- a Vertical axis from P1 to P2



To ensure correct results, the remote point and the reflector must be lined up vertically. If it is not possible to maintain an exactly vertical line, the acceptable **<Hz Dist Tol:>** must be chosen. The horizontal distance to the remote point and to the base point should coincide.

Properties of remote points

The properties stored with auto points are:

- Class: **MEAS**
 - Sub class: **TPS**
 - Source: **Survey (Rem Pt)**
 - Instrument source: **TPS**
-

Averaging of remote points

An average can be calculated for remote points if a measured point of class MEAS already exists with the same point ID. The average flag for the point is **AUTO**.

Remote point measurements are possible from the Survey application program when **<Use Remote Pt: Yes>** is set in the **SURVEY Configuration, Remote Pt** page and a valid distance measurement is available. Refer to "50.3 Configuring Remote Point".



Unless **<Display Mask: None>** in **SURVEY Configuration, Remote Pt** page, this screen contains an additional, user defined display mask.

Access

REMOT (F4) in **SURVEY Survey: Job Name** after one point is measured.

SURVEY Survey Remote Point, Remote Pt page

10:19		IR STD I		[Icons]	
SURVEY					
Survey Remote Point					
Remote Pt					
Point ID	:	0001			
ΔHt BaseRem	:	1.248 m			
Hz	:	55.0000 g			
V	:	37.0002 g			
Slope Dist	:	118.998 m			
Horiz Dist	:	65.333 m			
Easting	:	49.680 m			
					Q2 a ↑
STORE		BASE			

STORE (F1)

Stores the remote point. Stays in the **SURVEY Survey Remote Point** screen.

BASE (F4)

Returns to **SURVEY Survey: Job Name**. The distance measurement is cleared.

Description of fields

Field	Option	Description
<Point ID:>	User input	Displays the point ID for the remote point. The point ID in SURVEY Survey Remote Point is always identical to the point ID in SURVEY Survey: Job Name .
< Δ Ht BasRem:>	Output	The elevation difference between the base point and the remote point.
<Hz:>	Output	The current horizontal angle.
<V:>	Output	The current vertical angle.
<Slope Dist:>	Output	The current slope distance to the remote point calculated from the horizontal distance to the base point and the current vertical angle.
<Horiz Dist:>	Output	The horizontal distance measured to the base point.
<Easting:>	Output	Calculated Easting coordinate for the remote point.
<Northing:>	Output	Calculated Northing coordinate for the remote point.
<Height:>	Output	Calculated height for the remote point.

Next step

IF	THEN
if a remote point is to be stored	STORE (F1).

IF	THEN
a new base point is to be measured	BASE (F4) to return to SURVEY Survey: Job Name.

50.3

Configuring Remote Point

Access

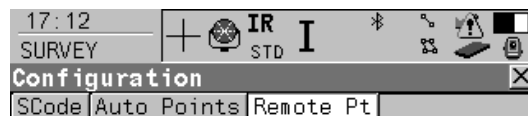
Select **Main Menu: Survey**. In **SURVEY Survey Begin** press **CONF (F2)** to access **SURVEY Configuration**. **PAGE (F6)** until the **Remote Pt** page is active.

OR

In **SURVEY Survey: Job Name** press **SHIFT CONF (F2)** to access **SURVEY Configuration**. **PAGE (F6)** until the **Remote Pt** page is active.

SURVEY Configuration, Remote Pt page

The settings on this screen activate the remote point function.



Use Remote Pt: **Yes** 

Hz Dist Tol : 0.2000 m
Display Mask : <None> 



CONT (F1)

To accept changes and return to the screen from where this screen was accessed.

DMASK (F3)

Accesses **CONFIGURE Define Display Mask n**. Available for <Display Mask:> being highlighted. Refer to "16.2 Display Settings".

Description of fields

Field	Option	Description
<Use Remote Pt:>	Yes	Activates the remote point function. REMOT (F4) is added to the function keys in SURVEY Survey: Job Name .
	No	Deactivates the remote point function, REMOT (F4) is not available in SURVEY Survey: Job Name .
<Hz Dist Tol:>	User input	The horizontal distance to the remote point is equal to the horizontal distance of the base point. The value for <Hz Dist Tol:> is the maximum tolerated length of the chord between the base point and the remote point.
<Display Mask:>	Choicelist	Displays <None> until a display mask is chosen. All display masks from Main Menu: Config...\Survey Settings...\Display Settings can be selected.

Next step

CONT (F1) to return to the screen **SURVEY Configuration** was accessed from.

Description

Application: Pick up points along a bridge. The points to be measured are not directly accessible with a reflector.

Working technique: Remote point surveying.

Settings: **<Use Remote Pt: Yes>** in the **SURVEY Configuration, Remote Pt** page.

Measuring remote points step-by-step

Step	Description
	The reflector height at the base point is always applied in the calculation of the base point elevation. For the calculation of the remote point elevation the reflector height is automatically set to zero.
1.	Aim at the reflector that is placed at the base point, which is directly underneath the remote point to be measured.
2.	SURVEY Survey: Job Name DIST (F2) to measure the horizontal distance to the base point.
3.	REMOT (F4).
4.	Aim at the remote point to be measured.
5.	SURVEY Survey Remote Point, Remote Pt page STORE (F1) to measure and store the angle measurements and calculated coordinates for the remote point.

Step	Description
6.	BASE (F4) to return to SURVEY Survey: Job Name and measure a new base point.

51.1

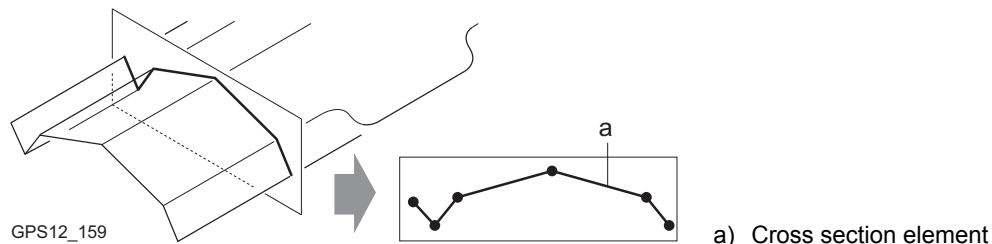
Overview

Description

The Survey Cross Section application program allows for the automatic changing of codes during a survey. This is particularly useful when surveying multiple cross sections. Examples could include surveys of railway lines, roads, small waterways, driveways and paths.

The codes for the elements in the cross section to be surveyed are all stored and pre-defined in a template. The codes are then automatically changed after each point observation.

Diagram



Template

Templates are used to pre-define the order of the codes for the survey.

A template pre-defines

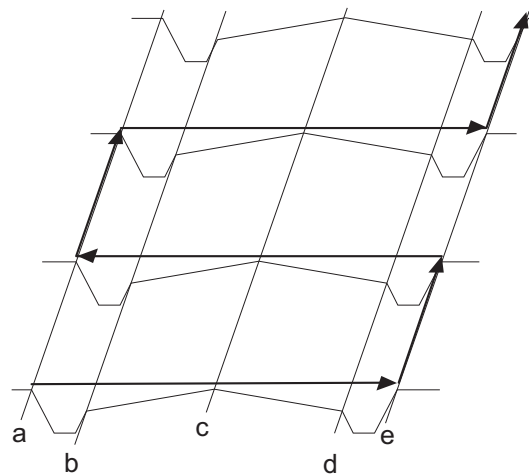
- the coding sequence of a cross section.
- the type of coding.

Cross section methods and directions

Templates can be applied

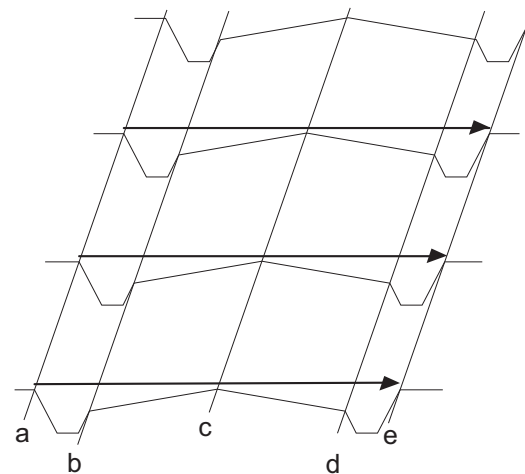
- to the ZigZag method or the Same Direction method.
- in either a forward direction or in a backward direction.

ZigZag



GPS12_168

Same Direction



GPS12_169

Coding of cross section elements

Codes can be attached to cross section elements. Refer to "8 Coding" for information on coding.

- Thematical coding: Available
- Free coding: Available
- Quick coding: Not available

Refer to "8.6 Code and Attribute Mismatch" for information on solving a code and/or attribute mismatch.

Properties of cross section points

The properties stored with cross section points are:

- Class: **MEAS**.
- Sub class: **TPS**.
- Source: **Cross Section**.
- Instrument source: **TPS**.

Averaging of cross section elements

The principles for averaging are identical to those of the Survey application program. Refer to "6.3.4 Mean Page" for information on averaging.

Exporting data

The points and lines are recorded as for all other application programs. The data can be exported as normal.

51.2

Accessing Survey Cross Section

Access

Select **Main Menu: Programs...\Survey Cross Section**.

OR

Press **PROG**. Highlight **Survey Cross Section. CONT (F1)**.

Refer to "36.2 Accessing the Programs Menu" for details on the **PROG** key.

OR

Press a hot key configured to access the screen **X-SECTION Begin**.

Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

X-SECTION Begin

12:17		IR STD		[Icons]	
X-SECTION					
Begin		[Close]			
Job	:	construction [Up/Down]			
Coord System	:	<None>			
Codelist	:	<None> [Up/Down]			
Config Set	:	cross sections [Up/Down]			
Reflector	:	Leica Circ Prism [Up/Down]			
Add. Constant	:	0.0 mm			
		Q2a [Up]			
CONT	CONF	SETUP			CSYS

CONT (F1)

To accept changes and access the subsequent screen. The chosen settings become active.

CONF (F2)

To configure Survey Cross Section application program. Accesses **X-SECTION Configuration**. Refer to "51.3 Configuring Survey Cross Section".

SETUP (F3)

To set up the station. Accesses **SETUP Station Setup**.

CSYS (F6)

To select a different coordinate system. Not available for **<Use Auto CrdSys: Yes>** configured in **CONFIGURE Additional Rover Settings**. Refer to "22.1.1 Configuration of Real-Time".

Description of fields

Field	Option	Description
<Job:>	Choicelist	The active job. All jobs from Main Menu: Manage...\Jobs can be selected.
<Coord System:>	Output	The coordinate system currently attached to the selected <Job:> . Cannot be edited for <Use Auto CrdSys: Yes> configured in CONFIGURE Additional Rover Settings . Refer to "22.1.1 Configuration of Real-Time".
<Codelist:>	Choicelist	No codes are stored in the selected job. All codelists from Main Menu: Manage...\Codelists can be selected.
	Output	Codes have already been stored in the selected <Job:> . If codes had been copied from a System RAM codelist, then the name of the codelist is displayed. If codes have not been copied from a System RAM codelist but typed in, then the name of the active job is displayed.

Field	Option	Description
<Config Set:>	Choicelist	The active configuration set. All configuration sets from Main Menu: Manage...\Configuration Sets can be selected.
<Reflector:>	Choicelist	The active reflector. All reflectors from Main Menu: Manage...\Reflectors can be selected.
<Add. Constant:>	Output	The additive constant stored with the chosen reflector.

Next step

IF the Survey Cross Section application program	THEN
is to be accessed	CONT (F1) accepts the changes and accesses Survey Cross Section application program. Refer to "51.4 Surveying Cross Sections".
is to be configured	CONF (F2) . Refer to "51.3 Configuring Survey Cross Section".

Access

Select **Main Menu: Programs...\Survey Cross Section**. In **X-SECTION Begin** press **CONF (F2)** to access **X-SECTION Configuration**.

OR

Press **PROG**. Highlight **Survey Cross Section**. **CONT (F1)**. In **X-SECTION Begin** press **CONF (F2)** to access **X-SECTION Configuration**.

OR

Press **SHIFT CONF (F2)** in **X-SECTION Survey: Job Name**.

**X-SECTION
Configuration,
General page**

12:24 X-SECTION IR STD I [Icons]

Configuration

General

Method : ZigZag

Direction : Forward

Show Attrib : 1

Show Dist : Yes

Display Mask : <None>

CONT [Buttons]

CONT (F1)

To accept changes and return to the screen from where this screen was accessed.

DMASK (F3)

To edit the display mask currently being displayed in this field. Accesses **CONFIGURE Define Display Mask n**. Available for **<Display Mask:>** being highlighted on **General** page. Refer to "16.2 Display Settings".

SHIFT ABOUT (F5)

To display information about the program name, the version number, the date of the version, the copyright and the article number.

Description of fields

Field	Option	Description
<Method:>		Method by which subsequent cross sections will be surveyed. Refer to "51.1 Overview" for a diagram.
	ZigZag	Each new cross section is started at the same end as where the previous cross section finished.
	Same Direction	Each new cross section is started at the same end as where the previous cross section started.
<Direction:>		The way of surveying the cross section. This influences in which order the elements of a template will be applied. Refer to "51.1 Overview" for a diagram.
	Forward	The cross sections will be surveyed in the same way as the elements are defined in the selected <Template:> in X-SECTION Survey: Job Name.
	Backward	The cross sections will be surveyed in the reverse way as the elements are defined in the selected <Template:> in X-SECTION Survey: Job Name.
<Show Attrib:>		Defines which attribute field is displayed in X-SECTION Survey: Job Name . Useful if the surveyor is stringing - can then see that the correct string attribute value is being used.
	Do Not Show	No attribute field is displayed in X-SECTION Survey: Job Name .

Field	Option	Description
	From 1 to 20	The attribute field which is displayed in X-SECTION Survey: Job Name .
<Show Dist:>	Yes or No	Activates an output field in X-SECTION Survey: Job Name . The horizontal grid distance from the current position to the point last surveyed for the same cross section will be displayed.
<Display Mask:>	Choicelist	The user defined display mask is shown in X-SECTION Survey: Job Name . All display masks of the active configuration set defined in CONFIGURE Display Settings can be selected.

Next step

CONT (F1) returns to the screen from where this screen was accessed.

51.4

Surveying Cross Sections

Description

The fields on this screen indicate which cross section element is to be surveyed next.

Access step-by-step

Step	Description
1.	Refer to "51.2 Accessing Survey Cross Section" to access X-SECTION Begin .
2.	In X-SECTION Begin select a job.
3.	Select an appropriate configuration set.
4.	Select a reflector.
5.	CONT (F1) to access X-SECTION Survey: Job Name, General page.

X-SECTION

Survey: Job Name, General page

The pages shown are those from a typical configuration set. An additional page is available when a user defined display mask is used.

12:31 X-SECTION IR STD

Survey: construction

General Map

Point ID : 0001

Reflector Ht : 1.250 m

Template : template

Element : 1/3

Code : kerb 1

Dist to Last : ----- m

Q2 a ↑

ALL DIST REC END SURVY PAGE

ALL (F1)

To measure and store distances and angles.

DIST (F2)

To measure and display distances. Available unless **<EDM Mode: Tracking>** and/or **<Log Auto Pts: Yes>**, after the tracking or logging is started.

REC (F3)

To record data.

If **<EDM Mode: Tracking>** and/or **<Log Auto Pts: Yes>**, records measured point and continues tracking.

START (F4) and END (F4)

To open and close the selected cross section template. While the template is open, the elements of the cross section can be surveyed.

SURVY (F5)

To manually occupy a point that is not part of the cross section. The point is not treated as an element of the cross section. The open template remains open.

Available if a template has been opened with **START (F4)**.

PAGE (F6)

To change to another page on this screen.

SHIFT CONF (F2)

To configure the Cross Section Survey application program. Refer to "51.3 Configuring Survey Cross Section".

SHIFT PREV (F3)

To select the previous element of the cross section template. The currently measured element will not be stored.

Available for **STOP (F4)** being displayed.

SHIFT NEXT (F4)

To select the next element of the cross section template. The currently measured element will not be stored.

Available for **STOP (F4)** being displayed.

SHIFT INDIV (F5) and SHIFT RUN (F5)

To change between entering an individual point ID different to the defined ID template and the running point ID according to the ID template. Refer to "16.1 ID Templates".

SHIFT QUIT (F6)

To exit Cross Section Survey application program. An open template will be closed.

Description of fields

Field	Option	Description
<Point ID:>	User input	The identifier for manually occupied points. The configured point ID template is used. The ID can be changed in the following ways:

Field	Option	Description
		- To start a new sequence of point ID's type over the point ID. - For an individual point ID independent of the ID template SHIFT INDIV (F5). SHIFT RUN (F5) changes back to the next ID from the configured ID template. Refer to "16.1 ID Templates".
<Reflector Ht:>	User input	The reflector height.
<Template:>	Choicelist	The active template for the cross section. The cross section template is closed. Opening the choicelist accesses X-SECTION Templates where a new template can be created and an existing template can be selected or deleted. Refer to "51.5 Cross Section Templates". ----- is displayed if no template is defined.
	Output	The cross section template is open.
<Element:>	Output	Displayed as x/y. x Number of next element on active template. The number increases/decreases as moving across the cross section depending on the selection for <Method:> in X-SECTION Configuration. y Total number of elements on active template.

Field	Option	Description
<Code:>	Output	The name of the code. Point codes will be stored with the measured point. Free codes will be stored, depending on the configuration, before or after the measured point.
<Stringline ID:>	Output	Available for <String Attrib:> being activated in CONFIGURE Coding & Linework, Coding page. Points that have the same code attached and belong to different cross sections are strung to one line.
<Dist to Last:>	Output	The horizontal grid distance from the current position to the last surveyed point. ----- is displayed for unavailable information.

Next step

IF	THEN
a cross section template is to be opened	select the desired <Template:>. START (F4).
an element of a cross section is to be surveyed	ALL (F1)
a cross section template is to be closed	select the desired <Template:>. END (F4).
data is to be viewed graphically	PAGE (F6). Refer to paragraph "X-SECTION Survey: Job Name, Map page".
the screen is to be quit	ESC.

X-SECTION

Survey: Job Name, Map page

The **Map** page provides an interactive display of the data. Refer to "35 MapView Interactive Display Feature" for information on the functionality and softkeys available. An element of a cross section template can also be surveyed from the **Map** page.

Next step

PAGE (F6) changes to the first page on this screen.

51.5

51.5.1

Description

Cross Section Templates

Accessing Cross Section Template Management

Cross section templates

- pre-define the sequence of codes for a cross section.
- consist of elements.

Elements can be defined such that the surveyed points of a cross section are

- stored with a point code.
- stored with a free code.

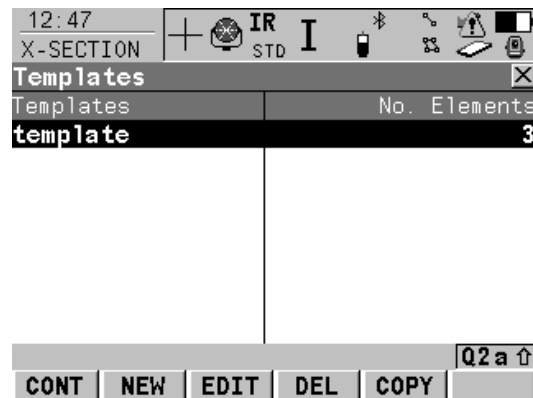
During the process of surveying a cross section, the code for the next element to be occupied is then selected and suggested automatically.

Access step-by-step

Step	Description
1.	Refer to "51.4 Surveying Cross Sections" to access X-SECTION Survey: Job Name .
2.	X-SECTION Survey: Job Name, General page Open the choicelist for <Template:> .

X-SECTION Templates

All cross section templates stored in the active job are listed in alphabetical order, including the number of elements in each cross section template.



CONT (F1)

To select the highlighted cross section template and to return to the screen from where this screen was accessed.

NEW (F2)

To create a cross section template. Refer to "51.5.2 Creating a New Cross Section Template".

EDIT (F3)

To edit the highlighted cross section template. Refer to "51.5.3 Editing a Cross Section Template".

DEL (F4)

To delete the highlighted cross section template.

COPY (F5)

To create a cross section template based on the one currently highlighted.

Next step

IF a cross section template	THEN
is to be selected	highlight the desired cross section template. CONT (F1) closes the screen and returns to the screen from where X-SECTION Templates was accessed.
is to be created	NEW (F2) . Refer to "51.5.2 Creating a New Cross Section Template".
is to be edited	highlight the cross section template and EDIT (F3) . Refer to "51.5.3 Editing a Cross Section Template".
is to be created based on an existing template	COPY (F5) . Refer to "51.5.2 Creating a New Cross Section Template".

Access

Step	Description
1.	Open the choicelist for <Template:> in X-SECTION Survey: Job Name, General page.
2.	X-SECTION Templates Is a cross section template to be created from scratch? • If yes, NEW (F2) to access X-SECTION New Template. • If no, COPY (F5) to access X-SECTION New Template.

**X-SECTION
New Template,
General page**

Type in a name for the new cross section template.

Next step

PAGE (F6) changes to the **Elements** page. Refer to paragraph "X-SECTION New Template, Elements page".

**X-SECTION
New Template,
Elements page**

IF this screen was accessed with	THEN
NEW (F2)	all columns are empty.
COPY (F5)	the same elements are listed as were being used for the template highlighted when COPY (F5) was pressed.

12:52 X-SECTION IR STD I

New Template

General Elements

No.	Code	Code Type
1	kerb l	Point
2	centre	Point
3	kerb r	Point

Q2 a ↑

STORE ADD EDIT DEL ->ADD PAGE

STORE (F1)

To store the cross section template and to return to the screen from where this screen was accessed.

ADD (F2)

To add one or several element(s) to the cross section template. Refer to paragraph "X-SECTION Add Element".

EDIT (F3)

To edit the highlighted element. Refer to paragraph "X-SECTION Add Element"

DEL (F4)

To delete the highlighted element from the cross section template.

->ADD (F5)

To insert one element before the currently highlighted element of the cross section template. Refer to paragraph "X-SECTION Add Element".

PAGE (F6)

To change to another page on this screen.

Description of columns

Field	Description
No.	The number of the element.

Field	Description
Code	The code assigned to the element. ----- is displayed if no code is assigned to the element.
Code Type	The type of the code assigned to the element.

Next step

IF	THEN
the creation of a template is finished	STORE (F1).
an element is to be added	ADD (F2) or ->ADD (F5). Refer to paragraph "X-SECTION Add Element".
an element is to be edited	EDIT (F3). Refer to paragraph "X-SECTION Add Element".

X-SECTION Add Element

The functionality of the screens **X-SECTION Insert Element** and **X-SECTION Edit Element in Template** is very similar. Differences to **X-SECTION Add Element** are outlined below.

12:54
X-SECTION
Add Element

Element No. : 4

Code Type : Thematic Codes

Code : cnr

Code Desc : building corner

CONT NEXT Q2 a ↑

CONT (F1)

To add the element at the end of the cross section template or to store the changes.

To return to the screen from where this screen was accessed.

NEXT (F5)

Available in **X-SECTION Add Element**.

To add the element at the end of the cross section template. To stay in this screen and create the next element.

PREV (F5)

Available in **X-SECTION Edit Element in Template**.

To store the changes. To stay in this screen and edit the previous element.

NEXT (F6)

Available in **X-SECTION Edit Element in Template**.

To store the changes. To stay in this screen and add the next element.

Description of columns

Field	Option	Description
<Element No.:>	Output	For X-SECTION Add Element and X-SECTION Insert Element: The number of the element to be added. For X-SECTION Edit Element in Template: Displayed as x/y. x Number of the element to be edited. y Total number of elements on the active template.
<Code Type:>	Free Code Thematic Codes	The type of code to be used with the element. To store a code independent of the element as time related information. To store a code together with the element.
<Rec Free Code:>	After Point or Before Point	Available for <Code Type: Free Code>. Determines if a free code is stored before or after the point.
<Code (free):>	Choicelist	The code which will be stored before or after the point/line. Available for <Code Type: Free Code>.
<Code:>	Choicelist	The code which will be stored with the next point/line. Available for <Code Type: Thematic Codes>.

Field	Option	Description
Attribute name	Output	The attribute and the attribute value which will be stored with the point/line. Available unless <Show Attrib: Do Not Show> in X-SECTION Configuration .

Next step

CONT (F1) adds the element or stores the changes and returns to **X-SECTION New Template, Elements** page.

51.5.3

Editing a Cross Section Template

Access

Refer to "51.2 Accessing Survey Cross Section" to access **X-SECTION Templates**.

Edit cross section template step-by-step

Step	Description
1.	In X-SECTION Templates highlight the cross section template to be edited.
2.	EDIT (F3) to access X-SECTION Edit Template, General page.
3.	X-SECTION Edit Template All the following steps are identical with the creation of a new cross section template. Refer to "51.5.2 Creating a New Cross Section Template".

51.6

Working Example

Description

Application:

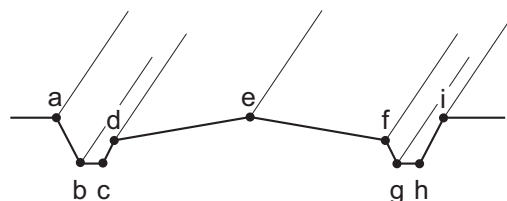
Surveying a road, taking the same cross sections at particular intervals.

Goal:

The points of each cross section are to be picked up. Codes are assigned automatically. The codes are shown in the diagram.

Each new cross section is started at the same end as where the previous cross section finished.

Diagram



- a) Top of bank 1, TB1
- b) Bottom of bank 1, BB1
- c) Bottom of bank 2, BB2
- d) Edge of bitumen 1, EB1
- e) Center line, CL
- f) Edge of bitumen 2, EB2
- g) Bottom of bank 3, BB3
- h) Bottom of bank 4, BB4
- i) Top of bank 2, TB2

Requirements

- A codelist containing the codes TB1, BB1, BB2, EB1, CL, EB2, BB3, BB4 and TB2 has been created in LGO and loaded onto the receiver.

Field procedure step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Start the Survey Cross Section application program.	51.2
2.	X-SECTION Begin <Codelist:> The codelist containing the point codes TB1, BB1, BB2, EB1, CL, EB2, BB3, BB4 and TB2 must be displayed. Check the settings.	51.2 7.3
3.	CONF (F2)	
4.	X-SECTION Configuration <Method: ZigZag> <Direction: Forward> <Show Dist: Yes>	51.3
5.	CONT (F1)	
6.	Have cross section templates been defined yet? • If yes, continue with step 18. • If no, continue with step 7.	
7.	OK (F4) to confirm the information message and to access X-SECTION New Template .	
8.	X-SECTION New Template, General page <Template Name:> Type in a name for the new cross section template.	51.5.2
9.	PAGE (F6) to access X-SECTION New Template, Elements page	

Step	Description	Refer to chapter
10.	ADD (F2) to access X-SECTION Add Element .	
11.	X-SECTION Add Element <Code Type: Thematic Codes> <Code: TB1>	51.5.2
12.	NEXT (F5) adds the element to the cross section template and stays in this screen to create the next element.	
13.	Repeat steps 11. and 12. for the next seven elements.	
14.	Repeat step 11. for the last element.	
15.	CONT (F1) to add the element to the cross section template and to return to X-SECTION New Template .	
16.	STORE (F1) to store the new cross section template and to return to X-SECTION Templates .	
17.	X-SECTION Templates The newly created template is highlighted.	
18.	CONT (F1) to access X-SECTION Survey: Job Name .	
19.	X-SECTION Survey: Job Name <Element: 1/5> <Code: TB1>	51.4
	Open the choicelist for < Templates: > to create a new cross section template or to select or delete an existing template.	

Step	Description	Refer to chapter
20.	START (F4) to open the template.	
21.	Go to the beginning of the first cross section.	
22.	ALL (F1) to measure and store the element.	
23.	Repeat steps 22. for the remaining four elements.	
24.	Go to the position for the next cross section. <Dist To Last:> displays the interval.	
	Since working in ZigZag mode, the next cross section starts "at the end", this means with TB2.	
25.	Continue until all cross sections are surveyed.	
26.	END (F4) to close the template.	
27.	SHIFT QUIT (F6) to quit the screen.	

52.1

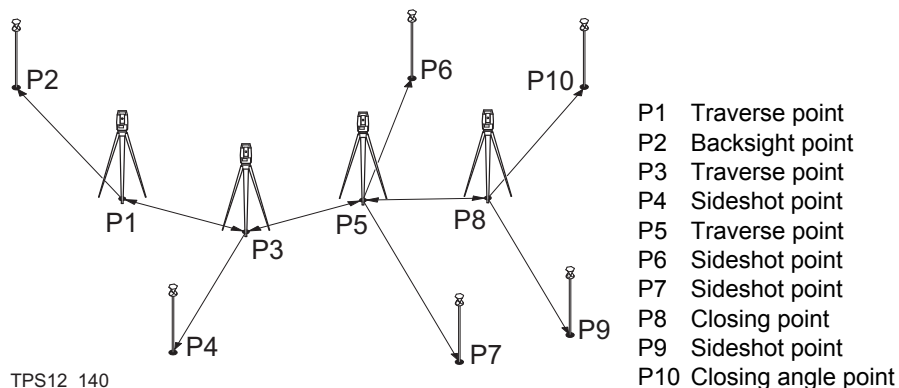
Overview

Description

The Traverse application is to fulfil one of the most common operations done by surveyors to establish a control point base system to be used as a skeleton for other survey operations for example topographic survey, point stakeout, line stakeout or road stakeout.

Types of traverse

- External reference & closed loop
- Internal reference & position check
- Open end & position check
- Closed end traverse



Properties of Traverse points

The properties stored with the Traverse points are:

- Class: **MEAS**
 - Sub class: **TPS**
 - Source: **Traverse**
 - Instrument: **TPS**
-

Averaging of Traverse points

An average point of class **MEAS** is calculated by the Traverse application program.

52.2

Accessing Traverse

Access

Select **Main Menu: Programs...\Traverse**.

OR

Press **PROG**. Highlight Traverse. **CONT (F1)**.

Refer to "36.2 Accessing the Programs Menu" for details on the **PROG** key.

OR

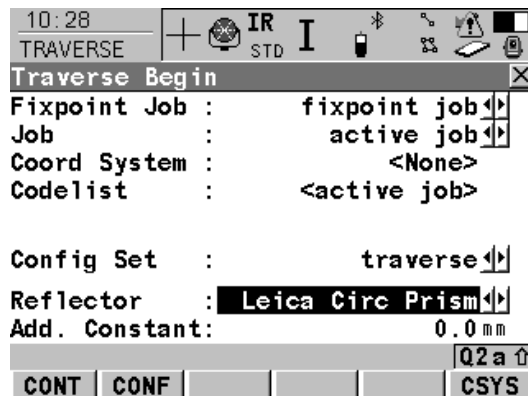
Press a hot key configured to access the screen **TRAVERSE Traverse Begin**.

Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

TRAVERSE Traverse Begin



10:28

TRAVERSE

Traverse Begin

Fixpoint Job : fixpoint job

Job : active job

Coord System : <None>

Codelist : <active job>

Config Set : traverse

Reflector : Leica Circ Prism

Add. Constant: 0.0 mm

Q2a ↑

CONT CONF CSYS

CONT (F1)

To accept changes and to access the subsequent screen. The chosen settings become active.

CONF (F2)

To configure the Traverse application program. Refer to "52.3 Configuring Traverse".

CSYS (F6)

To select a different coordinate system.

Description of fields

Field	Option	Description
<Fixpoint Job:>	Choicelist	The job containing points for the control points, to begin, to check and to end the traverse. Points are searched in <Fixpoint Job:>, if not found in <Fixpoint Job:>, the active job will be searched.
<Job:>	Choicelist	The active job. All jobs from Main Menu: Manage...\Jobs can be selected.
<Coord System:>	Output	The coordinate system currently attached to the selected <Job:>.
<Codelist:>	Choicelist	No codes are stored in the selected job. All codelists from Main Menu: Manage...\Codelists can be selected.
	Output	Codes have already been stored in the selected <Job:>. If codes had been copied from a System RAM codelist, then the name of the codelist is displayed. If codes have not been copied from a System RAM codelist but typed in, then the name of the active job is displayed.
<Config Set:>	Choicelist	The active configuration set. All configuration sets from Main Menu: Manage...\Configuration Sets can be selected.
<Reflector:>	Choicelist	The active reflector. All reflectors from Main Menu: Manage...\Reflectors can be selected.

Field	Option	Description
<Add. Constant:>	Output	The additive constant stored with the chosen reflector.

Next step

CONT (F1) accepts changes and accesses Traverse application program.

Access

Select **Main Menu: Programs...\Traverse**. In **TRAVERSE Traverse Begin** press **CONF (F2)** to access **TRAVERSE Configuration**.

OR

Press **PROG**. Highlight **Traverse**. **CONT (F1)**. In **TRAVERSE Traverse Begin** press **CONF (F2)** to access **TRAVERSE Configuration**.

OR

Press **SHIFT CONF (F2)** in **TRAVERSE Traverse Information**.

TRAVERSE Configuration, Parameters page

This screen consists of the **Parameters** page, the **Tolerances** page and the **Logfile** page. The explanations for the softkeys given below are valid for all pages, unless otherwise stated.

17:27 TRAVERSE Configuration

Parameters Tolerances Logfile

Meas Method : B'F'...'F''B''

Foresight : Single

Auto Survey : On

Display Mask : Code

User Guidance: Yes

CONT F JOB PAGE

CONT (F1)

To accept changes and to return to the screen from where this screen was accessed.

F JOB (F3)

To update the **<Fixpoint Job:>** previously selected in **TRAVERSE Traverse Begin** during runtime. To access a separate set of points to check or close on. Available on the **Parameters** page.

DMASK (F3)

To edit the display mask currently being displayed in this field. Accesses **CONFIGURE Define Display Mask n**. Available for **<Display Mask:>** being highlighted on **Parameters** page.

PAGE (F6)

To change to another page on this screen.

Description of fields

Field	Option	Description
<MeasMethod:>	B'F'...F''B''	All points are measured in face I, then measured in face II in reverse sequential order.
	B'F'...B''F''	All points are measured in face I, then measured in face II.
	B'B''F'F''	Backsight point is measured in face I immediately followed by face II. Other points are measured in face I, face II order.
	B'B''F''F'	Backsight point is measured in face I immediately followed by face II. Other points are measured in alternating face order.
	B'F'...	All points are measured in face I only.
<Foresight:>	Single or Multiple	Option to define if only one foresight point or multiple points are used during the sets.

Field	Option	Description
<Auto Survey:>	On or Off	For instruments with ATR and <Auto Survey: On> ATR search and ATR measurements are done to specified targets and subsequent sets.
<Display Mask:>	Choicelist	The user defined display mask to be shown in TRAVERSE XX, Set:X/X . All display masks of the active configuration set defined in CONFIGURE Display Settings can be selected.
<User Guidance:>	Yes or No	To activate/deactivate helpful message dialogs to assist in using the Traverse program.

Next step

PAGE (F6) changes to **Tolerances** page. Refer to paragraph "TRAVERSE Configuration, Tolerances page".

TRAVERSE Configuration, Tolerances page

Description of fields

Field	Option	Description
<Use Tolerance:>	Yes or No	The entered horizontal, vertical and distance tolerances are checked during the measurements to verify accurate pointing and measurements.
<Hz Tolerance:>	User input	Tolerance for horizontal directions.
<V Tolerance:>	User input	Tolerance for vertical directions.
<Dist Tol:>	User input	Tolerance for distance.
<BS Ht Tol:>	User input	Tolerance for the backsight height.

TRAVERSE Configuration, Logfile page

Next step

PAGE (F6) changes to **Logfile** page. Refer to paragraph "TRAVERSE Configuration, Logfile page".

Description of fields

Field	Option	Description
<Write Logfile:>	Yes or No	To generate a logfile when the application program is exited. A logfile is a file to which data from an application program is written to. It is generated using the selected <Format File:> .
<File Name:>	Choicelist	Available for <Write Logfile: Yes> . The name of the file to which the data should be written. A logfile is stored in the \DATA directory of the active memory device. The data is always appended to the file. Opening the choicelist accesses XX Logfiles where a name for a new logfile can be created and an existing logfile can be selected or deleted.
<Format File:>	Choicelist	Available for <Write Logfile: Yes> . A format file defines which and how data is written to a logfile. Format files are created using LGO. A format file must first be transferred from the CompactFlash card to the System RAM before it can be selected. Refer to "24 Tools...\Transfer Objects..." for information on how to transfer a format file.

Field	Option	Description
		Opening the choicelist accesses XX Format Files where an existing format file can be selected or deleted.

Next step

PAGE (F6) changes to the first page on this screen.

52.4

Traverse Information and Traverse Management

Description

The **TRAVERSE Traverse Information** screen provides an easy way to review and control the traverses inside a job. In **TRAVERSE Traverse Management**, it is possible to manage the different traverses which may be created in a given job.

Access

In **TRAVERSE Traverse Begin** press **CONT (F1)**.

TRAVERSE Traverse Information

17:21
TRAVERSE

IR STD

Traverse Information

Traverse ID : 001

Description : new traverse

Operator : Abc

Date : 06.03.06

Time : 17:17:53

Status : Open

Q2 a

CONT DATA RESLT

CONT (F1)

To begin traverse measurement.

DATA (F5)

To display traverse data. Accesses **TRAVERSE Traverse Data**. Refer to "52.5 Traverse Data". Not available for adjusted traverses.

RESLT (F6)

To view results of the traverse. Accesses **TRAVERSE Traverse Results**. Refer to "52.7 Traverse Results". Not available for open traverses.

Description of fields

Field	Option	Description
<Traverse ID:>	Choicelist	The ID of the traverse. ENTER to access TRAVERSE Traverse Management .
<Status:>	Open	The traverse is not closed in position.

Field	Option	Description
	Position Closed	The traverse has been closed in position on a control point.
	Pos & Ang Closed	The traverse has been closed both in position and angularly.
	Adjusted	The traverse data is the result from an adjustment.

Next step

ENTER when the **Traverse ID** is highlighted. Accesses **TRAVERSE Traverse Management**.

TRAVERSE Traverse Management

All traverses of the active job are displayed.

The screenshot displays the TRAVERSE Traverse Management interface. At the top, a status bar shows the time 17:29 and the word TRAVERSE, followed by several icons including a crosshair, a globe, and a battery level indicator. Below this is a title bar labeled 'Traverse Management'. The main display area is divided into two sections: 'Traverse ID' on the left, which has '001' highlighted, and 'Date' on the right, which shows '06.03.06'. A vertical line separates these two sections. At the bottom of the screen, there is a row of buttons: 'CONT', 'NEW', 'EDIT', and 'DATA'. To the right of these buttons is a button labeled 'Q2 a ↑'.

CONT (F1)

To confirm selection of highlighted traverse and return to **TRAVERSE Traverse Information**.

NEW (F2)

To create a new traverse.

EDIT (F3)

To edit the traverse ID and description of the highlighted traverse.

DATA (F5)

To display traverse data. Refer to paragraph "52.5 Traverse Data" for more information.

Next step

CONT (F1) to return to **TRAVERSE Traverse Information**.

Traverse Data

The **TRAVERSE Traverse Data** screen allows the review and editing of traverse stations inside of a traverse and allows the user to access **TRAVERSE Point Results** for editing.

DATA (F5) in TRAVERSE Traverse Information.

OR

DATA (F5) in TRAVERSE Traverse Management.

17:12
TRAVERSE

IR
STD

Traverse Data

Station ID	Backsight ID	No. Sets	No. FS
setup2	chair	1	1
tps15	setup2	1	1
tps19	tps15	1	1
tps020	tps19	1	1

CONT EDIT DEL PAGE

CONT (F1)

To return to where this screen was accessed from.

EDIT (F3)

To access the **TRAVERSE Traverse Point Results** screen. Refer to "52.6 Traverse Point Results".

DEL (F4)

To permanently delete the LAST traverse station.

PAGE (F6)

To change to another page on this screen.

Description of columns

Column	Description
Station ID	Point ID of the station ID.

Column	Description
Backsight ID	The backsight point measured from the current station ID.
No. Sets	Number of measured sets.
No. FS	Number of measured foresight points.

Next step

CONT (F1) returns to the previous screen.

52.6

Traverse Point Results

Description

Point observation results are displayed on this screen.

Access

Is displayed automatically after measuring all sets from the current station.

OR

DATA (F5) in **TRAVERSE** Traverse Information. **EDIT (F3)**.

TRAVERSE Point Results, Foresight page and Backsight page

This screen consists of the **Foresight** page, **Backsight** page, the **Stat Info** page and the **Map** page. The softkeys are explained except those for the **Map** page.

09:09		+ IR STD I		Bluetooth		Battery	
TRAVERSE							
Point Results							
Foresight		Backsight		Stn		Info	
Point ID		:		tps15		↔	
Reflector Ht		:		1.500		m	
Point Type		:		Foresight			
Used Sets		:		1/1			
Hz Spread		:		0°00'02"			
V Spread		:		0°00'02"			
Dist Spread		:		0.000		m	
a ↑							
CONT		+SETS		SETS		CLOSE MORE PAGE	

CONT (F1)

While measuring a traverse: Displays a confirmation window with traverse measurement options. Otherwise: To return to **TRAVERSE Traverse Data**.

+SETS (F2)

To add more sets while still at the setup. It might be necessary on particular legs of a traverse that more than the designated number of sets is required. Possibly some of the sets from the first run exceeded the tolerance limit and needed to be disabled.

SETS (F3)

To include or exclude measured sets in the calculation of a foresight point. In the **TRAVERSE Sets, Point** screen **USE (F3)** to include or exclude a set and **SPRD (F4)/RESID (F4)** to review the affect of using the set.

CLOSE (F4)

To set a point as a closing point if not selected before measurement. Or to revert a closing point to a normal foresight.

MORE (F5)

To display additional information.

PAGE (F6)

To change to another page on this screen.

SHIFT CONF (F2)

To configure the Traverse application program. Refer to "52.3 Configuring Traverse".

SHIFT EDIT (F3)

To edit point code and annotations.

SHIFT CHECK (F4)

To check inverse distances and closure between the selected point in the **TRAVERSE Traverse Results, Foresight** page and a point from the fixpoint job. Available on the **Foresight** page. Fields and keys are identical with those in **TRAVERSE Traverse Results**. Refer to "52.7 Traverse Results".

SHIFT CTRL (F5)

Available on the **Backsight** page of the initial station. Refer to "52.8.4 Creating a Control Point from Backsight by Azimuth".

SHIFT QUIT (F6)

To return to **TPS1200+ Main Menu**.

Description of fields

Field	Option	Description
<Point ID:>	Choicelist	Selected point ID.
<Reflector Height:>	User input	The reflector height of the target point. Editable.
<Point Type:>	Foresight, Close or Close Angle	The current point type.
<Used Sets:>	Output	The number of sets out of all measured sets used for the calculation. Available for the Foresight page.
<No. of Sets:>	Output	The number of sets the point was measured in. Available for the Backsight page.
<Hz Arc Avg:>	Output	Average horizontal angle.
<V Avg:>	Output	Average vertical angle.
<Dist Avg:>	Output	Average distance.
<Hz Arc StdDev:>	Output	Standard deviation of horizontal angle.
<V StdDev:>	Output	Standard deviation of vertical angle.

Field	Option	Description
<Dist StdDev:>	Output	Standard deviation of distance.
<Hz Spread:>	Output	Spread of horizontal angle.
<V Spread:>	Output	Spread of vertical angle.
<Dist Spread:>	Output	Spread of distance.

Next step

PAGE (F6) changes to the **Stat Info** page. Refer to "TRAVERSE Point Results, Stat Info page".

TRAVERSE Point Results, Stat Info page

Description of fields

Field	Option	Description
<Station ID:>	Output	The station ID of the instrument station.
<Instrument Ht:>	User input	Current instrument height. Editable.
<Easting:>	Output	Easting value of the station position.
<Northing:>	Output	Northing value of the station position.
<Height:>	Output	Orthometric height of the station position.
<Scale:>	Output	Scale factor used in the calculation.
<Temperature:>	Output	Temperature set on the instrument.
<Pressure:>	Output	Atmospheric ppm set on the instrument.

TRAVERSE Point Results, Map page

Next step

PAGE (F6) changes to the **Stat Info** page. Refer to "TRAVERSE Point Results, Map page".

The Map page provides an interactive display of the data. Refer to "35 MapView Interactive Display Feature" for information on the functionality and softkeys available.

Next step

IF accessed	THEN
after sets measurement	CONT (F1) opens a confirmation window with options that are dependant on traverse status: • For an open traverse: Move to next station, return to TRAVERSE Point Results, to survey a sideshot, to view traverse data or to quit the traverse application. • For a closed traverse: Move to close angle, return to TRAVERSE Point Results, to survey a sideshot or to quit the traverse application.
from TRAVERSE Traverse Data	CONT (F1) returns to TRAVERSE Traverse Data .

52.7

Traverse Results

Description

Traverse closure results are displayed on this screen.

Access

Is displayed automatically after the traverse closing point is measured or selected.

OR

RESLT (F6) in **TRAVERSE Traverse Information** when a traverse is closed.

TRAVERSE Traverse Results, Position page

18:08 TRAVERSE IR STD I Bluetooth

Traverse Results

Position Angle Map

Start Stn : setup2

Close Point : setup3

Length of Err: 0.0124 m

Direc of Err : 98.3659 g

Δ Height : -0.0023 m

Total Dist : 170.7260 m

2D Accuracy : 1/13782

1D Accuracy : 1/74695

Q2 a ↑

CONT N & E ADJUST PAGE

CONT (F1)

To move to close angle, to return to **TRAVERSE Traverse Results**, to survey a sideshot, to adjust the traverse or to quit the Traverse application.

N & E (F3) or L & D (F3)

To view the misclosure error in north/east or length/direction.

ADJUST (F4)

To adjust the traverse.

DATA (F5)

To display traverse data.

PAGE (F6)

To change to another page on this screen.

Description of fields

Field	Option	Description
<Start Stn:>	Output	The point ID of the traverse start point.
<Close Point:>	Output	The point ID of the traverse closing point.

Field	Option	Description
<Length of Err:>	Output	The length of the misclosure error.
<Direc. of Err:>	Output	The direction of the misclosure error.
< Δ North:>	Output	Error in north.
< Δ East:>	Output	Error in east.
< Δ Height:>	Output	Error in height.
<Total Dist:>	Output	Total length of the traverse.
<2D Accuracy:>	Output	Position ratio of misclosure.
<1D Accuracy:>	Output	Height ratio of misclosure.

Next step

PAGE (F6) changes to the **Angle** page. Refer to paragraph "TRAVERSE Traverse Results, Angle page".

TRAVERSE Traverse Results, Angle page

Description of fields

Field	Option	Description
<Foresight ID:>	Output	Point ID of the closing angle point. Displays ----- if no values are available.
<Known Azimuth:>	Output	Defined azimuth of closing line. Displays ----- if no values are available.
<Azimuth Avg:>	Output	Mean value of the measured azimuth closing line. Displays ----- if no values are available.

Field	Option	Description
<Angular Misc:>	Output	Angular misclosure of traverse. Displays ----- if no values are available.

Next step

CONT (F1) to move to close angle, to return to **TRAVERSE Traverse Results**, to survey a sideshot, to adjust the traverse or to quit the Traverse application.

52.8

52.8.1

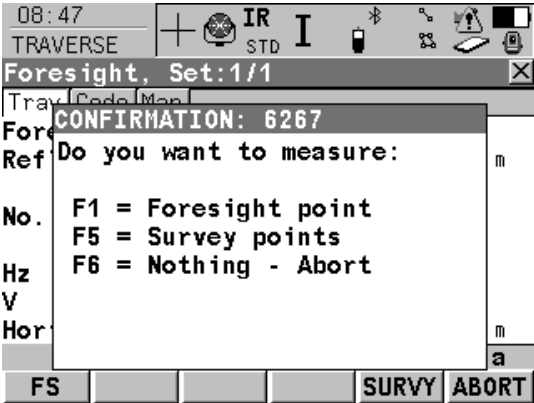
Start traverse step-by-step

Traverse Methods

Starting Traverse

The quickest setup method is described.

Step	Description	Refer to chapter
1.	Start the Traverse application program.	52.2
2.	TRAVERSE Traverse Begin Check the settings.	
3.	CONT (F1) to access TRAVERSE Traverse Information .	
4.	TRAVERSE Traverse Information <Traverse ID:> The name of the new traverse.	
	ENTER to select an existing traverse or to create a new one.	52.4
5.	CONT (F1) to access TRAVERSE Traverse Configuration . Check the settings.	52.3
6.	CONT (F1) to access SETUP Station Setup . Any standard setup method can be used.	46.6
7.	SET (F1) to set the station and orientation.	

Step	Description	Refer to chapter
8.	If User Guidance is active, a confirmation window is displayed.  FS (F1)	
9.	TRAVERSE Foresight, Set:X/X <Foresight ID:> The name of the foresight point. <Reflector Ht:> The reflector height of the foresight point. <No. of Sets:> The number of sets to be measured.	
10.	ALL (F1) to measure and record. The measurement settings for the first measurement to each point are used for all further sets.	
11.	TRAVERSE Point Results	52.6

Step	Description	Refer to chapter
	CONT (F1) to move to the next station, to return to the TRAVERSE Point Results screen (and set a point as a closing point), to survey a sideshot, to view traverse data or to end the traverse.	
12.	MOVE (F1) to move to the next station.	
	After pressing MOVE (F1) Traverse is exited. To continue with the Traverse from the next Station refer to "Measure traverse step-by-step".	52.8.2

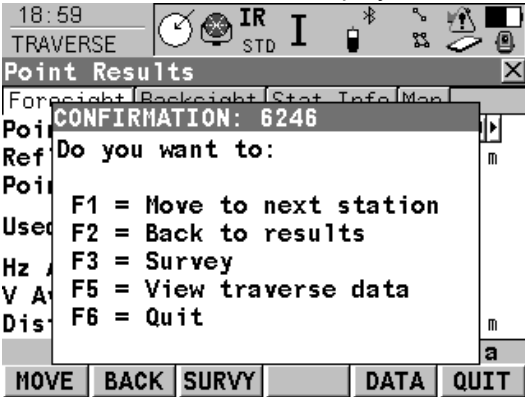
52.8.2

Continuing an Existing Traverse

Measure traverse step-by-step

Step	Description	Refer to chapter
1.	Start the Traverse application program.	52.2
2.	TRAVERSE Traverse Begin Check the settings.	
3.	CONT (F1) to access TRAVERSE Traverse Information .	
4.	TRAVERSE Traverse Information <Traverse ID:> The name of the traverse. ENTER to select a different existing traverse.	52.4
	DATA (F5) to view data of the active traverse.	52.6
	SHIFT CONF (F2) to change the configuration settings.	52.3
5.	CONT (F1) to access TRAVERSE Backsight, Set:X/X . Enter <Instrument Ht:>. <Hz:>, <V:> and <Horiz Dist:> The measured values are displayed. <Calc Azimuth:> The calculated azimuth from the current station point to the backsight point. <Δ Horiz Dist:> and <Δ Height:> The difference between the computed and measured values.	
	MORE (F5) to change between the displayed values.	
6.	ALL (F1) to measure and record the backsight point.	

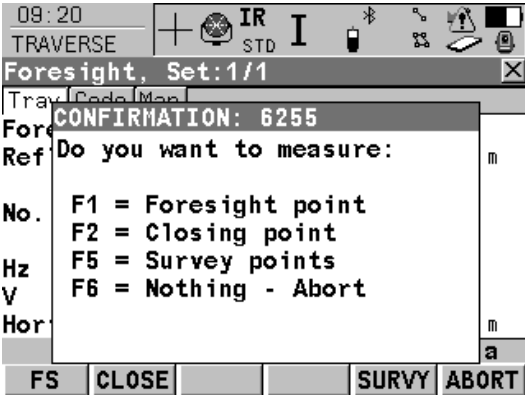
Step	Description	Refer to chapter
7.	FS (F1) to measure a foresight point.	
8.	TRAVERSE Foresight, Set:X/X <Foresight ID:> The name of the foresight point. <Reflector Ht:> The reflector height of the foresight point. <No. of Sets:> The number of sets to be measured.	
	SURVY (F5) to measure sideshot points.	
9.	ALL (F1) to measure and record the foresight points. The measurement settings for the first measurement to each point are used for all further sets.	
10.	TRAVERSE Point Results CONT (F1)	52.6

Step	Description	Refer to chapter
11.	A Confirmation window is displayed.  MOVE (F1) to move to the next station.	
12.	Repeat steps 1. to 11. until traverse is ready to be closed.	

52.8.3

Closing Traverse

Close traverse step-by-step

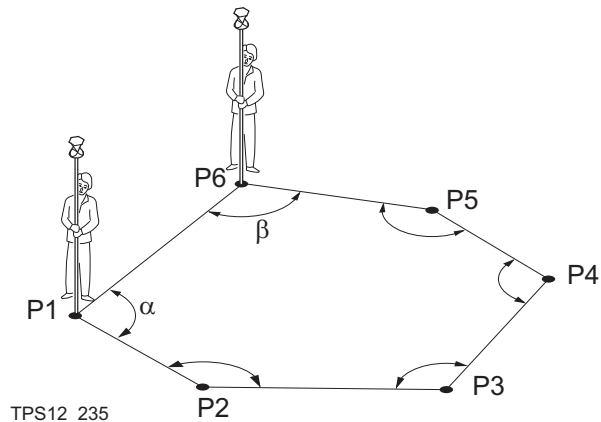
Step	Description	Refer to chapter
1.	Refer to paragraph "Measure traverse step-by-step" to measure a traverse. Measure a backsight on a new station.	52.8.2
2.	The Confirmation window in TRAVERSE Foresight, Set:X/X is displayed.  CLOSE (F2)	
3.	OK (F4)	
4.	TRAVERSE Data Highlight the closing point.	
5.	CONT (F1)	

Step	Description	Refer to chapter
6.	TRAVERSE Foresight, Set:X/X ALL (F1) to measure and record the closing point.	
7.	TRAVERSE Point Results CONT (F1) to view traverse results.	52.6
8.	TRAVERSE Traverse Results CONT (F1)	52.7
9.	C ANG (F1) to close the traverse with angular closure.	
	Optionally the traverse can be adjusted.	52.9
10.	Move to the closure point and start Traverse application program.	52.2
11.	TRAVERSE Traverse Begin Check the settings.	
12.	CONT (F1) to access TRAVERSE Traverse Information .	
13.	TRAVERSE Traverse Information The existing traverse is shown	
14.	CONT (F1) to access TRAVERSE Close Angle .	
15.	TRAVERSE Close Angle <FS Type:> To measure onto a known point or a known azimuth. <Foresight ID:> The point ID of the foresight point. <Known Azimuth:> Available for <FS Type: Known Azimuth> . Known azimuth for foresight point.	

Step	Description	Refer to chapter
16.	CONT (F1) to access TRAVERSE Backsight, Set:X/X .	
17.	ALL (F1) to measure all sets.	
18.	TRAVERSE Point Results CONT (F1) to view traverse results.	52.6
19.	TRAVERSE Traverse Results CONT (F1) to exit viewing traverse results.	52.7
20.	QUIT (F6) to quit the Traverse application.	
	Optionally the traverse can be adjusted.	52.9

Close traverse on internal reference

This option is used for determining the closure of a closed loop traverse, consisting of a single control point with an arbitrary backsight azimuth. This allows completion of a traverse without having to reoccupy the initial station setup to measure a closing angle. The positional closure is calculated by comparing the control position of the initial station setup to the measured position of the final foresight. The angular closure is calculated by comparing the set azimuth of the initial backsight to the azimuth of the final measured leg.



The first station setup is on P1, and an assumed direction to backsight P6. Upon closing this traverse, with the last setup over P6, the closing point is P1. In this case the only point that is considered as a control is P1.

Step	Description
1.	When on the last setup point (P6 in the above example), measure a backsight.
2.	CLOSE (F2)
3.	TRAVERSE Data Select the closing point from the available list (P1 in the above example). CONT (F1)
4.	Measure all of the sets to the closing point as per a standard traverse.
5.	TRAVERSE Point Results CONT (F1) when the review of the results is completed.
6.	YES (F6) to confirm the automatic calculation.

Step	Description
7.	TRAVERSE Traverse Results The traverse closure is shown with positional and angular values.

52.8.4

Creating a Control Point from Backsight by Azimuth

Description

If a traverse is to be established on existing control points, two control points must be defined to start the traverse. If the traverse absolute position is arbitrary, it can be convenient to define the control in the field with arbitrary values. This functionality is an option to turn the averaged position value into a control point when a backsight by azimuth is collected.

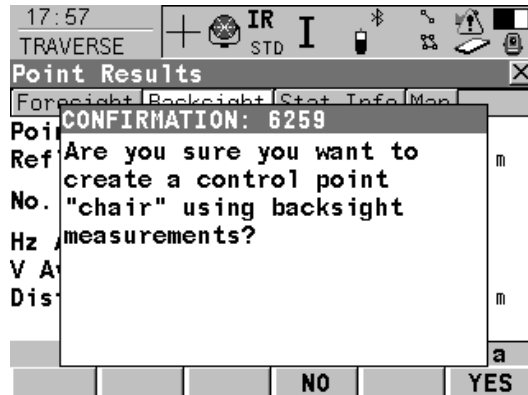
Access

At the beginning of a traverse when all the measurements are completed to the BS: On the **TRAVERSE Point Results** screen select **PAGE (F6)** to reach the **Backsight** page. **SHIFT CTRL (F4)**.

OR

Anytime during the traverse: On the **TRAVERSE Traverse Data** screen, highlight the first station setup then **EDIT (F3)**. On the **TRAVERSE Point Results** screen select **PAGE (F6)** to reach the **Backsight** page. **SHIFT CTRL (F5)**.

TRAVERSE Point Results CONFIRMATION



NO (F4)

To close the confirmation window without further action.

YES (F6)

To store the point as control point.

52.9

Traverse Adjustment

52.9.1

Accessing Traverse Adjustment

Description

- A traverse adjustment can be performed on three components: 2D positions, angles and elevations.
 - Various adjustment methods are available for selection. Once the adjustment is performed, the results can be reviewed. Adjusted points are stored into a new job, and a report can be generated.
-



Survey points have to be measured while Traverse is running to be part of the adjustment calculations.

Access

The traverse adjustment option can be reached in different ways based on specific conditions.

Upon completing the observations onto the closing point, **ADJUST (F4)** to access **TRAVERSE Adjustment Method**.

OR

After the measurements are done on the closing line for angular closure, **ADJUST (F4)** to access **TRAVERSE Adjustment Method**.

OR

When the traverse is closed: **RESULT (F6)** in **TRAVERSE Traverse Information**, then **ADJUST (F4)** in **TRAVERSE Traverse Results** to access **TRAVERSE Adjustment Method**.

TRAVERSE Adjustment Method

17:14

TRAVERSE

Adjustment Method

Method Map

Traverse ID : 001

Horz. Adjust.: **Compass**

Angle Balance: No Distribution

Vert. Adjust.: Equally

Progress :

CALC (F1)

To calculate the result.

Q2 a ↑

CALC PAGE

PAGE (F6)

To change to another page on the screen.

Description of fields

Field	Option	Description
<Traverse ID:>	Output	The point ID of the traverse start point.
<Horz. Adjust:>	Compass	Suitable for surveys, where angles and distances were measured with equal precision.
	Transit	Suitable for surveys, where angles were measured with a higher precision than the distances.
	No Distribution	No distribution is made.
<Angle Balance:>	Equally	The angle misclosure is distributed equally.

Field	Option	Description
	No Distribu- tion	No distribution is made.
<Vert. Adjust:>	Equally	The height error is distributed equally.
	By distance	The height error is distributed by distance.
	No Distribu- tion	No distribution is made.

Next step

CALC (F1) starts the adjustment calculation.

52.9.2

Adjustment Results

Description

The results of the adjustment calculations can be reviewed by accessing the different pages.

Access

CALC (F1) in **Traverse Adjustment Methods**.

TRAVERSE Adj. Results, Position page

17:38
TRAVERSE

Adj. Results: 001

Position	Angle	Points	Method	Map
Closure	:		Adjusted	
Start Stn	:		setup2	
Close Point	:		setup3	
Length of Err	:		0.000 m	
Dirac of Err	:		0°00'00"	
Δ Height	:		-0.000 m	
Total Dist	:		35.817 m	
2D Accuracy	:		----	

CONT N & E MORE PAGE

CONT (F1)

To access the next screen.

N & E (F3) or L & D (F3)

To view the misclosure error in north/east or length/direction.

MORE (F5)

To display the values for the unadjusted, the balanced and the adjusted solution.

PAGE (F6)

To change to another page on this screen.

Description of fields

Field	Option	Description
<Closure:>	Adjusted, Unadjusted or Balanced	MORE (F5) to change between the options and display the values accordingly.
<Start Stn:>	Output	The point ID of the traverse start point.

Field	Option	Description
<Close Point:>	Output	The point ID of the traverse close point.
<Length of Err:>	Output	The length of the misclosure error.
<Direc of Err:>	Output	The direction of the misclosure error.
< Δ North:>	Output	Error in north.
< Δ East:>	Output	Error in east.
< Δ Height:>	Output	Error in height.
<Total Dist:>	Output	Total length of the traverse.
<2D Accuracy:>	Output	Position ratio of misclosure.
<1D Accuracy:>	Output	Height ratio of misclosure.

Next step

PAGE (F6) changes to the **Angle** page.

TRAVERSE Adj. Results, Angle page

Description of fields

Field	Option	Description
<Closure:>	Output	MORE (F5) to change between the options.
<Known Azimuth:>	Output	Defined azimuth of closing line. Displays ----- if no values are available.
<Azimuth Avg:>	Output	Mean value of the measured azimuth closing line. Displays ----- if no values are available.

Field	Option	Description
<Angular Misc:>	Output	Angular misclosure of traverse. Displays ----- if no values are available.

Next step

PAGE (F6) changes to the **Points** page.

TRAVERSE Adj. Results, Points page

The adjusted points are listed. The **Point Type** column shows the function for each point. **VIEW (F3)** shows the coordinate values of the highlighted point.

Next step

PAGE (F6) changes to the **Method** page.

TRAVERSE Adj. Results, Method page

The adjustment methods previously selected in **TRAVERSE Traverse Method** and used for the adjustment are displayed.

Next step

PAGE (F6) changes to the **Map** page.

TRAVERSE Adj. Results, Map page

The Map page provides an interactive display of the data. Refer to "35 MapView Interactive Display Feature" for information on the functionality and softkeys available.

Next step

CONT (F1) accesses **TRAVERSE Adjustment Store**.

TRAVERSE Adjustment Store

Description of fields

Field	Option	Description
<Traverse ID:>	Choicelist	The point ID of the traverse start point.
<Store to Job:>	User input	Once adjustment results have been reviewed and accepted, the adjusted position of the points can be stored in a separate job.
<Incl. Srvy Pt:>	Yes or No	Survey points can be included or not. Adjusted points are stored in the new job as a triplet of class ADJ (adjusted).
<Add Identifier:>	Yes or No	Activates the use of additional identifiers for the point ID's of the adjusted points.
<Identifier:>	User input	The identifier with up to four characters is added in front of or at the end of the ID of the adjusted points.
<Prefix/Suffix:>	Prefix	Adds the setting for <Identifier:> in front of the original point ID's.
	Suffix	Adds the setting for <Identifier:> at the end of the original point ID's.

Next step

STORE (F1) stores the results.

REPRT (F4) to generate an adjustment report. The adjustment report is stored into an XML file. For the XML file to be viewable as HTML a XSL file named adjust_report.xsl has to be placed in a directory named SRC in the folder containing the XML file.

53.1

Overview

Description

The Volume Calculations application program allows surfaces to be measured and volumes (and other information) to be computed from these surfaces.

Calculation tasks

The Volume calculations application program can be used for the following tasks:

- Measuring points (surface points and boundary points) defining a new surface or extending existing surfaces from the active job.
- Calculating the triangulation of the measured surface points to establish the surface.
- Calculating volumes from a reference (3D point, entered elevation) or by a stockpile method.

The surface calculation can be made from:

- existing point data in the job.
- manually measured points.
- entered coordinates.

Activating the application program

The Volume Calculations application program must be activated via a licence key. Refer to "28 Tools...\Licence Keys" for information on how to activate the application program.

Point types

Heights and positions are always taken into account. Points must have full coordinate triplets.

Properties of measured points

The properties stored with staked points are:

- Class: **MEAS**
 - Sub class: **TPS**
 - Source: **Survey**
 - Instrument source: **TPS**.
-

Access

Select **Main Menu: Programs...Volume Calculations.**

OR

Press **PROG**. Highlight **Volume Calculations. CONT (F1).**

Refer to "36.2 Accessing the Programs Menu" for information on **PROG** key.

OR

Press a hot key configured to access **VOLUMES Volume Calculations Begin.**

Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

VOLUMES

Volume Calculations
Begin

17:30 VOLUMES

Volume Calculations Begin

Job : active job

Coord System : <None>

Codelist : <None>

Config Set : configure set

Reflector : Leica Circ Prism

Add. Constant: 0.0 mm

CONT CONF SETUP CSYS

CONT (F1)

To accept changes and access the subsequent screen. The chosen settings become active.

CONF (F2)

To access **VOLUMES Configuration.**

SETUP (F3)

To set up station. Accesses **SETUP Station Setup.**

CSYS (F6)

To select a different coordinate system. Not available for **<Use Auto CrdSys: Yes>** configured in **CONFIGURE Additional Rover Settings**. Refer to "22.1.1 Configuration of Real-Time".

Description of fields

Field	Option	Description
<Job:>	Choicelist	The active job. All jobs from Main Menu: Manage...\Jobs can be selected.
<Coord System:>	Output	The coordinate system currently attached to the selected <Job:>. Cannot be edited for <Use Auto CrdSys: Yes> configured in CONFIGURE Additional Rover Settings . Refer to "22.1.1 Configuration of Real-Time".
<Codelist:>	Choicelist	No codes are stored in the selected <Job:>. All codelists from Main Menu: Manage...\Codelists can be selected.
	Output	Codes have already been stored in the selected <Job:>. If codes had been copied from a System RAM codelist, then the name of the codelist is displayed. If codes have not been copied from a System RAM codelist but typed in manually, then the name of the active job is displayed.

Field	Option	Description
<Config Set:>	Choicelist	The active configuration set. All configuration sets from Main Menu: Manage...\Configuration Sets can be selected.
<Reflector:>	Choicelist	The reflector currently set in the selected configuration set. All reflectors from Main Menu: Manage...\Reflectors can be selected.
<Add. Constant:>	Output	The additive constant stored with the chosen reflector.

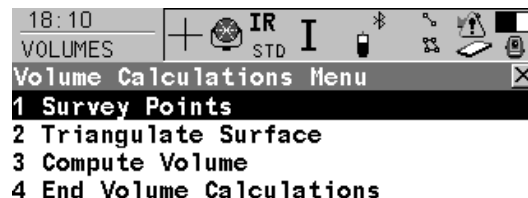
Next step

CONT (F1) accepts changes and accesses **VOLUMES Volume Calculations Menu**.

VOLUMES

Volume Calculations Menu

The **Volume Calculations Menu** lists all of the necessary steps and the option to close the program.



CONT (F1)

To select the highlighted option and to continue with the subsequent screen.



SHIFT CONF (F2)

To access **VOLUMES Configuration**.

Description of the items in the Volume Calculations Menu

Volume Calculations menu options	Description	Refer to chapter
Step 1) Survey Points	To measure points defining a new surface or extending existing surfaces currently stored in the active job.	53.4.1
Step 2) Triangulate Surface	To triangulate (delauny triangulation) the measured surface points to establish the surface.	53.4.2

Volume Calculations menu options	Description	Refer to chapter
Step 3) Compute Volume	To compute the volume of a surface by a reference (3D point, entered elevation) or by the stockpile method.	53.4.3
Step 4) End Volume Calculations	To end Volume Calculations and return to the screen from where Volume Calculations was accessed.	

Next step

IF	THEN
to start the program	highlight the relevant option and press CONT (F1) . Refer to the chapters stated above.
to configure the program	press SHIFT CONF (F2) . Refer to "53.3 Configuring Volume Calculations".
to close the program	highlight End Volume Calculations and press CONT (F1) .

Access

Select **Main Menu: Programs...Volume Calculations**. In **VOLUMES Volume Calculations Begin** press **CONF (F2)** to access **VOLUMES Configuration**.

OR

Press **PROG**. Highlight **Volume Calculations**. **CONT (F1)**. In **VOLUMES Volume Calculations Begin** press **CONF (F2)** to access **VOLUMES Configuration**.

OR

Press **SHIFT CONF (F2)** in **Volume Calculations XX VOLUMES**.

**VOLUMES
Configuration,
Logfile page**

17:42 VOLUMES Configuration

Logfile

Write Logfile: Yes

File Name : logfile.txt

Format File :

CONT Q2 a ↑

CONT (F1)

To accept changes and return to the screen from where this screen was accessed.

SHIFT ABOUT (F5)

To display information about the program name, the version number, the date of the version, the copyright and the article number.

Description of fields

Field	Option	Description
<Write Logfile:>	Yes or No	To generate a logfile when the application program is exited.
		A logfile is a file to which data from an application program is written to. It is generated using the selected <Format File:>.
<File Name:>	Choicelist	Available for <Write Logfile: Yes>. The name of the file to which the data should be written. A logfile is stored in the \DATA directory of the active memory device. The data is always appended to the file. Opening the choicelist accesses XX Logfiles where a name for a new logfile can be created and an existing logfile can be selected or deleted.
<Format File:>	Choicelist	Available for <Write Logfile: Yes>. A format file defines which and how data is written to a logfile. Format files are created using LGO. A format file must first be transferred from the CompactFlash card to the System RAM before it can be selected. Refer to "24 Tools...\Transfer Objects..." for information on how to transfer a format file. Opening the choicelist accesses XX Format Files where an existing format file can be selected or deleted.

53.4

53.4.1

Calculating the Volume

Step 1) Surveying the Points

Description

To measure points to a new surface or to an existing surface in the active job. If no surfaces currently exist in the active job, the user has to enter a **New Surface** first in **VOLUMES Choose Task & Surface**. The menu items **Triangulate Surface** and **Compute Volume** within the **VOLUMES Volumes & Surfaces Menu** are marked grey if no surface exists in the active job.

Access

Refer to "53.2 Accessing Volume Calculations" to access **VOLUMES Surface Points**.

VOLUMES Surface Points, Survey page

The pages shown are those from a typical configuration set. An additional page is available when a user defined display mask is used.

17:24
VOLUMES

Surface Points

Survey | Offset | Code | Map

Point ID : 100
Reflector Ht : 1.567 m

Hz : 200.0009 g
V : 100.0029
Horiz Dist : 50.010 m
Ht Diff : -0.014 m

Q2 a ↑

ALL DIST REC >BNDY DONE PAGE

ALL (F1)

To measure and store distances and angles.

STOP (F1)

Available if <EDM Mode: Tracking> and **DIST (F2)** was pressed. Stops the distance measurements. (F1) changes back to **ALL**.

DIST (F2)

To measure and display distances. Available unless <EDM Mode: Tracking> and/or <Log Auto Pts: Yes>, after the tracking or logging is started.

REC (F3)

To record data.

If **<EDM Mode: Tracking>** and/or **<Log Auto Pts: Yes>**, records measured point and continues tracking.

>BNDY (F3) / >SURF (F3)

To change the class of the point to be measured between surface point and boundary point.

DONE (F5)

To finish measuring and to return to the **Volumes Calculations Menu**.

PAGE (F6)

To change to another page on this screen.

SHIFT INDIV (F5) and SHIFT RUN (F5)

To change between entering an individual point ID different to the defined ID template and the running point ID according to the ID template. Refer to "16.1 ID Templates".

Description of fields

Field	Option	Description
<Point ID:>	User input	The identifier for manually occupied points. The configured point ID template is used. The ID can be changed in the following ways: To start a new sequence of point ID's type over the point ID.

Field	Option	Description
		For an individual point ID independent of the ID template SHIFT INDIV (F5). SHIFT RUN (F5) changes back to the next ID from the configured ID template. Refer to "16.1 ID Templates".
<Reflector Ht:>	User input	The last used reflector height is suggested when accessing the Survey application program. An individual reflector height can be typed in.
<Hz:>	Output	The current horizontal angle.
<V:>	Output	The current vertical angle.
<Horiz Dist:>	Output	The horizontal distance after DIST (F2) was pressed. No distance is displayed when accessing the screen and after REC (F3) or ALL (F1) .
<Ht Diff:>	Output	The height difference between station and measured point after DIST (F2) . Displays ----- when accessing the screen and after REC (F3) or ALL (F1) .

Next step

Press **ESC** returns to the **VOLUMES Choose Task & Surface** screen.

Press **ESC** again to return to the **VOLUMES Volume Calculations Menu** screen.

53.4.2

Step 2) Triangulating the Surface

Description

To calculate a surface by establishing a triangulation (triangulation method: delauny) of the measured surface points.

Access

Refer to "53.2 Accessing Volume Calculations" to access **VOLUMES Triangulate Surface**.

VOLUMES Triangulate Surface, General page

17:23
VOLUMES
Triangulate Surface
General Points Map
Surface Name : S1
No. Surf Pts : 93
No. Bndy Pts : 33
Last Pt ID : 1000
Last Pt Date : 29.03.06
Last Pt Time : 12:24:29
CONT PAGE Q2 a

CONT (F1)

To access **VOLUMES Boundary Definition**.
(F1) changes to **CALC**.

PAGE (F6)

To change to another page on this screen.

SHIFT CONF (F2)

To access **VOLUMES Configuration**.

SHIFT DEL S (F4)

To delete the surface.

Description of fields

Field	Option	Description
<Surface Name:>	Choicelist	Name of the surface to be triangulated.
<No. Surf Pts:>	Output	Number of the measured surface points.
<No. Bndy Pts:>	Output	Number of the measured boundary points.

Field	Option	Description
<Last Pt ID:>	Output	ID of the last measured point of the chosen surface.
<Last Pt Date:>	Output	Date of the last measured point of the chosen surface.
<Last Pt Time:>	Output	Time of the last measured point of the chosen surface.

Next step

CONT (F1) continues to **VOLUMES Boundary Definition**.

VOLUMES Boundary Definition, Points page

Point ID	Height
1044	1641.070
1000	1641.550
1001	1641.060
1007	1640.610
1008	1640.260
1009	1640.870
1010	1641.310

Q2 a ↑

CALC ADD 1 UP DOWN MORE PAGE

CALC (F1)

To start calculating the triangulation and to access to the **VOLUMES Triangulation Results**.

ADD 1 (F2)

To add points from the active job to the surface.

UP (F3)

To move the focused point one step up within the boundary definition.

DOWN (F4)

To move the focused point one step down within the boundary definition.

MORE (F5)

To display information about the code group, the code type, the code description and the quick codes if available.

PAGE (F6)

To change to another page on this screen.

SHIFT HOME (F2)

To move the focus to the top of the points list.

SHIFT END (F3)

To move the focus to the bottom of the points list.

SHIFT REM 1 (F4)

To remove the marked point from the surface.

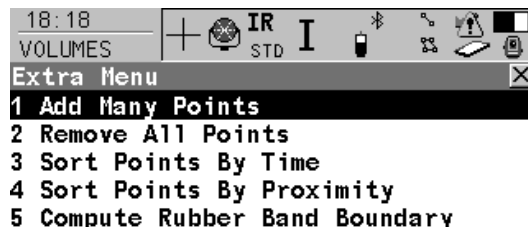
SHIFT EXTRA (F5)

To access to the **VOLUMES Extra Menu**.

Next step

SHIFT EXTRA (F5) continues to **VOLUMES Extra Menu**. Refer to "VOLUMES Extra Menu".

VOLUMES Extra Menu



CONT (F1)

To enter the highlighted option from the **VOLUMES Extra Menu**.



Description of fields

Field	Description
<Add Many Points>	Access Data Manage and all points that are in the list.
<Remove All Points>	Method to remove all points that are indicated in the Boundary Definition points page.
<Sort Points by Time>	Method to sort all points in the Boundary Definition points page by the time they were stored.
<Sort Points by Proximity>	Method to sort all points in the Boundary Definition points page by the closest proximity.
<Compute Rubber Band Boundary>	Method to define a new boundary as if a rubber band was placed around the points. The current list of boundary points will be ignored.

VOLUMES Triangulation Results, Summary page

Next step

CONT (F1) returns to the screen

CALC (F1) calculates the triangulation and continues to **VOLUMES Triangulation Results**.

17:23
VOLUMES

Triangulation Results

Summary Details Map

Surface Name : S1

Area : 24727.08 m²

No. Triangles: 217

No. Surf Pts : 93

No. Bndy Pts : 33

DONE DXF PAGE

DONE (F1)

To close the triangulation of the surface and return to **Volumes Calculations Menu**.

DXF (F4)

To export the triangulation results to a DXF file on the data or root directory of the CF Card.

PAGE (F6)

To change to another page on this screen.

SHIFT CONF (F2)

To access **VOLUMES Configuration**.

Description of fields

Field	Option	Description
<Surface Name:>	Output	Name of the surface.
<Area:>	Output	Area of the base plane.
<No. Triangles:>	Output	Number of triangles used within the triangulation.
<No. Surf Pts:>	Output	Number of points inside the surface.

Field	Option	Description
<No. Bndy Pts:>	Output	Number of boundary points of the surface.

Next step

PAGE (F6) changes to the **Details** page.

Refer to "VOLUMES Triangulation Results, Details page".

VOLUMES Triangulation Results, Details page

Description of fields

Field	Option	Description
<No. Points:>	Output	Total number of points from the surface.
<Min Elevation:>	Output	Minimal elevation of the triangulated surface.
<Max Elevation:>	Output	Maximal elevation of the triangulated surface.
<Longest Side:>	Output	Value of the longest triangle side.
<Area (3D):>	Output	Surface area (3D).

Next step

PAGE (F6) changes to the **Map** page.

Refer to "VOLUMES Triangulation Results, Map page".

VOLUMES Triangulation Results, Map page

The **Map** page provides an interactive display of the data. Refer to "35 MapView Interactive Display Feature" for information on the functionality and softkeys available.

Next step

DONE (F1) returns to **Volume Calculation Menu** page.

Refer to "VOLUMES Volume Calculations Menu".

53.4.3

Step 3) Computing the Volume

Description

To calculate a surface by establishing a triangulation (triangulation method: delauny) of the measured surface points.

To compute the volume of the triangulated surface by using either:

- the stockpile method,
- an elevation plane as a reference,
- a single point as a reference.

Access

Refer to "53.2 Accessing Volume Calculations" to access **VOLUMES Compute Volume**.

VOLUMES

Compute Volume

17:22
VOLUMES

IR STD

Compute Volume

Method : Stockpile

Surface Name : S1

No. Triangles: 217

CALC

Q2 a ↑

CALC (F1)

Computing the volume and access to the **VOLUMES Volume Calculation Results** page. (F1) changes to **CONT**.

SHIFT CONF (F2)

To access **VOLUMES Configuration**.

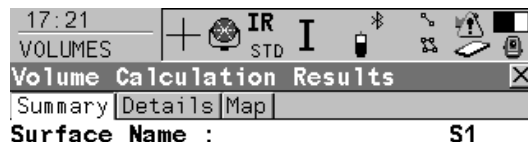
Description of fields

Field	Option	Description
<Method:>	Choicelist	To calculate the volume of the triangulated surface.
	Stockpile	To calculate a volume between the triangulated surface and the surface defined by the boundary points of the surface.
	Surface to Elev	To calculate a volume between the triangulated surface and the height entered by the user.
	Surface to Point	To calculate a volume between the triangulated surface and the height of a selected point.
<Surface Name:>	Choicelist	The surface chosen from the triangulated surfaces currently stored to the active job.
<No. Triangles:>	Output	The number of triangles from the triangulated surface
<To Elevation:>	User Input	To enter a height for the elevation plane. This height will be used as the reference when <Method: Surface To Elev> is selected.
<To Point:>	Choicelist	To select a point from the active job. This point height will be used as the reference when <Method: Surface To Point> is selected.
<Elevation:>	Output	The elevation of the selected point.

Next step

CALC (F1) calculates the volume and continues to **VOLUMES Volume Calculation Results**.

VOLUMES Volume Calculation Results, Summary page



Area : 24727.08 m²
Net Volume : 228439.47 m³



CONT (F1)

Computing the volume and access to the **VOLUMES Volume Calculation Results** page. (F1) changes to **CONT**.

PAGE (F6)

To change to another page on this screen.

SHIFT CONF (F2)

To access **VOLUMES Configuration**.

Description of fields

Field	Option	Description
<Surface Name:>	Output	Surface.
<Area:>	Output	Area of the base plane.
<Net Volume:>	Output	Volume of the surface.

Next step

PAGE (F6) changes to the **Details** page.

VOLUMES
Volume Calculation
Results,
Details page

Refer to "VOLUMES Volume Calculation Results, Details page".

Description of fields

Field	Option	Description
<Min Elevation:>	Output	Minimal elevation of the calculated volume.
<Max Elevation:>	Output	Maximal elevation of the calculated volume.
<Avg Thickness:>	Output	Average thickness of the calculated volume.
<Perimeter:>	Output	Perimeter of the measured surface area (intersection of the measured surface to the reference datum).

Next step

PAGE (F6) changes to the **Map** page.

Refer to "VOLUMES Triangulation Results, Map page".

VOLUMES
Volume Calculation
Results,
Map page

The **Map** page provides an interactive display of the data. Refer to "35 MapView Interactive Display Feature" for information on the functionality and softkeys available.

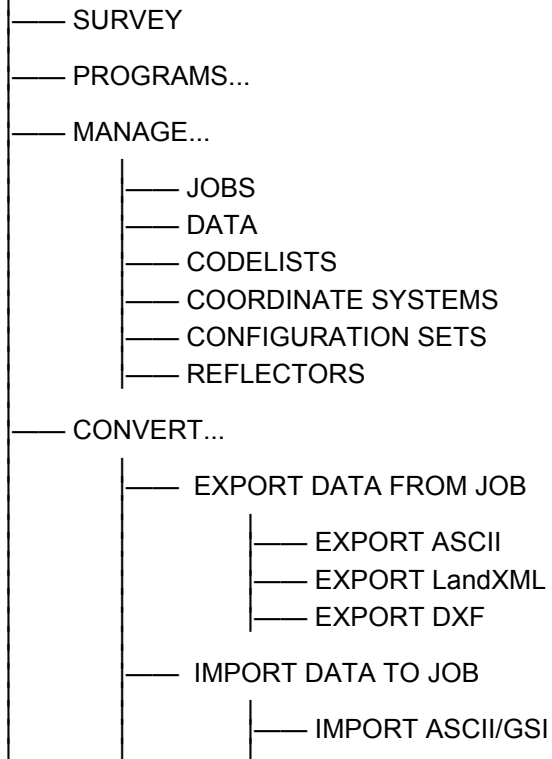
Next step

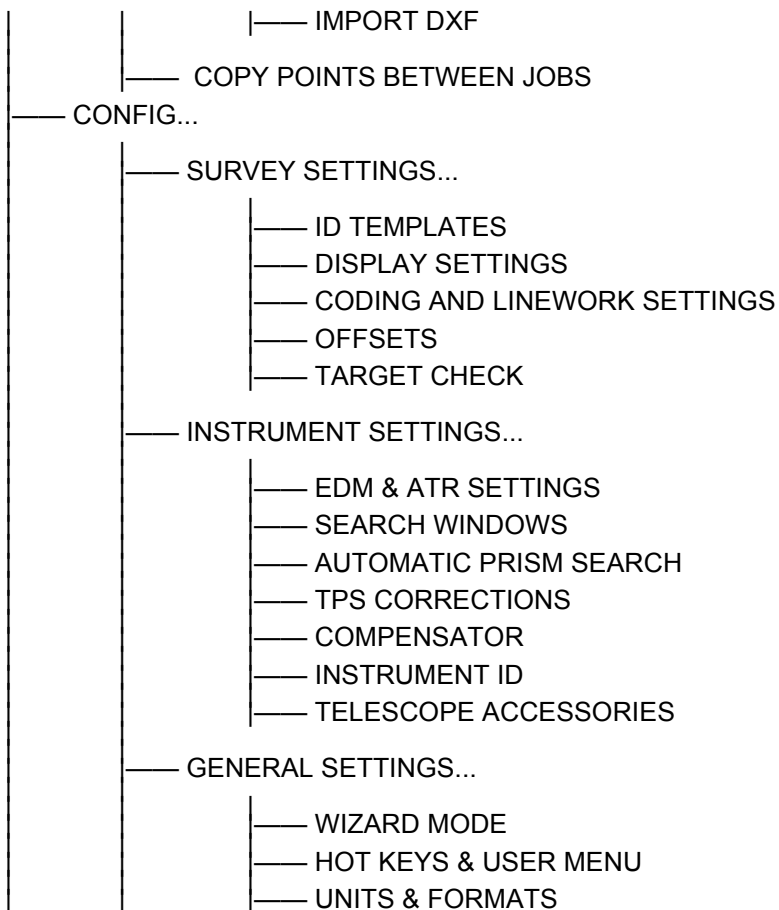
CONT (F1) returns to **Volume Calculation Menu** page.

Refer to "VOLUMES Volume Calculations Menu".

Menu tree

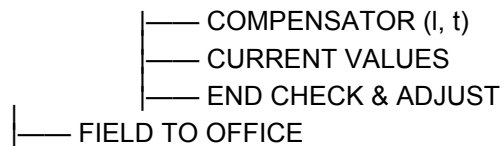
MAIN MENU







- CODELISTS
- CONFIGURATION SETS
- COORDINATE SYSTEMS
- GEOID FIELD FILES
- CSCS FIELD FILES
- FORMAT FILES
- JOBS, if internal memory is fitted
- SYSTEM RAM CONTENTS
- MODEM/GSM STATIONS, for SmartStation
- IP HOSTS, for SmartStation
- ANTENNA RECORDS, for SmartStation
- PZ-90-TRANSFORMATION, for SmartStation
- UPLOAD SYSTEM FILES...
 - APPLICATION PROGRAMS
 - SYSTEM LANGUAGES
 - INSTRUMENT FIRMWARE
- CALCULATOR
- FILE VIEWER
- LICENCE KEYS
- CHECK & ADJUST...
 - COMBINED (l, t, i, c, ATR)
 - TILTING AXIS (a)



Appendix B Memory Types

Types of memory available

CompactFlash card/Internal memory

- Jobs
 - Points
 - Codes
- Coordinate systems
- Raw observations
- ASCII output files
- Logfiles
- ASCII files to be imported (CompactFlash card)
- CSCS field files (usually on System RAM, can also be used from CompactFlash card)
- Geoid field files (usually on System RAM, can also be used from CompactFlash card)

The information is managed in the job database DB-X and in the measurement database.

Application programs memory, 8 MB

- System language
- Font files
- Application programs
 - Language files

System RAM, 1 MB

- Codelists
- Coordinate systems
- Configuration sets
- Antenna files

- Font files

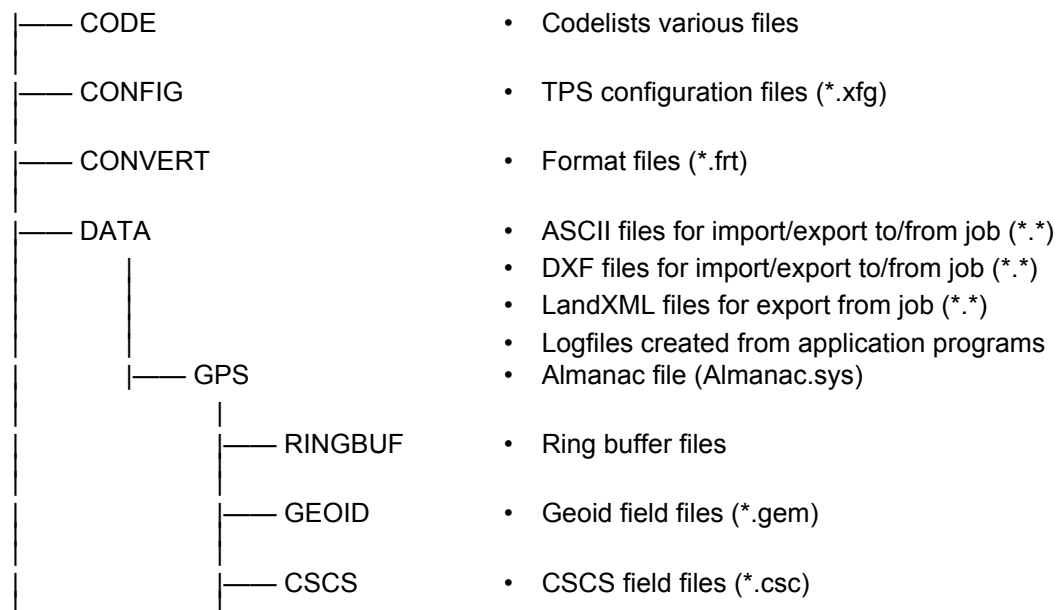
- Format files
- CPCS models/CPCS field files
- Geoid models/Geoid field files
- Almanac
- ID templates
- Sort and filter settings

Appendix C Directory Structure of the Memory Device

Description

On the memory device, files are stored in certain directories. The following diagram of the directory structure refers to both CompactFlash card and internal memory if fitted. Backwards compatible with TPS1100 are GSI files.

Directory structure



— DBX	• Job files, various files • DTM jobs, various files • GNSS raw observation files • Coordinate system file from GPS1200+ (Trfset.dat)
— GPS	• Antenna file from GPS1200+ (List.ant) • GSM/Modem station list from GPS1200+ (Stations1200.fil)
— GSI	• GSI files (*.gsi) • ASCII files for export from job (*.*)
— SYSTEM	• Application program files (*.a*) • Firmware files (*.fw) • Language files (*.s*) • Licence file (*.key) • System files (System.ram)

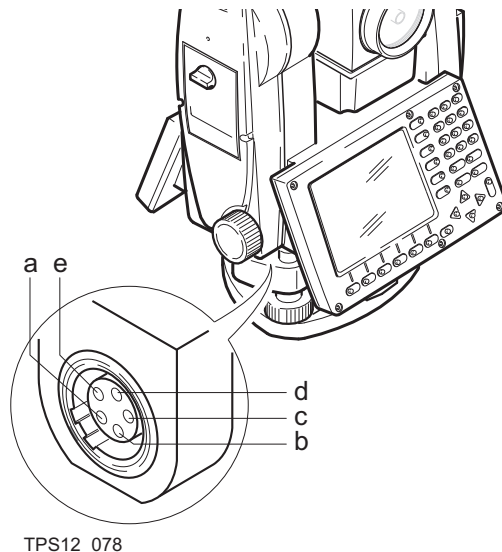
D.1

Instrument

Description

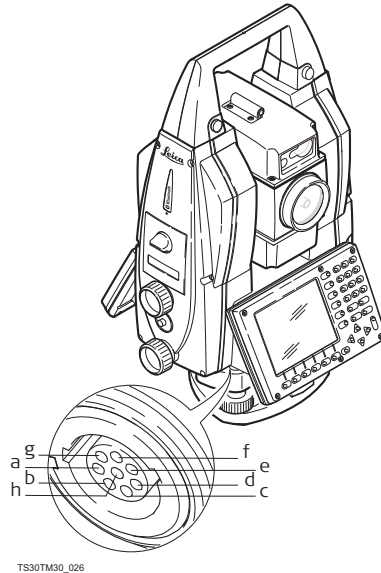
Some application programs require knowledge of the pin assignments for the instrument port.
In this chapter, the pin assignments and socket for the port 1 of the instrument are explained.

Port 1 and pin assignments for TPS1200+



Pin	Name	Description	Direction
1	PWR_IN	Power input, + 12 V nominal (11 - 16 V).	In
2	-	Not used.	-
3	GND	Single ground.	-
4	Rx	RS232, receive	In
5	Tx	RS232, transmit	Out

Port 1 and pin assignments for TS30/TM30



- a) Pin 1
- b) Pin 2
- c) Pin 3
- d) Pin 4
- e) Pin 5
- f) Pin 6
- g) Pin 7
- h) Pin 8

Pin	Name	Description	Direction
1	USB_D+	USB data line	In or out
2	USB_D-	USB data line	In or out
3	GND	Signal ground	-
4	RxD	RS232, receive data	In
5	TxD	RS232, transmit data	Out
6	ID	Identification pin	In or out
7	PWR	Power input, 5 -28 V	In
8	ATX_ON	ATX on control signal, RS232 levels	In

Sockets

Port 1:

For TPS1200+: LEMO-0, 5 pin, LEMO ENA.OB.305.CLN
For TS30/TM30: LEMO-1, 8 pin, LEMO HMI.1B.308.CLNP,
same as on the SmartAntenna.

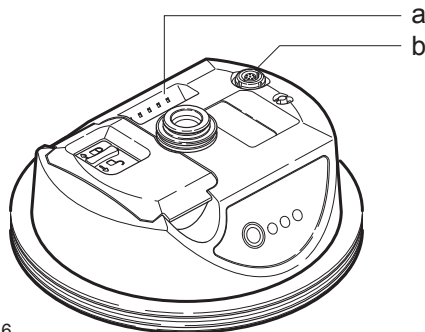
D.2

SmartAntenna

Description

Some applications require knowledge of the pin assignments for the SmartAntenna ports. In this chapter, the pin assignments and sockets for the ports of the SmartAntenna are explained.

Ports at the Smart-Antenna



TPS12_216

- a) Clip-on-contacts for connecting SmartAntenna to SmartAntenna Adapter on TPS1200+/TS30/TM30
- b) 8 pin LEMO-1 to connect antenna cable

Pin assignments for 8 pin LEMO-1

Pin	Name	Description	Direction
1	USB_D+	USB data line	In or out
2	USB_D-	USB data line	In or out
3	GND	Signal ground	-
4	RxD	RS232, receive data	In
5	TxD	RS232, transmit data	Out
6	ID	Identification pin	In or out
7	PWR	Power input, 5 -28 V	In
8	ATX_ON	ATX on control signal, RS232 levels	In

Sockets

8 pin LEMO-1: LEMO-1, 8 pin, LEMO HMI.1B.308.CLNP

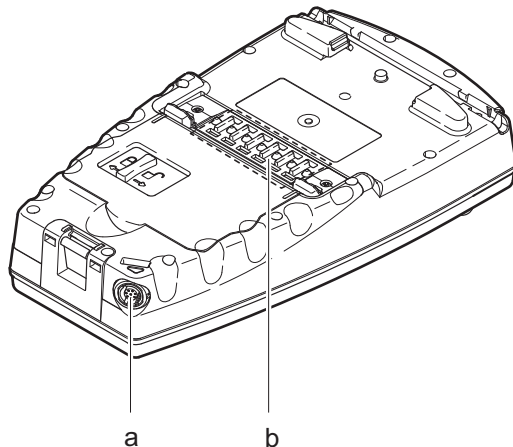
D.3

RX1250

Description

Some applications require knowledge of the pin assignments for the RX1250 ports. In this chapter, the pin assignments and sockets for the ports of the RX1250 are explained.

Ports at the RX1250



RX12_040

- a) 8 pin LEMO-1 to connect data cable
- b) Clip-on-contacts for connecting RX1250 to GHT56 holder

Pin assignments for 8 pin LEMO-1

Pin	Name	Description	Direction
1	USB_D+	USB data line	In or out
2	USB_D-	USB data line	In or out
3	GND	Signal ground	-
4	RxD	RS232, receive data	In
5	TxD	RS232, transmit data	Out
6	ID	Identification pin	In or out
7	PWR	Power input, 5 -28 V	In
8	TRM_ON/USB_ID	RS232, general purpose signal	In

Sockets

8 pin LEMO-1: LEMO-1, 8 pin, LEMO HMI.1B.308.CLNP

Description

Some applications require the connection of instruments, devices or accessories to the TPS1200+/TS30/TM30. In this chapter, the required cables and their use are listed.

Cables connecting instruments, devices or accessories

The table shows in alphabetical order which instruments, devices or accessories can be connected using cables. Refer to paragraph "Cables and product names" for a full description of these cables.

From	To	Cables
AX1200	GPS1200+	• GEV108 • GEV119 • GEV120 • GEV134 • GEV141 • GEV142 • GEV194 • Cable 70 m, GNSS antenna
	GRX1200+/ GRX1200+ GNSS	• GEV108 • GEV119 • GEV120 • GEV134 • GEV141

From	To	Cables
		• GEV142 • GEV194 • Cable 70 m, GNSS antenna
Car battery	GPS1200+	• GEV97 + GEV71
	GRX1200+/ GRX1200+ GNSS	• GEV97 + GEV71 • GEV172 + GEV71
	TPS1200+	• GEV52 + GEV71
	TS30/TM30	• GEV52 + GEV219
Device for Event Input	GPS1200+	• GEV42
	GRX1200+/ GRX1200+ GNSS	• GEV42
Device for PPS	GRX1200+/ GRX1200+ GNSS	• GEV150
Ethernet communication device	GRX1200+/ GRX1200+ GNSS	• GEV168
GEB171 or GEV208	GPS1200+	• GEV97 • GEV97 + GEV172
	GRX1200+/ GRX1200+ GNSS	• GEV97 • GEV97 + GEV172
	RX1250	• GEV215 • GEV219

From	To	Cables
	SmartAntenna	• GEV215
	TPS1200+	• GEV52
	TS30/TM30	• GEV219 • GEV220
Modem	GPS1200+	• GEV113
	GRX1200+/ GRX1200+ GNSS	• GEV113
Oscillator, external	GRX1200+/ GRX1200+ GNSS	• GEV169
Power supply for GPS receiver, 12 V DC	GPS1200+	• GEV172
	GRX1200+/ GRX1200+ GNSS	• GEV172
Radio housing	Radio antenna on radio antenna arm	• GEV141
RS232 9 pin on PC	GFU14	• GEV171
	GPS1200+	• GEV160 • GEV162
	GRX1200+/ GRX1200+ GNSS	• GEV160 • GEV162
	RX1250	• GEV162
	SmartAntenna	• GEV162

From	To	Cables
	TCPS27	• GEV186 + GK1
	TPS1200+	• GEV102 • GEV187
	TS30/TM30	• GEV220
RX1210	GPS1200+	• GEV163 • GEV164
	GRX1200+/ GRX1200+ GNSS	• GEV163 • GEV164
RX1250	SmartAntenna	• GEV173 • GEV215
	TPS1200+	• GEV217
Satellite radio	GPS1200+	• GEV125
	GRX1200+/ GRX1200+ GNSS	• GEV125
Satellite Epic Pro radio	GPS1200+	• GEV221
System 500 GFU	GPS1200+	• GEV167
	GRX1200+/ GRX1200+ GNSS	• GEV167
TCPS27	TPS1200+	• GEV186
USB on PC	GPS1200+	• GEV195

From	To	Cables
	GRX1200+/ GRX1200+ GNSS	• GEV195
	RX1250	• GEV161 • GEV218
	TPS1200+	• GEV189
	TS30/TM30	• GEV218

Cables and product names

The product names of the cables in the above table are explained in detail below in ascending order.

Name	Description
-	Cable 70 m, GNSS antenna
GEV42	Cable, Event input for GPS
GEV52	Cable 1.8 m, TPS1200+ to battery
GEV71	Cable 4.0 m, LEMO to 12 V DC power supply It allows a connection to a 12 V DC power supply for example a car battery. Cables used to connect to a GEB171 battery can be connected to adapter cable number 7.
GEV97	Cable 1.8 m, GX power cable
GEV102	Cable 2.0 m, TPS1200+ to RS232
GEV108	Cable 30 m, GNSS antenna
GEV113	Cable, GX com to modem

Name	Description
GEV119	Cable 10 m, GNSS antenna
GEV120	Cable 2.8 m, GNSS antenna
GEV125	Cable, Sateline without housing to GX
GEV134	Cable 50 m, GNSS antenna
GEV141	Cable 1.2 m, GNSS antenna
GEV142	Cable 1.6 m, GNSS antenna, extension
GEV150	Cable, PPS output for GPS
GEV160	Cable 2.8 m, data transfer GX COM to RS232
GEV161	Cable 2.8 m, data transfer GX RX1250 to USB
GEV162	Cable 2.8 m, data transfer GX RX to RS232
GEV163	Cable 1.8 m, RX to GX
GEV164	Cable 1.0 m, RX to GX, all-on-pole setup
GEV167	Cable 0.5 m, GX to System 500 GFU housings
GEV168	Cable 5.0 m, GX to Ethernet communication device
GEV169	Cable 2.0 m, GX to external oscillator
GEV171	Y-cable 1.8 m, programming cable, GFU14 to RS232 with power
GEV172	Cable 2.8 m, dual external power input
GEV173	Cable 1.2 m, SmartAntenna to RX1250
GEV186	Y-cable 1.8 m, TCPS27 to TPS1200+ with power
GEV187	Y-cable 2.0 m, TPS1200+ to RS232 with power

Name	Description
GEV189	Cable 2.8 m, data transfer TPS to USB
GEV194	Cable 1.8 m, GNSS antenna, all-on-pole setup
GEV195	Cable 2.8 m, data transfer GX to USB
GEV208	Power supply unit, 12 V DC
GEV215	Y-cable, SmartAntenna and RX1250 to GEB171
GEV217	Cable 1.8 m, TPS1200+ to RX1250
GEV221	Y-cable 2.0 m, Sateline 3AS Epic Pro radio to GPS1200+ and 12 V car battery
GK1	Lemo convertor to RS232 for PC connection
GEV218	Cable 2.0 m, data transfer from TS30/TM30 or RX1250 to USB
GEV219	Cable 1.8 m, TS30/TM30 or RX1250 to battery
GEV220	Y-cable 1.8 m, TS30/TM30 to RS232 with power

Appendix F NMEA Message Formats

F.1

Overview

Description

National Marine Electronics Association is a standard for interfacing marine electronic devices. This chapter describes all NMEA-0183 messages which can be output by the receiver.

Access

To set the output of NMEA messages on the receiver

Select **Main Menu: Config...\Interfaces...\NMEA Out.**

OR

Within the configuration set wizard. Refer to "11 Manage...\Configuration Sets".

Steer from a connected device



Use a query message. Refer to the interface control documents for GPS1200+ for information on this query message. The firmware CD contains these documents in electronic format.

A Talker ID appears at the beginning of the header of each NMEA message. The Talker ID can be user defined or standard (based on the NMEA 4.0). This is normally GP for GPS but can be changed in **CONFIGURE NMEA Output 1** or **CONFIGURE NMEA Output 2**.

F.2

Used symbols for describing the NMEA formats

Description

NMEA messages consist of various fields. The fields are:

- Header
- Special format fields
- Numeric value fields
- Information fields
- Null fields

Certain symbols are used as identifier for the field types.
These symbols are described in this section.

Header

Symbol	Field	Description	Example
\$	-	Start of sentence	\$
--ccc	Address	• -- = alphanumeric characters identifying the talker Options: GP = GPS only GL = GLONASS only GN = G lobal N avigation S atellite S ystem like WAAS and EGNOS	GPGGA

Symbol	Field	Description	Example
		ccc = alphanumeric characters identifying the data type and string format of the successive fields. This is usually the name of the message.	

Special format fields

Symbol	Field	Description	Example
A	Status	- A = Yes, Data Valid, Warning Flag Clear - V = No, Data Invalid, Warning Flag Set	V
IIII.II	Latitude	- Degreesminutes.decimal - Two fixed digits of degrees, two fixed digits of minutes and a variable number of digits for decimal fraction of minutes. - Leading zeros are always included for degrees and minutes to maintain fixed length.	4724.538950
yyyyy.yy	Longitude	- Degreesminutes.decimal - Three fixed digits of degrees, two fixed digits of minutes and a variable number of digits for decimal fraction of minutes. - Leading zeros are always included for degrees and minutes to maintain fixed length.	00937.046785

Symbol	Field	Description	Example
eeeeee.eee	Grid Easting	At the most six fixed digits for metres and three fixed digits for decimal fractions of metres.	195233.507
nnnnnn.nnn	Grid Northing	At the most six fixed digits for metres and three fixed digits for decimal fractions of metres.	127223.793
hhmmss.ss	Time	• hoursminutesseconds.decimal • Two fixed digits of hours, two fixed digits of minutes, two fixed digits of seconds and a variable number of digits for decimal fraction of seconds. • Leading zeros are always included for hours, minutes and seconds to maintain fixed length.	115744.00
mmddy	Date	• Monthdayyear - two fixed digits of month, two fixed digits of day, two fixed digits of year. • Leading zeros always included for month, day and year to maintain fixed length.	093003
No specific symbol	Defined field	• Some fields are specified to contain predefined constants, most often alpha characters.	M

Symbol	Field	Description	Example
		Such a field is indicated by the presence of one or more valid characters. Excluded from the list of valid characters are the following that are used to indicate other field types: A, a, c, x, hh, hhmmss.ss, llll.ll, yyyyyy.yy.	

Numeric value fields

Symbol	Field	Description	Example
x.x	Variable numbers	- Integer or floating numeric field - Optional leading and trailing zeros. Decimal point and associated decimal-fraction are optional if full resolution is not required.	73.10 = 73.1 = 073.1 = 73
hh_	Fixed HEX field	Fixed length HEX numbers	3F

Information fields

Symbol	Field	Description	Example
c--c	Variable text	Variable length valid character field	A
aa_	Fixed alpha field	Fixed length field of upper case or lower case alpha characters	N
xx_	Fixed number field	Fixed length field of numeric characters	1

Null fields

Symbol	Field	Description	Example
No symbol	Information unavailable for output	Null fields do not contain any information at all.	,,



Fields are always separated by a comma. Before the Checksum field there is never a comma.



When information for a field is not available, the position in the data string is empty.

F.3

GGA - Global Positioning System Fix Data

Syntax

\$--GGA,hhmmss.ss,IIII.II,a,yyyyy.yy,a,x,xx,x.x,x.x,M,x.x,M,x.x,xxxx*hh<CR><LF>

Description of fields

Field	Description
\$--GGA	Header including Talker ID
hhmmss.ss	UTC time of position
IIII.II	Latitude (WGS 1984)
a	Hemisphere, N orth or S outh
yyyyy.yy	Longitude (WGS 1984)
a	E ast or W est
x	Position quality indicator 0 = Fix not available or invalid 1 = No real-time position, navigation fix 2 = Real-time position, ambiguities not fixed 3 = Valid fix for GNSS P recise P ositioning S ervice mode, for example WAAS 4 = Real-time position, ambiguities fixed
xx	Number of satellites in use, 00 to 26.
x.x	HDOP

Field	Description
x.x	Altitude of position marker above/below mean sea level in metres. If no orthometric height is available the local ellipsoidal height will be exported. If the local ellipsoidal height is not available either, the WGS 1984 ellipsoidal height will be exported.
M	Units of altitude as fixed text M
x.x	Geoidal separation in metres. This is the difference between the WGS 1984 earth ellipsoid surface and mean sea level.
M	Units of geoidal separation as fixed text M
x.x	Age of differential GNSS data, empty when DGPS not used
xxxx	Differential reference station ID, 0000 to 1023
*hh	Checksum
<CR>	C arriage R eturn
<LF>	L ine F eed

Examples

User defined Talker ID = GN

\$GNNGGA,113805.50,4724.5248541,N,00937.1063044,E,4,13,0.7,1171.281,M,-703.398,M,0.26,0000*42

F.4

GGK - Real-Time Position with DOP

Syntax

\$--GGK,hhmmss.ss,mmddyy,IIII.II,a,yyyyy.yy,a,x,xx,x.x,EHTx.x,M*hh<CR><LF>

Description of fields

Field	Description
\$--GGK	Header including Talker ID
hhmmss.ss	UTC time of position
mmddyy	UTC date
IIII.II	Latitude (WGS 1984)
a	Hemisphere, N orth or S outh
yyyyy.yy	Longitude (WGS 1984)
a	E ast or W est
x	Position quality indicator 0 = Fix not available or invalid 1 = No real-time position, navigation fix 2 = Real-time position, ambiguities not fixed 3 = Real-time position, ambiguities fixed
xx	Number of satellites in use, 00 to 26.
x.x	GDOP
EHT	Ellipsoidal height
x.x	Altitude of position marker as local ellipsoidal height. If the local ellipsoidal height is not available, the WGS 1984 ellipsoidal height will be exported.

Field	Description
M	Units of altitude as fixed text M
*hh	Checksum
<CR>	Carriage Return
<LF>	Line Feed

Examples

Standard Talker ID

\$GNGGK,113616.00,041006,4724.5248557,N,00937.1063064,E,3,12,1.7,EHT1171.742,M
*6D

User defined Talker ID = GN

\$GNGGK,113806.00,041006,4724.5248557,N,00937.1063064,E,3,13,1.4,EHT1171.746,M
*66

F.5

GGK(PT) - Real-Time Position with DOP, Trimble Proprietary

Syntax

\$PTNL,GGK,hhmmss.ss,mmddyy,llll.ll,a,yyyyy.yy,a,x,xx,x.x,EHTx.x,M*hh<CR><LF>

Description of fields

Field	Description
\$PTNL	\$ = Start of sentence delimiter, talker ID fixed with PTNL
GGK	GGK sentence formatter
hhmmss.ss	UTC time of position
mmddyy	UTC date
llll.ll	Latitude (WGS 1984)
a	Hemisphere, N orth or S outh
yyyyy.yy	Longitude (WGS 1984)
a	E ast or W est
x	Position quality indicator 0 = Fix not available or invalid 1 = No real-time position, navigation fix 2 Not existing 3 = Real-time position, ambiguities fixed 4 = Real-time position, ambiguities not fixed
xx	Number of satellites in use, 00 to 26.
x.x	PDOP
EHT	Ellipsoidal height

Field	Description
x.x	Altitude of position marker as local ellipsoidal height. If the local ellipsoidal height is not available, the WGS 1984 ellipsoidal height will be exported.
M	Units of altitude as fixed text M
*hh	Checksum
<CR>	C arriage R eturn
<LF>	L ine F eed

Examples

Standard Talker ID

\$PTNL,GGK,113616.00,041006,4724.5248557,N,00937.1063064,E,3,12,1.5,EHT1171.74
2,M*4C

User defined Talker ID = GN

\$PTNL,GGK,113806.00,041006,4724.5248557,N,00937.1063064,E,3,13,1.2,EHT1171.74
6,M*43

F.6

GGQ - Real-Time Position with CQ

Syntax

\$--GGQ,hhmmss.ss,mmddyy,IIII.II,a,yyyy.yy,a,x,xx,x.x,x.x,M*hh<CR><LF>

Description of fields

Field	Description
\$--GGQ	Header including talker ID
hhmmss.ss	UTC time of position
mmddyy	UTC date
IIII.II	Latitude (WGS 1984)
a	Hemisphere, N orth or S outh
yyyy.yy	Longitude (WGS 1984)
a	E ast or W est
x	Position quality indicator 0 = Fix not available or invalid 1 = No real-time position, navigation fix 2 = Real-time position, ambiguities not fixed 3 = Real-time position, ambiguities fixed
xx	Number of satellites in use, 00 to 26.
x.x	Coordinate quality in metres

Field	Description
x.x	Altitude of position marker above/below mean sea level in metres. If no orthometric height is available the local ellipsoidal height will be exported. If the local ellipsoidal height is not available either, the WGS 1984 ellipsoidal height will be exported.
M	Units of altitude as fixed text M
*hh	Checksum
<CR>	Carriage Return
<LF>	Line Feed

Examples

Standard Talker ID

```
$GNGGQ,113615.50,041006,4724.5248556,N,00937.1063059,E,3,12,0.009,1171.281,M*22
$GPGGQ,113615.50,041006,,,,08,,*67
$GLGGQ,113615.50,041006,,,,04,,*77
```

User defined Talker ID = GN

```
$GNGGQ,113805.50,041006,4724.5248541,N,00937.1063044,E,3,13,0.010,1171.281,M*2E
```

F.7

GLL - Geographic Position Latitude/Longitude

Syntax

\$--GLL,IIII.II,a,yyyyy.yy,a,hhmmss.ss,A,a*hh<CR><LF>

Description of fields

Field	Description
\$--GLL	Header including talker ID
IIII.II	Latitude (WGS 1984)
a	Hemisphere, N orth or S outh
yyyyy.yy	Longitude (WGS 1984)
a	E ast or W est
hhmmss.ss	UTC time of position
A	Status A = Data valid V = Data not valid
a	Mode indicator A = Autonomous mode D = Differential mode N = Data not valid
*hh	Checksum
<CR>	C arriage R eturn
<LF>	L ine F eed



The Mode indicator field supplements the Status field. The Status field is set to A for the Mode indicators A and D. The Status field is set to V for the Mode indicator N.

Examples

Standard Talker ID

\$GNGLL,4724.5248556,N,00937.1063059,E,113615.50,A,D*7B

User defined Talker ID = GN

\$GNGLL,4724.5248541,N,00937.1063044,E,113805.50,A,D*7E

F.8

GNS - GNSS Fix Data

Syntax

```
$--GNS,hhmmss.ss,IIII.II,a,yyyyy.yy,a,c--c,xx,x.x,x.x,x.x,x.x,xxxx*hh<CR><LF>
```

Description of fields

Field	Description
\$--GNS	Header including talker ID
hhmmss.ss	UTC time of position
IIII.II	Latitude (WGS 1984)
a	Hemisphere, N orth or S outh
yyyyy.yy	Longitude (WGS 1984)
a	E ast or W est
c--c	Mode indicator N = Satellite system not used in position fix or fix not valid A = Autonomous; navigation fix, no real-time fix D = Differential; real-time position, ambiguities not fixed R = Real-time kinematic; ambiguities fixed
xx	Number of satellites in use, 00 to 99
x.x	HDOP
x.x	Altitude of position marker above/below mean sea level in metres. If no orthometric height is available the local ellipsoidal height will be exported. If the local ellipsoidal height is not available either, the WGS 1984 ellipsoidal height will be exported.

Field	Description
x.x	Geoidal separation in metres
x.x	Age of differential data
xxxx	Differential reference station ID, 0000 to 1023
*hh	Checksum
<CR>	Carriage Return
<LF>	Line Feed

Examples

Standard Talker ID

\$GNGNS,113616.00,4724.5248557,N,00937.1063064,E,RR,12,0.9,1171.279,-
703.398,0.76,0000*6C

\$GPGNS,113616.00,,,,,08,,,,*69

\$GLGNS,113616.00,,,,,04,,,,*79

User defined Talker ID = GN

\$GNGNS,113806.00,4724.5248547,N,00937.1063032,E,R,13,0.7,1171.283,-
703.398,0.76,0000*39

F.9

GSA - GNSS DOP and Active Satellites

Syntax

\$--GSA,a,x,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,x.x,x.x,x.x*hh<CR><LF>

Description of fields

Field	Description
\$--GSA	Header including talker ID
a	Mode M = Manual, forced to operate in 2D or 3D mode A = Automatic, allowed to automatically change between 2D and 3D
x	Mode 1 = Fix not available 2 = 2D 3 = 3D
xx	Numbers of the satellites used in the solution. This field is repeated 12 times. 1 to 32 = PRN numbers of GPS satellites 33 to 64 = Numbers of WAAS and WAAS like satellites 65 to 96 = Slot numbers of GLONASS satellites
x.x	PDOP
x.x	HDOP
x.x	VDOP
*hh	Checksum
<CR>	Carriage Return

Field	Description
<LF>	Line Feed

Examples

Standard Talker ID

\$GNGSA,A,3,01,11,14,17,19,20,24,28,,,,,1.5,0.9,1.2*26

\$GNGSA,A,3,65,66,67,81,,,,,,,,,1.5,0.9,1.2*29

User defined Talker ID = GN

\$GNGSA,A,3,01,11,14,17,19,20,23,24,28,,,65,66,67,81,,,,,,,,,1.2,0.7,1.0*27

F.10

GSV - GNSS Satellites in View

Syntax

\$--GSV,x,x,xx,xx,xx,xxx,xx,.....*hh<CR><LF>

Description of fields

Field	Description
\$--GSV	Header including talker ID
x	Total number of messages, 1 to 4
x	Message number, 1 to 4
xx	Number of theoretically visible satellites according to the current almanac.
xx	PRN (GPS) / Slot (GLONASS) number of satellite
xx	Elevation in degrees, 90 maximum, empty when not tracking
xxx	Azimuth in degrees true North, 000 to 359, empty when not tracking
xx	Signal to Noise Ration C/No in dB, 00 to 99 of L1 signal, null field when not tracking.
...	Repeat set PRN / Slot number, elevation, azimuth and SNR up to four times
*hh	Checksum
<CR>	Carriage Return
<LF>	Line Feed



Satellite information may require the transmission of multiple messages, specified by the total number of messages and the message number.



The fields for the PRN / Slot number, Elevation, Azimuth and SNR form one set. A variable number of these sets are allowed up to a maximum of four sets per message.

Examples

Standard Talker ID

\$GPGSV,3,1,11,01,55,102,51,11,85,270,50,14,31,049,47,17,21,316,46*7A

\$GPGSV,3,2,11,19,31,172,48,20,51,249,50,22,00,061,,23,11,190,42*7E

\$GPGSV,3,3,11,24,11,292,43,25,08,114,,28,14,275,44,,,*,45

\$GLGSV,2,1,06,65,16,055,42,66,64,025,48,67,46,262,42,68,01,245,*64

\$GLGSV,2,2,06,81,52,197,47,83,07,335,,,,,,,,*,68

User defined Talker ID = GN

\$GNGSV,3,1,10,01,55,100,51,11,86,263,50,14,31,049,47,17,22,316,46*65

\$GNGSV,3,2,10,19,30,172,48,20,52,249,51,23,12,190,42,24,12,292,42*6C

\$GNGSV,3,3,10,25,09,114,,28,14,274,44,,,,,,,,*,62

F.11

LLK - Leica Local Position and GDOP

Syntax

\$--LLK,hhmmss.ss,mmddyy,eeeeee.eee,M,nnnnnn.nnn,M,x,xx,x.x,x.x,M*hh<CR><LF>

Description of fields

Field	Description
\$--LLK	Header including talker ID
hhmmss.ss	UTC time of position
mmddyy	UTC date
eeeeee.eee	Grid Easting in metres
M	Units of grid Easting as fixed text M
nnnnnn.nnn	Grid Northing in metres
M	Units of grid Northing as fixed text M
x	Position quality 0 = Fix not available or invalid 1 = No real-time position, navigation fix 2 = Real-time position, ambiguities not fixed 3 = Real-time position, ambiguities fixed
xx	Number of satellites used in computation
x.x	GDOP
x.x	Altitude of position marker above/below mean sea level in metres. If no orthometric height is available the local ellipsoidal height will be exported.
M	Units of altitude as fixed text M

Field	Description
*hh	Checksum
<CR>	Carriage Return
<LF>	Line Feed

Examples

Standard Talker ID

\$GNLLK,113616.00,041006,764413.024,M,252946.774,M,3,12,1.7,1171.279,M*0F

\$GPLLK,113616.00,041006,,,,,08,,, *57

\$GLLLLK,113616.00,041006,,,,,04,,, *47

User defined Talker ID = GN

\$GNLLK,113806.00,041006,764413.021,M,252946.772,M,3,13,1.4,1171.283,M*04

F.12

LLQ - Leica Local Position and Quality

Syntax

\$--LLQ,hhmmss.ss,mmddyy,eeeeee.eee,M,nnnnnn.nnn,M,x,xx,x.x,x.x,M*hh<CR><LF>

Description of fields

Field	Description
\$--LLQ	Header including talker ID
hhmmss.ss	UTC time of position
mmddyy	UTC date
eeeeee.eee	Grid Easting in metres
M	Units of grid Easting as fixed text M
nnnnnn.nnn	Grid Northing in metres
M	Units of grid Northing as fixed text M
x	Position quality 0 = Fix not available or invalid 1 = No real-time position, navigation fix 2 = Real-time position, ambiguities not fixed 3 = Real-time position, ambiguities fixed
xx	Number of satellites used in computation
x.x	Coordinate quality in metres
x.x	Altitude of position marker above/below mean sea level in metres. If no orthometric height is available the local ellipsoidal height will be exported.
M	Units of altitude as fixed text M

Field	Description
*hh	Checksum
<CR>	Carriage Return
<LF>	Line Feed

Examples

Standard Talker ID

\$GNLLQ,113616.00,041006,764413.024,M,252946.774,M,3,12,0.010,1171.279,M*12

\$GPLLQ,113616.00,041006,,,,,08,,, *4D

\$GLLLQ,113616.00,041006,,,,,04,,, *5D

User defined Talker ID = GN

\$GNLLQ,113806.00,041006,764413.021,M,252946.772,M,3,13,0.010,1171.283,M*1A

F.13

RMC - Recommended Minimum Specific GNSS Data

Syntax

\$--RMC,hhmmss.ss,A,IIII.II,a,yyyyy.yy,a,x.x,x.x,xxxxxx,x.x,a,a*hh<CR><LF>

Description of fields

Field	Description
\$--RMC	Header including talker ID
hhmmss.ss	UTC time of position fix
A	Status A = Data valid V = Navigation receiver warning
IIII.II	Latitude (WGS 1984)
a	Hemisphere, N orth or S outh
yyyyy.yy	Longitude (WGS 1984)
a	E ast or W est
x.x	Speed over ground in knots
x.x	Course over ground in degrees
xxxxxx	Date: ddmmyy
x.x	Magnetic variation in degrees
a	E ast or W est
a*hh	Mode Indicator A = Autonomous mode D = Differential mode

Field	Description
	N = Data not valid
<CR>	Carriage Return
<LF>	Line Feed

Examples

Standard Talker ID

\$GNRMC,113616.00,A,4724.5248557,N,00937.1063064,E,0.01,11.43,100406,11.43,E,D*1C

User defined Talker ID = GN

\$GNRMC,113806.00,A,4724.5248547,N,00937.1063032,E,0.00,287.73,100406,287.73,E,D*10

F.14

VTG - Course Over Ground and Ground Speed

Syntax

\$--VTG,x.x,T,x.x,M,x.x,N,x.x,K,a*hh<CR><LF>

Description of fields

Field	Description
\$--VTG	Header including talker ID
x.x	Course over ground in degrees true North, 0.0 to 359.9
T	Fixed text T for true North
x.x	Course over ground in degrees magnetic North, 0.0 to 359.9
M	Fixed text M for magnetic North
x.x	Speed over ground in knots
N	Fixed text N for knots
x.x	Speed over ground in km/h
K	Fixed text K for km/h
a	Mode Indicator A = Autonomous mode D = Differential mode N = Data not valid
*hh	Checksum
<CR>	C arriage R eturn
<LF>	L ine F eed



The Magnetic declination is set in the receiver in **CONFIGURE\Units & Formats, Angle** page.

Examples

Standard Talker ID

\$GNVTG,11.4285,T,11.4285,M,0.007,N,0.013,K,D*3D

User defined Talker ID = GN

\$GNVTG,287.7273,T,287.7273,M,0.002,N,0.004,K,D*3E

F.15

ZDA - Time and Date

Syntax

\$--ZDA,hhmmss.ss,xx,xx,xxxx,xx,xx*hh<CR><LF>

Description of fields

Field	Description
\$--ZDA	Header including talker ID
hhmmss.ss	UTC time
xx	UTC day, 01 to 31
xx	UTC month, 01 to 12
xxxx	UTC year
xx	Local zone description in hours, 00 to ± 13
xx	Local zone description in minutes, 00 to +59
*hh	Checksum
<CR>	Carriage Return
<LF>	Line Feed



This message is given high priority and is output as soon as it is created. Latency is therefore reduced to a minimum.

Examples

Standard Talker ID

\$GPZDA,091039.00,01,10,2003,-02,00*4B

User defined Talker ID = GN

\$GNZDA,113806.00,10,04,2006,02,00*76

AT commands

Hayes Microcomputer Products is a leading manufacturer of modems that has developed a language called the AT command set for controlling digital cellular phones and modems that has become the de facto standard.

List of selected AT commands

The characters in the table below are the most commonly used AT commands when configuring a digital cellular phone or modem. Refer to the manual of the used digital cellular phone or modem for information on which AT commands to use.

General commands

AT command	Description
^M	Inserts a carriage return and send command.
^#	Inserts the phone number as defined in digital cellular phone connection.
~	Inserts a delay of 1/4 second.
^^	Insert character ^.

GSM commands

AT command	Description
^C	Bearer Service: Connection Element.
^S	Bearer Service: Speed including Protocol and NetDataRate.

Glossary of terms

Term	Description
GPS Mode	SmartStation always switches to GPS mode when measuring real-time.
GPS Point	- Points measured by SmartStation in GPS mode. - The coordinates of GPS points are always stored in the WGS84 coordinates system. This is a three dimensional system Cartesian coordinate system with the origin at the centre of the Earth. WGS84 coordinates are given as X,Y,Z Cartesian coordinates, or latitude, longitude and height (above the WGS84 ellipsoid). - GPS Points are stored as class MEAS or class NAV: - Class MEAS: If there are 5 or more satellites and if the distance to the reference is not too great for the prevailing ionospheric conditions, SmartStation will compute a GPS real-time position. The CQ indicator for this type of point is about 0.01 m to 0.05 m. - Class NAV: If the reference stops working, or if the communication link between the reference and SmartStation fails, SmartStation will only compute a navigation position. The CQ indicator for this type of point is about 3 m to 20 m.
TPS Mode	SmartStation always switches to TPS mode when measuring angles and distances.

Term	Description
TPS Point	• Points measured by TPS1200+/TS30/TM30. • Points measured by SmartStation in TPS mode. • The coordinates of TPS points are always stored as local grid coordinates. The coordinates are Eastings, Northings and Height (above a datum).

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