Table of contents

Introduction .................................................................................................................. 4

TPS Section

GSI data format ......................................................................................................... 5
GSI word information ................................................................................................. 6
Online command structure ......................................................................................... 7

TPS100 series (TC400/600/800/900) .................................................................... 8
  SET .......................................................................................................................... 9
  CONF ..................................................................................................................... 11
  PUT ....................................................................................................................... 13
  GET ....................................................................................................................... 14
  Remote Stake out ................................................................................................. 15
  Warnings and Errors ............................................................................................ 16

TPS110C/300/400/700 series ................................................................................. 17
  SET ....................................................................................................................... 18
  CONF ..................................................................................................................... 21
  PUT ....................................................................................................................... 25
  GET ....................................................................................................................... 27
  Telescope positioning ......................................................................................... 29
  Warnings and Errors ............................................................................................ 29

TPS1000/1100/2000/5000 series ........................................................................... 30
  SET ....................................................................................................................... 31
  CONF ..................................................................................................................... 33
  PUT ....................................................................................................................... 35
  GET ....................................................................................................................... 36
  Telescope positioning ......................................................................................... 38
  Warnings and Errors ............................................................................................ 39

DNA Section

GSI data format ......................................................................................................... 40
GSI word information ................................................................................................. 41
Word list .................................................................................................................. 41
Introduction

A large set of interfacing commands support the Leica TPS Total Stations and Digital Levels to allow direct access to computers and data loggers via RS232 serial interface.

The Leica Geo Serial Interface (GSI) is a general purpose, serial data interface for bi-directional communication between the instrument and the computer. GSI uses a simple command structure to read/write values from/to the sensor. Global and instrument specific Word Indexes (WI) are used to specify various data types. GSI provides specific sets of commands adapted to the functionality of the various instrument series.

In addition to the former Online Guide "WILD INSTRUMENTS ONLINE", this User Guide focuses the Leica Series of Total Stations TPS100/110C/300/400/700/1000/1100/2000/5000 and of the Digital Levels DNA03/DNA10. The guide is designed as a simple command listing and therefore basic aspects of serial data communications will not be covered. For detailed information and advice on GSI communication, we strongly recommend to consult the "WILD INSTRUMENTS ONLINE" guide.

The document is divided into a section for TPS and a section for DNA instruments.
**TPS Section**

**GSI data format**

GSI data is transmitted in blocks with each block ending with a terminator (CR or CR/LF). Every block consists of several data words (see the examples below). The data word begins with a two character Word Index, the WI code, specifying the data type within this block. The GSI-8 block has in total 16 characters, consisting of 7 information characters (e.g. WI, sign), 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 IDs.

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).

**Example 1: GSI-8**

```
|<----- Word 1 -----|<----- Word 2-----|<----- Word 3----- |
1234567890123456  (16 characters per word)
110001+0000A110 81..00+00005387 82..00-0000992
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
```

**GSI-8 data word structure:**

- Pos. 1-2: Word Index (WI) e.g. "11" (WI for PtID)
- Pos. 3-6: Information related to data e.g. "0003" (block number in word 1)
- Pos. 7: Sign e.g. "+" or "-"
- Pos. 8-15: Data (8 digits) e.g. "000000000PNC0058" (PtID)
- Pos. 16: Blank (= separating character)

**Example 2: GSI-16**

```
|<-------- Word 1 --------|<-------- Word 2 --------|<-------- Word 3 -------- |
123456789012345678901234  (24 characters per word)
*110001+0000000000PNC0055 21.002+0000000013384650 22.002+000000005371500
*110002+0000000000PNC0056 21.002+0000000012802530 22.002+000000005255000
*110003+0000000000PNC0057 21.002+000000001222360 22.002+000000005433800
*110004+0000000000PNC0058 21.002+0000000010573550 22.002+000000005817600
*110005+0000000000PNC0059 21.002+000000009983610 22.002+000000005171400
```

**GSI-16 data word structure:**

- Pos. 1-2: Word Index (WI) e.g. "11"; WI code
- Pos. 3-6: Information related to data e.g. "002"; PtID code
- Pos. 7: Sign e.g. "+" or "-
- Pos. 8-23: GSI-16 data (16 digits) e.g. "000000000PNC0058"; PtID
- Pos. 16/24: Blank (= separating character)
### TPS Section

#### GSI word information

<table>
<thead>
<tr>
<th>Position</th>
<th>Explanation</th>
<th>Applicable for</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>No significance</td>
<td>All words</td>
</tr>
<tr>
<td>4</td>
<td><strong>AUTOMATIC INDEX INFORMATION</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0: Automatic index OFF</td>
<td>All words containing angle information</td>
</tr>
<tr>
<td></td>
<td>1: Automatic index OPERATING</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3: Automatic index OPERATING</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td><strong>INPUT MODE</strong></td>
<td>Measured data</td>
</tr>
<tr>
<td></td>
<td>0: Original measured values transferred from the instrument</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1: Manual input from keyboard</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2: Measured value, Hz-Correction ON</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3: Measured value, Hz-Correction OFF</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4: Result of special function</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td><strong>UNITS</strong></td>
<td>Measured data</td>
</tr>
<tr>
<td></td>
<td>0: Meter (last digit: 1mm)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1: Feet (last digit: 1/1000ft)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2: 400 gon</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3: 360° decimal</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4: 360° sexagesimal</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5: 6400 mil</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6: Meter (last digit: 1/10mm)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>7: Feet (last digit: 1/10'000ft)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>8: Meter (last digit: 1/100mm)</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td><strong>SIGN</strong></td>
<td>Measured data</td>
</tr>
<tr>
<td></td>
<td>+: Positive value</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-: Negative value</td>
<td></td>
</tr>
<tr>
<td>8-15</td>
<td><strong>DATA</strong></td>
<td>Measured data</td>
</tr>
<tr>
<td></td>
<td>(8-23) Data includes a sequence of 8(16) numerical or alphanumerical characters.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Note that certain data blocks are allowed to carry more than 1 value (e.g. PPM/MM). Those data are automatically transferred with a sign before each single value.</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td><strong>SEPARATING CHARACTER</strong></td>
<td>All words</td>
</tr>
<tr>
<td></td>
<td>(24) : Blank</td>
<td></td>
</tr>
</tbody>
</table>

[Tab.1]
Online command structure

GSI online commands represent a simple syntax structure consisting of four basic commands. To access a wide range of settings or values, commands can be enhanced with a limited sequence of word indexes (WI) and parameters. Following, a short summary explaining the meaning of the basic commands continued with some examples.

- **SET** Set instrument parameters
- **CONF** Read internal parameter settings
- **PUT** Write/change values within the Total station
- **GET/I/...** Get instant values from the Total Station (last valid value)
- **GET/M/...** Release measurement and get measured values from the Total Station

Examples:

**SET commands**
SYNTAX: SET/<set spec>/<parameter><CR/LF>
EXAMPLE: SET/30/0
RESPONSE: ?

| Instrument BEEP: | SET/30/0 OFF (disable) | SET/30/1 ON (enable) |

**CONF commands**
SYNTAX: CONF/<conf spec><CR/LF>
EXAMPLE: CONF/30
RESPONSE: 0030/000

Above CONF/30 reads the BEEP setting
0030/0000 Beep disabled
0030/0001 Beep enabled

**PUT commands**
SYNTAX: PUT/<put spec> <Value>_<CR/LF>
EXAMPLE: PUT/11....+00000012
RESPONSE: ?
CONFIRMATION: <CR/LF>

Writes Pointnumber PUT/11....+00000012 → PtNo “1234”

* Make sure you put a space (_,) behind <Value>!

**GET commands**
SYNTAX: GET/n/WI<get spec><CR/LF>
EXAMPLE: GET/M/WI21
RESPONSE: 21.102+12149400

<table>
<thead>
<tr>
<th>Read Hz-Angle value</th>
<th>GET/I/WI21 → 21.104+12149400</th>
</tr>
</thead>
<tbody>
<tr>
<td>Read Hz-, and V-Angles</td>
<td>GET/I/WI21/WI22 → 21.104+12149400, 22.104+08832420</td>
</tr>
</tbody>
</table>
TPS100 Series (TC400/600/800/900)

The TPS100 Series were introduced in 1996/97. These Total Stations were the first series supporting an enhanced set of GSI interfacing commands. The additional functionality conducted to increasing operational benefit, compared to its predecessor TC500 which is described in the WILD INSTRUMENTS ONLINE, Appendix E.

Supported Instruments:
- TC403L, TC600, TC800 (Firmware Version 2.13 and higher)
- TC605/L, TC805/L TC905/L (collectively the “TCx05” series)

The following command listing is split into separate sections for each basic command (SET, CONF, PUT, GET). Some of the listed features may require specially equipped instruments (e.g. instruments with Laser Plummet or EGL). For detailed description of single functions, we recommend to consult the corresponding User Manual.

Low Level commands
SYNTAX: <command>CR/LF
RESPONSE: ?

<table>
<thead>
<tr>
<th>&lt;Command&gt;</th>
<th>a</th>
<th>b</th>
<th>c</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Powers on the instrument
Powers off the instrument
Clears a distance measurement

Restrictions:
1) Applies to TCx05 instruments only
2) Applies to TCx00/403 instruments only
3) Applies to instruments equipped with EGL (Electronic Guide Light) only
4) Applies to instruments equipped with Laser Plummet only
**Syntax:**  SET/<SET SPEC>/<Parameter><CR/LF>

<table>
<thead>
<tr>
<th>&lt;SET SPEC&gt;</th>
<th>FUNCTION</th>
<th>&lt;PARAMETER&gt;</th>
<th>SETTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>BEEP</td>
<td>0</td>
<td>OFF</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>ON</td>
</tr>
<tr>
<td>32</td>
<td>Display contrast</td>
<td>0</td>
<td>Low contrast</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>Medium contrast</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>Medium to high contrast</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>High contrast</td>
</tr>
<tr>
<td>34</td>
<td>BEEP @ 90°</td>
<td>0</td>
<td>OFF</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>ON</td>
</tr>
<tr>
<td>40</td>
<td>Angle UNIT</td>
<td>0</td>
<td>GON</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>Degree decimal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>Degree sexagesimal</td>
</tr>
<tr>
<td>41</td>
<td>Distance UNIT</td>
<td>0</td>
<td>Meter</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>Feet</td>
</tr>
<tr>
<td>44</td>
<td>V angle READING</td>
<td>0</td>
<td>Zenith</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>Horizontal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>Slope in percent</td>
</tr>
<tr>
<td>49 ¹)</td>
<td>Time/Date format</td>
<td>0</td>
<td>Form 1 (am/pm)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>Form 2 (24 hours)</td>
</tr>
<tr>
<td>50</td>
<td>Angle rounding</td>
<td>0</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(refer to manual)</td>
<td></td>
</tr>
<tr>
<td>70</td>
<td>Baudrate</td>
<td>0</td>
<td>300 Baud</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>600 Baud</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>1200 Baud</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>2400 Baud</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>4800 Baud</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
<td>9600 Baud</td>
</tr>
<tr>
<td>71</td>
<td>Parity</td>
<td>0</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>Odd</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>Even</td>
</tr>
<tr>
<td>73</td>
<td>Terminator</td>
<td>0</td>
<td>CR</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>CR/LF</td>
</tr>
<tr>
<td>76</td>
<td>Data recording device</td>
<td>0</td>
<td>Internal Memory</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>RS232</td>
</tr>
<tr>
<td>80 ³)</td>
<td>EGL activity</td>
<td>0</td>
<td>OFF</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>ON</td>
</tr>
<tr>
<td>81 ³)</td>
<td>EGL intensity</td>
<td>0</td>
<td>Poor</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>Strong</td>
</tr>
<tr>
<td>95</td>
<td>AutoOFF</td>
<td>0</td>
<td>OFF</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>ON</td>
</tr>
<tr>
<td>102 ⁴)</td>
<td>Laser plummet</td>
<td>0</td>
<td>OFF</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>ON</td>
</tr>
</tbody>
</table>

[...cont.]
### Example:
Intended action:  
Change Display contrast to “HIGH” contrast
Command:  
SET/32/3<CR/LF>
Response:  

<table>
<thead>
<tr>
<th>SET SPEC</th>
<th>FUNCTION</th>
<th>PARAMETER</th>
<th>SETTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>103</td>
<td>Laser plummet availibility</td>
<td>0</td>
<td>No</td>
</tr>
<tr>
<td>1</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>135</td>
<td>RS232 recording mask</td>
<td>0</td>
<td>Mask1 (11, 21, 22, ...)</td>
</tr>
<tr>
<td>1</td>
<td>Mask2 (11, ..., 81, 82, 83)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>136</td>
<td>Data transfer output format</td>
<td>0</td>
<td>Mask1</td>
</tr>
<tr>
<td>1</td>
<td>Mask2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Activates user format #1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Activates user format #2 (refer to manual)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>137</td>
<td>RS232 format length</td>
<td>0</td>
<td>GSI-8</td>
</tr>
<tr>
<td>1</td>
<td>GSI-16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>138</td>
<td>Quick code recording</td>
<td>0</td>
<td>Before measurement</td>
</tr>
<tr>
<td>1</td>
<td>After measurement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>149</td>
<td>Display MASK</td>
<td>0</td>
<td>WI 11, 21, 22, 31</td>
</tr>
<tr>
<td>1</td>
<td>WI 21, 22, 32, 33</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>WI 11, 81, 82, 83</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>WI 11, 41, 32, 87</td>
<td></td>
<td></td>
</tr>
<tr>
<td>160</td>
<td>Setting measured distance to invalid</td>
<td>0</td>
<td>Set distance (WI31,32,33) and coordinates (WI81,82,83) to invalid</td>
</tr>
<tr>
<td>171</td>
<td>Direction of horizontal circle reading (Hz-Angle)</td>
<td>0</td>
<td>Clockwise</td>
</tr>
<tr>
<td>1</td>
<td>Counterclockwise</td>
<td></td>
<td></td>
</tr>
<tr>
<td>177</td>
<td>Compensator</td>
<td>0</td>
<td>OFF</td>
</tr>
<tr>
<td>1</td>
<td>ON</td>
<td></td>
<td></td>
</tr>
<tr>
<td>178</td>
<td>Hz compensator</td>
<td>0</td>
<td>OFF</td>
</tr>
<tr>
<td>1</td>
<td>ON (refer to manual)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>179</td>
<td>Hz collimation</td>
<td>0</td>
<td>OFF</td>
</tr>
<tr>
<td>1</td>
<td>ON (refer to manual)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

[Tab.2]
### CONF Syntax: CONF/<CONF SPEC><CR/LF>

<table>
<thead>
<tr>
<th>&lt;CONF SPEC&gt;</th>
<th>FUNCTION</th>
<th>RESPONSE</th>
<th>CONFIGURATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>BEEP</td>
<td>0030/0000</td>
<td>OFF</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0030/0001</td>
<td>ON</td>
</tr>
<tr>
<td>32</td>
<td>Display contrast</td>
<td>0032/0000</td>
<td>Low contrast</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0032/0001</td>
<td>Medium contrast</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0032/0002</td>
<td>Medium to high contrast</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0032/0003</td>
<td>High contrast</td>
</tr>
<tr>
<td>34</td>
<td>BEEP @ 90°</td>
<td>0034/0000</td>
<td>OFF</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0034/0001</td>
<td>ON</td>
</tr>
<tr>
<td>40</td>
<td>Angle UNIT</td>
<td>0040/0000</td>
<td>GON</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0040/0001</td>
<td>Degree decimal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0040/0002</td>
<td>Degree sexagesimal</td>
</tr>
<tr>
<td>41</td>
<td>Distance UNIT</td>
<td>0041/0000</td>
<td>Meter</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0041/0001</td>
<td>Feet</td>
</tr>
<tr>
<td>44</td>
<td>V angle READING</td>
<td>0044/0000</td>
<td>Zenith</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0044/0001</td>
<td>Horizontal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0044/0002</td>
<td>Slope in percent</td>
</tr>
<tr>
<td>49 1)</td>
<td>Time/Date format</td>
<td>0049/0000</td>
<td>Form1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0049/0001</td>
<td>Form2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(refer to manual)</td>
</tr>
<tr>
<td>50</td>
<td>Angle rounding</td>
<td>0050/0000</td>
<td>low</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0050/0001</td>
<td>medium</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0050/0002</td>
<td>high</td>
</tr>
<tr>
<td>70</td>
<td>Baudrate</td>
<td>0070/0000</td>
<td>300 Baud</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0070/0001</td>
<td>600 Baud</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0070/0002</td>
<td>1200 Baud</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0070/0003</td>
<td>2400 Baud</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0070/0004</td>
<td>4800 Baud</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0070/0005</td>
<td>9600 Baud</td>
</tr>
<tr>
<td>71</td>
<td>Parity</td>
<td>0071/0000</td>
<td>NONE</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0071/0001</td>
<td>ODD</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0071/0002</td>
<td>EVEN</td>
</tr>
<tr>
<td>73</td>
<td>Terminator</td>
<td>0073/0000</td>
<td>CR</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0073/0001</td>
<td>CR/LF</td>
</tr>
<tr>
<td>76</td>
<td>Data recording device</td>
<td>0076/0000</td>
<td>Internal Memory</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0076/0001</td>
<td>RS232</td>
</tr>
<tr>
<td>80 3)</td>
<td>EGL activity</td>
<td>0080/0000</td>
<td>OFF</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0080/0001</td>
<td>ON</td>
</tr>
<tr>
<td>81 3)</td>
<td>EGL intensity</td>
<td>0081/0000</td>
<td>poor</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0081/0001</td>
<td>medium</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0081/0002</td>
<td>strong</td>
</tr>
<tr>
<td>90</td>
<td>Battery level</td>
<td>0090/000n</td>
<td>N[1=empty...9=full]</td>
</tr>
<tr>
<td>91</td>
<td>Instr. Temperature</td>
<td>0091/00nn</td>
<td>nn&lt;100: Temp in °C</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>nn&gt;200: nn-255= temperature in -°C</td>
</tr>
</tbody>
</table>

[...cont.]

<table>
<thead>
<tr>
<th>CONF SPEC</th>
<th>FUNCTION</th>
<th>RESPONSE</th>
<th>CONFIGURATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>95</td>
<td>AutoOFF</td>
<td>0095/0000</td>
<td>OFF</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0095/0001</td>
<td>ON</td>
</tr>
<tr>
<td>102 (^1)</td>
<td>Laser plummet</td>
<td>0102/0000</td>
<td>OFF</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0102/0001</td>
<td>ON</td>
</tr>
<tr>
<td>103 (^2)</td>
<td>Laser plummet availability</td>
<td>0103/0000</td>
<td>Not available</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0103/0001</td>
<td>Available</td>
</tr>
<tr>
<td>135</td>
<td>RS232 recording mask</td>
<td>0135/0000</td>
<td>Mask1 (11, 21, 22, ...)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0135/0001</td>
<td>Mask2 (11, ..., 81, 82, 83)</td>
</tr>
<tr>
<td>136</td>
<td>Data transfer output format</td>
<td>0136/0000</td>
<td>Mask1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0136/0001</td>
<td>Mask2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0136/0002</td>
<td>Activates user format #1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0136/0003</td>
<td>Activates user format #2 (refer to manual)</td>
</tr>
<tr>
<td>FORM/n</td>
<td>Check format name; n:{1..4}</td>
<td>&quot;Format_1&quot;</td>
<td>e.g. CONF/FORM/1 -&gt; .GSI 2&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&quot;Format_n&quot;</td>
<td></td>
</tr>
<tr>
<td>137</td>
<td>RS232 format length</td>
<td>0137/0000</td>
<td>GSI-8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0137/0001</td>
<td>GSI-16</td>
</tr>
<tr>
<td>138 (^3)</td>
<td>Quick code recording</td>
<td>0138/0000</td>
<td>Before measurement</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0138/0001</td>
<td>After measurement</td>
</tr>
<tr>
<td>149</td>
<td>Display MASK</td>
<td>0149/0000</td>
<td>WI 11, 21, 22, 31</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0149/0001</td>
<td>WI 21, 22, 32, 33</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0149/0002</td>
<td>WI 11, 81, 82, 83</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0149/0003</td>
<td>WI 11, 41, 32, 87</td>
</tr>
<tr>
<td>160</td>
<td>Validity of measured distance</td>
<td>0160/0000</td>
<td>Invalid DIST</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0160/0001</td>
<td>Valid DIST</td>
</tr>
<tr>
<td>161</td>
<td>EDM measuring mode</td>
<td>0161/0000</td>
<td>IR Fine mode</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0161/0001</td>
<td>IR Rapid mode</td>
</tr>
<tr>
<td>171</td>
<td>Direction of horizontal circle reading (Hz-Angle)</td>
<td>0171/0000</td>
<td>Clockwise</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0171/0001</td>
<td>Counterclockwise</td>
</tr>
<tr>
<td>177</td>
<td>Compensator</td>
<td>0177/0000</td>
<td>Off</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0177/0001</td>
<td>On</td>
</tr>
<tr>
<td>178</td>
<td>Hz compensator</td>
<td>0178/0000</td>
<td>Off</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0178/0001</td>
<td>On</td>
</tr>
<tr>
<td>179</td>
<td>Hz collimation</td>
<td>0179/0000</td>
<td>Off</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0179/0001</td>
<td>On</td>
</tr>
<tr>
<td>180</td>
<td>Instrument Series</td>
<td>0180/0004</td>
<td>TC403</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0180/0006</td>
<td>TC600/605</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0180/0008</td>
<td>TC800/805</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0180/0009</td>
<td>TC905</td>
</tr>
<tr>
<td>181</td>
<td>Instrument Type</td>
<td>0181/0000</td>
<td>T (Theodolite)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0181/0001</td>
<td>TC (Total Station)</td>
</tr>
<tr>
<td>182</td>
<td>Firmware version</td>
<td>0182/0217</td>
<td>e.g. Version 2.17</td>
</tr>
</tbody>
</table>

[Tab.3]
## PUT

Syntax: SET/<PUT SPEC>/<Parameter>_<CR/LF>

<table>
<thead>
<tr>
<th>&lt;PUT SPEC&gt;</th>
<th>FUNCTION</th>
<th>Access/Example</th>
</tr>
</thead>
</table>
| 11         | Set Pointnumber | PUT/11….+00001234_<CR/LF>  
              |          | puts PtID “1234” |
| 21         | Hz Angle   | PUT/21…n+10000000_<CR/LF>  
              |          | n[2..4]; angle units must be specified  
              |          | for n=2; puts Hz=“100.0000 gon” |
| 58         | Prism const | PUT/58….+00000200_<CR/LF>  
              |          | puts reflector constant to “20mm” |
| 59         | PPM        | PUT/59….+02200000_<CR/LF>  
              |          | puts PPM correction to “220” |
| 84         | Station Easting | PUT/84…n+00100000_<CRLF>  
              |          | n[0..1]; distance unit must be specified  
              |          | for n=0; puts Easting=“100.000 m” |
| 85         | Station Northing | PUT/85…n+00100000_<CRLF>  
              |          | n[0..1]; distance unit must be specified  
              |          | for n=0; puts Northing=“100.000 m” |
| 86         | Station Elevation | PUT/86…n+00045000_<CRLF>  
              |          | n[0..1]; distance unit must be specified  
              |          | for n=0; puts Elevation=“45.000 m” |
| 87         | Reflector height | PUT/87…n+00001700_<CRLF>  
              |          | n[0..1]; distance unit must be specified  
              |          | for n=0; puts hr=“1.700 m” |
| 88         | Instrument height | PUT/88…n+00001500_<CRLF>  
              |          | n[0..1]; distance unit must be specified  
              |          | for n=0; puts hi=“1.500 m” |
### GET Syntax:

\[ \text{GET/n/WI<GET SPEC>/<Parameter><CR/LF> \} } \]

<table>
<thead>
<tr>
<th>&lt;GET SPEC&gt;</th>
<th>FUNCTION</th>
<th>Access/Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>Pointnumber</td>
<td>GET/M/WI11&lt;CR/LF&gt;; e.g. 11....+00000H66 (\rightarrow) PtNo=&quot;H66&quot;</td>
</tr>
<tr>
<td>21</td>
<td>Hz Angle</td>
<td>GET/M/WI21&lt;CR/LF&gt;; e.g. 21.102+17920860 (\rightarrow) Hz „179.086“ gon</td>
</tr>
<tr>
<td>22</td>
<td>Vertical Angle</td>
<td>GET/M/WI22&lt;CR/LF&gt;; e.g. 22.102+07567500 (\rightarrow) V: „75.675“ gon</td>
</tr>
<tr>
<td>31</td>
<td>Slope distance</td>
<td>GET/M/WI31&lt;CR/LF&gt;; e.g. 31..00+00003387 (\rightarrow) Sdist: „3.387“ m</td>
</tr>
<tr>
<td>32</td>
<td>Horizontal distance</td>
<td>GET/M/WI32&lt;CR/LF&gt;; e.g. 32..00+00003198 (\rightarrow) Hdist: „3.198“ m</td>
</tr>
<tr>
<td>33</td>
<td>Height difference</td>
<td>GET/M/WI33&lt;CR/LF&gt;; e.g. 33..00+00001119 (\rightarrow) Hdif: „1.119“ m</td>
</tr>
<tr>
<td>51</td>
<td>PPM and Prism constant</td>
<td>GET/I/WI51; e.g. 51....+0220+002 (\rightarrow) PPM „220“ and Prism const „2“ mm</td>
</tr>
<tr>
<td>58</td>
<td>Prism constant</td>
<td>GET/I/WI58; e.g. 58..16+00000020 (\rightarrow) Prism „2“ mm</td>
</tr>
<tr>
<td>59</td>
<td>PPM</td>
<td>GET/I/WI59; e.g. 59..16+02200000 (\rightarrow) PPM „220“</td>
</tr>
<tr>
<td>81</td>
<td>Target Easting (E)</td>
<td>GET/M/WI81; e.g. 81..00+01999507 (\rightarrow) E: „1999.507“ m</td>
</tr>
<tr>
<td>82</td>
<td>Target Northing (N)</td>
<td>GET/M/WI82; e.g. 82..00-00213159 (\rightarrow) N: „-2139.159“ m</td>
</tr>
<tr>
<td>83</td>
<td>Target Elevation (H)</td>
<td>GET/M/WI83; e.g. 83..00+00032881 (\rightarrow) H: „32.881“ m</td>
</tr>
<tr>
<td>84</td>
<td>Station Easting (E0)</td>
<td>GET/I/WI84; e.g. 84..11+00393700 (\rightarrow) E: „393.700“ m</td>
</tr>
<tr>
<td>85</td>
<td>Station Northing (N0)</td>
<td>GET/I/WI85; e.g. 85..11+06561220 (\rightarrow) N: „6561.220“ m</td>
</tr>
<tr>
<td>86</td>
<td>Station Height (H0)</td>
<td>GET/I/WI86; e.g. 86..11+00065618 (\rightarrow) H: „65.618“ m</td>
</tr>
<tr>
<td>87</td>
<td>Reflector height (hr)</td>
<td>GET/I/WI87; e.g. 87..11+00001700 (\rightarrow) hr: „1.700“ m</td>
</tr>
<tr>
<td>88</td>
<td>Instrument height (hi)</td>
<td>GET/I/WI88; e.g. 88..11+00001550 (\rightarrow) hi: „1.550“ m</td>
</tr>
</tbody>
</table>

**GETDATE** \(^1\)

Read date

\[ \text{GETDATE}; (dd:mm:yy) \]

\(\rightarrow\) 07/02/00

**GETTIME** \(^1\)

Read time

\[ \text{GETTIME}; (hh:mm:ss) \]

\(\rightarrow\) 04:06:58p

[Tab.5]
Remote Stake Out

The TCx05 series support a remote set-out method for surveyors using handheld or external recording devices. Stake out data can be transferred from via RS232 interface to the instrument's onboard Remote Stake Out application. The following procedure describes a possible way for successful field stake out. [Note: "_" represents a space character]

- Remote Set Station

<table>
<thead>
<tr>
<th>Start Remote S/O</th>
<th>SETOUT&lt;CR/LF&gt;</th>
<th>Calls onboard S/O</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set Station Pointnumber</td>
<td>PUT/16….+000S7000_,&lt;CRLF&gt;</td>
<td>e.g. “S7000”</td>
</tr>
<tr>
<td>Set Station Easting</td>
<td>PUT/84….0+00100000_,&lt;CRLF&gt;</td>
<td>e.g. “100.000”[m]</td>
</tr>
<tr>
<td>Set Station Northing</td>
<td>PUT/85….0+00100000_,&lt;CRLF&gt;</td>
<td>e.g. “100.000”[m]</td>
</tr>
<tr>
<td>Set Station Height</td>
<td>PUT/86….0+00050000_,&lt;CRLF&gt;</td>
<td>e.g. “50.000”[m]</td>
</tr>
<tr>
<td>Set Instrument Height</td>
<td>PUT/88….0+00001500_,&lt;CRLF&gt;</td>
<td>e.g. “1.500”[m]</td>
</tr>
</tbody>
</table>

- Remote Set Orientation

| Set Hz-Orientation | PUT/21…2+00000000_,<CRLF> | e.g. “0.000” gon (respectively Hz=0) |

- Remote Target Point setting out

| Set Target Pointnumber | PUT/11….+000S7000_,<CRLF> | e.g. “S7000”            |
| Set stakeout bearing   | PUT/24….2+00102000_,<CRLF> | e.g. “102.000”[m]      |
| Set stakeout distance  | PUT/34….0+00103000_,<CRLF> | e.g. “103.000”[m]      |
| Set stakeout height    | PUT/83….0+00053000_,<CRLF> | e.g. “53.000”[m]       |
| Set Reflector height   | PUT/87….+00001500_,<CRLF> | e.g. “1.500”[m]        |

Release DIST or ALL key to measure a distance
Terminating remote S/O X<CR/LF> Quit remote S/O

For further information, please refer to the corresponding instrument manual. Refer also to „Basic Knowledge“ BK99/44.
### Warnings and Errors

<table>
<thead>
<tr>
<th>Message ID</th>
<th>Meaning</th>
<th>Possible reasons</th>
</tr>
</thead>
<tbody>
<tr>
<td>@W100</td>
<td>Instrument busy</td>
<td>Any other device is still interfacing the instrument; check interfacing priorities</td>
</tr>
<tr>
<td>@W127</td>
<td>Invalid command</td>
<td>The string sent to the TC could not be decoded properly or does not exist; check the syntax, or ... Input buffer overflow (max. 100 characters)</td>
</tr>
<tr>
<td>@W139</td>
<td>EDM error</td>
<td>The EDM could not proceed the requested measurement; no or weak signal; Check EDM mode and target</td>
</tr>
<tr>
<td>@W158</td>
<td>One of the instruments sensor corrections could not be assigned.</td>
<td>Instrument is not stable or levelled; Tilt is out of range (e.g. when tilt sensor is out of range)</td>
</tr>
<tr>
<td>@E101</td>
<td>Value out of range</td>
<td>Check parameter range</td>
</tr>
<tr>
<td>@E103</td>
<td>Invalid Value</td>
<td>No valid value; Check parameter range</td>
</tr>
<tr>
<td>@E112</td>
<td>Battery low</td>
<td>Low Battery; check voltage</td>
</tr>
<tr>
<td>@E114</td>
<td>Invalid command</td>
<td>No valid command; check the syntax</td>
</tr>
<tr>
<td>@E117</td>
<td>Initialisation error</td>
<td>Contact service</td>
</tr>
<tr>
<td>@E119</td>
<td>Temperature out of range</td>
<td>Refer to manual for temperature range</td>
</tr>
<tr>
<td>@E121</td>
<td>Parity error</td>
<td>Wrong parity set; check Com-Port settings</td>
</tr>
<tr>
<td>@E122</td>
<td>RS232 time-out</td>
<td>The instrument was waiting for a response for the last 2 seconds</td>
</tr>
<tr>
<td>@E124</td>
<td>RS232 overflow</td>
<td>RS232 overflow; check Com-Port settings</td>
</tr>
<tr>
<td>@E151</td>
<td>Compensator error</td>
<td>Inclination Error; check instrument setup or switch of the compensator</td>
</tr>
<tr>
<td>@E155</td>
<td>EDM intensity</td>
<td>Weak signal; target is most likely outside the field of view</td>
</tr>
<tr>
<td>@E156</td>
<td>EDM system error</td>
<td>Contact service</td>
</tr>
<tr>
<td>@E158</td>
<td>One of the instruments sensor corrections could not be assigned.</td>
<td>Instrument is not stable, not levelled or suffering of vibration; Tilt is out of range (e.g. when tilt sensor is out of range); Level instrument or switch off compensator</td>
</tr>
<tr>
<td>@E190</td>
<td>General hardware error</td>
<td>Contact service</td>
</tr>
<tr>
<td>@E197</td>
<td>Initialization error</td>
<td>Contact service</td>
</tr>
</tbody>
</table>

[Tab.6]
TPS110C/300/400/700 series

The TPS300 and TPS700 series were introduced in 1998/99/2001, TPS400 in 2002; TPS110C and 410C in 2003. Featuring the latest generation technology, these instruments have further increased their interfacing capabilities. Considering the new firmware and application platform, lots of new commands have been added or existing commands being changed compared to its predecessors, the TPS100 Total Stations. However, basic functions use the same commands and therefore most of the existing TPS100 interfacing applications will still support the TPS110C/300/400/700 series.

Supported Instruments:

- TCR110C
- TC302, TC303, TC305, TC307
- TCR302, TCR303, TCR305, TCR307
- TC403, TC405, TC407, TC410
- TCR403, TCR405, TCR407, TCR410
- TCR403power, TCR405power, TCR407power
- TC702, TC703, TC705
- TCR702, TCR703, TCR705
- TC(R)702 auto, TC(R)703 auto, TC(R)705 auto

The following command listing is split into separate sections for each basic command (SET, CONF, PUT, GET). Some of the listed features may require specially equipped instruments (e.g. Reflectorless EDM → RL). For detailed description of single functions, we recommend to consult the corresponding User Manual.

Low Level commands

SYNTAX: <command>CR/LF
SYNTAX: BEEP/<value>

<table>
<thead>
<tr>
<th>&lt;Command&gt;:</th>
<th>a</th>
<th>b</th>
<th>c</th>
<th>&lt;Value&gt;:</th>
<th>&lt;Value&gt;:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Powers on the instrument</td>
<td>Powers off the instrument</td>
<td>Clears a distance measurement</td>
<td>BEEP/0</td>
<td>Short beep</td>
</tr>
<tr>
<td></td>
<td>BEEP/1</td>
<td>Long beep</td>
<td>BEEP/2</td>
<td>Alarm beep (short beep, 3 times)</td>
<td></td>
</tr>
</tbody>
</table>

Restrictions:

1) TCR models ONLY
2) Instruments equipped with EGL3 only
3) TC(R) auto models ONLY
## SET

Syntax: `SET/<SET SPEC>/<Parameter><CR/LF>`

<table>
<thead>
<tr>
<th><code>&lt;SET SPEC&gt;</code></th>
<th><code>FUNCTION</code></th>
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<td>0050/0003</td>
<td>.nnn0</td>
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<td>0050/0004</td>
<td>.nnnn</td>
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<th>FUNCTION</th>
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<th>CONFIGURATION</th>
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<tr>
<td>Distance; displayed decimals</td>
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<td>0051/0001</td>
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<td>0051/0002</td>
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<td>0051/0003</td>
<td>.000 .n0 .nn0</td>
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<td>0051/0004</td>
<td>.000 .n0 .nn0 .nn(n)</td>
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<td>Angle rounding</td>
<td>0055/00nn</td>
<td>n:[1..10]</td>
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<td>Distance rounding</td>
<td>0056/00nn</td>
<td>n:[1..10]</td>
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<td>0070/0000</td>
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<td>0070/0001</td>
<td>600 Baud (not available)</td>
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<td>0070/0002</td>
<td>1200 Baud (not available)</td>
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<td>0070/0003</td>
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<td>4800 Baud</td>
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<td>0070/0005</td>
<td>9600 Baud</td>
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<td>0070/0006</td>
<td>19200 Baud</td>
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<td>0075/0001</td>
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<tr>
<td>Data recording device</td>
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<td>RS232</td>
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<td>Timeout delay</td>
<td>[0..50]</td>
<td>Increase of 10ms/unit</td>
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<td>Battery level</td>
<td>0090/00nn</td>
<td>n:[0..10]</td>
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<td>0: Empty</td>
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<td>10: Full</td>
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<tr>
<td>Temperature</td>
<td>0091/0nnn</td>
<td>[0..±100] °C</td>
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<td>Auto-OFF</td>
<td>0095/0000</td>
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<td>Laser plummet</td>
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<td>Laser plummet availability</td>
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<td>0103/0001</td>
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<td>0105/0nnn</td>
<td>N: [0..100]</td>
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<td>0: Low</td>
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<td>100: bright</td>
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<td>Display heat</td>
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<td>0106/0001</td>
<td>On</td>
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<tr>
<td>Status of display Heat Activity</td>
<td>0107/0000</td>
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<td>Orientation face definition</td>
<td>0120/0000</td>
<td>Face I</td>
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<td>0120/0001</td>
<td>Face II</td>
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<tr>
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<td>1</td>
<td>Turn</td>
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<td>122 Orientation face status (face of last measurement)</td>
<td>0122/0000</td>
<td>Face I</td>
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<td>0122/0001</td>
<td>Face II</td>
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<tr>
<td>130 Aim Type</td>
<td>0130/0000</td>
<td>User definition</td>
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<tr>
<td>0130/0001</td>
<td>Round Prism</td>
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<td>0130/0002</td>
<td>Mini Prism</td>
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<tr>
<td>0130/0003</td>
<td>360° Prism</td>
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<td>0130/0004</td>
<td>Tape</td>
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<td>0130/0005</td>
<td>Reflect</td>
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<td>131 Aim Value</td>
<td>0131/0000</td>
<td>Relative</td>
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<td>0131/0001</td>
<td>Absolute</td>
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<td>135 RS232 recording mask</td>
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<td>WI</td>
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<td>11..21..22..31..51..87..88..</td>
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<td>WI</td>
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<td>0135/0003</td>
<td>11..21..22..31..81..82..83..87</td>
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<td>136 Output format number</td>
<td>0136/0000</td>
<td>GSI format</td>
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<td>0136/0001</td>
<td>IDEX format</td>
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<td>0136/0002</td>
<td>User format</td>
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<tr>
<td>0136/0003</td>
<td>User format</td>
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<td>0136/0004</td>
<td>User format</td>
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<td>0136/0005</td>
<td>User format</td>
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<td>137 RS232 recording length</td>
<td>0137/0000</td>
<td>GSI-8</td>
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<td>GSI-16</td>
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<tr>
<td>138 Quick code recording</td>
<td>0138/0000</td>
<td>Before measurement</td>
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<td>0138/0001</td>
<td>After measurement</td>
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<td>139 Insert GSIBlocknumber in GSI format</td>
<td>0139/0000</td>
<td>Off</td>
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<td>On</td>
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<tr>
<td>149 Display MASK</td>
<td>0138/000n</td>
<td>N: [0..8]</td>
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<td>151 Status of motorisation</td>
<td>0151/0000</td>
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<td>0151/0002</td>
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<td>158 ATR (OFF/ON)</td>
<td>0158/0000</td>
<td>OFF</td>
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<tr>
<td>0158/0001</td>
<td>ON</td>
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<td>160 Validity of measured distance</td>
<td>0160/0000</td>
<td>Distance invalid</td>
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<tr>
<td>0160/0001</td>
<td>Distance valid</td>
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<td>161 EDM modes (SET/161/n)</td>
<td>0161/0000</td>
<td>IR Standard</td>
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<td>0161/0001</td>
<td>IR Fast</td>
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<td>0161/0005</td>
<td>IR Tracking</td>
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<tr>
<td>0161/0006</td>
<td>RL Long (with prisms)</td>
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<tr>
<td>0161/0007</td>
<td>RL Short</td>
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<tr>
<td>0161/0009</td>
<td>RL Tracking</td>
<td></td>
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<tr>
<td>0161/0010</td>
<td>IR Tape</td>
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<td>170 Detect current face</td>
<td>0170/0000</td>
<td>Face I</td>
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<tr>
<td>0170/0001</td>
<td>Face II</td>
<td></td>
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<tr>
<td>( refer to manual)</td>
<td></td>
<td></td>
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<tr>
<td>Function</td>
<td>Response</td>
<td>Configuration</td>
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<td>171</td>
<td>Direction of horizontal circle reading (Hz-Angle)</td>
<td>0171/0000 0171/0001</td>
</tr>
<tr>
<td>173</td>
<td>Compensator</td>
<td>0173/0000 0173/0001</td>
</tr>
<tr>
<td>174</td>
<td>Compensator Status</td>
<td>0174/0000 0174/0001 0174/0002 0174/0003 0174/0004</td>
</tr>
<tr>
<td>178</td>
<td>Standing axis correction</td>
<td>0178/0000 0178/0001</td>
</tr>
<tr>
<td>179</td>
<td>Hz collimation</td>
<td>0179/0000 0179/0001</td>
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</tbody>
</table>
### PUT

Syntax: SET/<PUT SPEC>/<Parameter> <CR/LF>

<table>
<thead>
<tr>
<th>&lt;PUT SPEC&gt;</th>
<th>FUNCTION</th>
<th>Access/Example</th>
</tr>
</thead>
</table>
| 11         | Set Pointnumber | PUT/11…+00001234 <CR/LF>  
|            |          | puts PtID “1234”  |
| 16         | Station Pointnumber | PUT/16…+0000A100 <CR/LF>  
|            |          | puts StNr “A100”  |
| 21         | Hz Angle | PUT/21…+n+10000000 <CR/LF>  
|            |          | n[2..4]; angle units must be specified  
|            |          | for n=2; puts Hz="100.0000 gon"  |
| 41         | Code-Block ID | PUT/41…+0000TREE <CR/LF>  
|            |          | puts code value “TREE”  |
| 42         | Information 1 | PUT/42…+000012.4 <CR/LF>  
|            |          | puts info value “12.4”  |
| 43         | Information 2 | PUT/43…+0000CAT2 <CR/LF>  
|            |          | puts info value “CAT2”  |
| 44         | Information 3 | PUT/44…+000000NN <CR/LF>  
|            |          | puts info value “NN”  |
| 45         | Information 4 | PUT/45…+000000NN <CR/LF>  
|            |          | puts info value “NN”  |
| 46         | Information 5 | PUT/46…+000000NN <CR/LF>  
|            |          | puts info value “NN”  |
| 47         | Information 6 | PUT/47…+000000NN <CR/LF>  
|            |          | puts info value “NN”  |
| 48         | Information 7 | PUT/48…+000000NN <CR/LF>  
|            |          | puts info value “NN”  |
| 49         | Information 8 | PUT/49…+000000NN <CR/LF>  
|            |          | puts info value “NN”  |
| 58         | Prism const | PUT/58…+0000200 <CR/LF>  
|            |          | puts reflector constant to “20mm”  |
| 59         | PPM | PUT/59…+0220000 <CR/LF>  
|            |          | puts PPM correction to “220”  |
| 84         | Station Easting | PUT/84…+n+00100000 <CRLF>  
|            |          | n[0..1]; distance unit must be specified  
|            |          | for n=0; puts Easting=“100.000 m”  |
| 85         | Station Northing | PUT/85…+n+00100000 <CRLF>  
|            |          | n[0..1]; distance unit must be specified  
|            |          | for n=0; puts Northing=“100.000 m”  |
| 86         | Station Elevation | PUT/86…+n+00045000 <CRLF>  
|            |          | n[0..1]; distance unit must be specified  
|            |          | for n=0; puts Elevation=“45.000 m”  |
| 87         | Reflector height | PUT/87…+n+00001700 <CRLF>  
|            |          | n[0..1]; distance unit must be specified  
|            |          | for n=0; puts hr=“1.700 m”  |

[...cont.]
### PUT SPEC

<table>
<thead>
<tr>
<th>FUNCTION</th>
<th>Access/Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>88</td>
<td>Instrument height PUT/88...n+00001500.&lt;CRLF&gt; n[0..1]; distance unit must be specified =&gt; for n=0; puts hi=&quot;1.500 m&quot;</td>
</tr>
<tr>
<td>531</td>
<td>Atmos. Correction Pressure PUT/531.16+10132500.&lt;CRLF&gt; =&gt; &quot;1013 hPa&quot;</td>
</tr>
<tr>
<td>532</td>
<td>Atmos. Correction Temperature PUT/532.16+00120000.&lt;CRLF&gt; =&gt; Temperature &quot;12&quot;°C</td>
</tr>
<tr>
<td>560</td>
<td>Time: [hh.mm.ss] PUT/560..6+00113059.&lt;CRLF&gt; =&gt; &quot;11:30:59&quot;</td>
</tr>
<tr>
<td>561</td>
<td>Date: [mm.dd] PUT /561..6+00113059.&lt;CRLF&gt; =&gt; February 8th 2000</td>
</tr>
<tr>
<td>562</td>
<td>Year: [yyyy] PUT/562...+00002000.&lt;CRLF&gt; =&gt; year &quot;2000&quot;</td>
</tr>
<tr>
<td>912</td>
<td>Station Pointnumber PUT/912...+0000ST15 &lt;CRLF&gt; =&gt; puts Station PtID “ST15”</td>
</tr>
</tbody>
</table>

[Tab.9]
### GET Syntax:

`GET/n/WI<GET SPEC>/<Parameter><CR/LF>`

<table>
<thead>
<tr>
<th>&lt;GET SPEC&gt;</th>
<th>FUNCTION</th>
<th>Access/Example</th>
</tr>
</thead>
</table>
| 11         | Pointnumber | `GET/M/WI11<CR/LF>`; e.g. `11....+00000H66`  
  `PtNo="H66"` |
| 12         | Serial number | `GET/I/WI12<CR/LF>`; e.g. `12....+00640054`  
  `S.No. "640054"` |
| 13         | Instrument type | `GET/I/WI13<CR/LF>`; `13....+00TCR305`  
  `Instr. "TCR305"` |
| 16         | Station Pointnumber | `GET/I/WI16`; e.g. `16....+00000100`  
  `St.No. "100"` |
| 17         | Date [DD.MM.YYYY] | `GET/I/WI17`; e.g. `17....+08022000`  
  `Feb. 8th 2000` |
| 18         | Year Second | `GET/M/WI18`; e.g. `18....+01130000` |
| 19         | Time [MM.DD.hh.mm] | `GET/I/WI19`; e.g. `19....+02081029`  
  `Feb. 8th; 10:29` |
| 21         | Horizontal Angle | `GET/M/WI21<CR/LF>`; e.g. `21.102+17920860`  
  `Hz „179.086“ gon` |
| 22         | Vertical Angle | `GET/M/WI22<CR/LF>`; e.g. `22.102+07567500`  
  `V.: „75.675“ gon` |
| 31         | Slope distance | `GET/M/WI31<CR/LF>`; e.g. `31..00+00003387`  
  `Sdist: „3.387“ m` |
| 32         | Horizontal distance | `GET/M/WI32<CR/LF>`; e.g. `32..00+00003198`  
  `Hdist: „3.198“ m` |
| 33         | Height difference | `GET/M/WI33<CR/LF>`; e.g. `33..00+00001119`  
  `Hdiff: „1.119“ m` |
| 41         | Code-Block ID | `GET/I/WI41<CR/LF>`; e.g. `41....+0000013`  
  `Code: „13“ m` |
| 42         | Information 1 | `GET/I/WI42<CR/LF>`; e.g. `42....+0000020`  
  `TREES` |
| 43         | Information 2 | `GET/I/WI43<CR/LF>`; e.g. `43....+00004.5`  
  `Info2: „4.5“` |
| 44         | Information 3 | `GET/I/WI44<CR/LF>`; e.g. `44....+0000004.5`  
  `Info3: „CAT.02“` |
| 45         | Information 4 | `GET/I/WI45<CR/LF>`; e.g. `45....+0000000NN`  
  `Info4: „NN“` |
| 46         | Information 5 | `GET/I/WI46<CR/LF>`; e.g. `46....+0000000NN`  
  `Info5: „NN“` |
| 47         | Information 6 | `GET/I/WI47<CR/LF>`; e.g. `47....+0000000NN`  
  `Info6: „NN“` |
| 48         | Information 7 | `GET/I/WI48<CR/LF>`; e.g. `48....+0000000NN`  
  `Info7: „NN“` |
| 49         | Information 8 | `GET/I/WI49<CR/LF>`; e.g. `49....+0000000NN`  
  `Info8: „NN“` |
| 58         | Prism constant | `GET/I/WI58`; e.g. `58..16+0000020`  
  `Prism „2“ mm` |
| 59         | PPM | `GET/I/WI59`; e.g. `59..16+02200000`  
  `PPM „220“` |

[...]cont.]
<table>
<thead>
<tr>
<th>FUNCTION</th>
<th>Access/Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>81 Target Easting (E)</td>
<td>GET/M/WI81; e.g. 81..00+01999507 → E: &quot;1999.507&quot;m</td>
</tr>
<tr>
<td>82 Target Northing (N)</td>
<td>GET/M/WI82; e.g. 82..00+00213159 → N: &quot;2139.159&quot;m</td>
</tr>
<tr>
<td>83 Target Elevation (H)</td>
<td>GET/M/WI83; e.g. 83..00-00032881 → H: &quot;32.881&quot;m</td>
</tr>
<tr>
<td>84 Station Easting (E0)</td>
<td>GET/I/WI84; e.g. 84..11+00393700 → E: &quot;393.700&quot;m</td>
</tr>
<tr>
<td>85 Station Northing (N0)</td>
<td>GET/I/WI85; e.g. 85..11+06561220 → N: &quot;6561.220&quot;m</td>
</tr>
<tr>
<td>86 Station Height (H0)</td>
<td>GET/I/WI86; e.g. 86..11+00065618 → H: &quot;65.618&quot;m</td>
</tr>
<tr>
<td>87 Reflector height (hr)</td>
<td>GET/I/WI87; e.g. 87..11+00001700 → hr: &quot;1.700&quot; m</td>
</tr>
<tr>
<td>88 Instrument height (hi)</td>
<td>GET/I/WI88; e.g. 88..11+00001550 → hi: &quot;1.550&quot; m</td>
</tr>
<tr>
<td>531 Atmos. correction: pressure</td>
<td>GET/I/WI531; e.g. 531.16+10130000 → &quot;1013&quot;</td>
</tr>
<tr>
<td>538 Coefficient of refraction</td>
<td>GET/I/WI538; e.g. 538.16+00001300 → &quot;1.300&quot;</td>
</tr>
<tr>
<td>560 Time: [hh.mm.ss]</td>
<td>GET/I/WI560; e.g. 560..6+00105018 → &quot;10:50:18&quot;</td>
</tr>
<tr>
<td>561 Date: [mm.dd]</td>
<td>GET/I/WI561; e.g. 561..6+00020800 → &quot;2.8.2000&quot;</td>
</tr>
<tr>
<td>562 Year: [yyyy]</td>
<td>GET/I/WI562; e.g. 562..6+00002000 → year &quot;2000&quot;</td>
</tr>
<tr>
<td>590 SW-Version: Application</td>
<td>GET/I/WI590; e.g. 590..6+00021000 → &quot;V2.10&quot;</td>
</tr>
<tr>
<td>591 SW-Version: Operating system</td>
<td>GET/I/WI591; e.g. 591..6+00020000 → &quot;V2.00&quot;</td>
</tr>
<tr>
<td>592 SW-Version: OS interface</td>
<td>GET/I/WI592; e.g. 592..6+00010000 → &quot;V1.00&quot;</td>
</tr>
<tr>
<td>593 SW-Version: GEOCOM</td>
<td>GET/I/WI593; e.g. 593..6+00022000 → &quot;V2.20&quot;</td>
</tr>
<tr>
<td>594 SW-Version: Gsi communication</td>
<td>GET/I/WI594; e.g. 594..6+00010000 → &quot;V1.00&quot;</td>
</tr>
<tr>
<td>595 SW-Version: Edm Device</td>
<td>GET/I/WI595; e.g. 595..6+00011100 → &quot;V1.11&quot;</td>
</tr>
<tr>
<td>913 Job</td>
<td>GET/I/WI913; e.g. 913...+BLDG.A12 → &quot;BLDG.A12&quot;</td>
</tr>
<tr>
<td>914 Operator</td>
<td>GET/I/WI914; e.g. 914...+0MM-3519 → &quot;MM-3519&quot;</td>
</tr>
</tbody>
</table>

[Tab.10]
Telescope positioning (TC(R) auto models only)

<table>
<thead>
<tr>
<th>Command</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>GSI/EXTEND</td>
<td>Allows the use of the following commands. It must be sent at least once after the instrument is switched on.</td>
</tr>
<tr>
<td>CFACE</td>
<td>Turns the telescope to the opposite face</td>
</tr>
<tr>
<td>POSIT/&lt;spec&gt;Hz/V</td>
<td>Turns the telescope to the given direction horizontally and vertically. Hz and V are given in the unit set in the instruments.</td>
</tr>
</tbody>
</table>

List of <spec>

- A: Absolute positioning to the given values
- R: Relative positioning from the current position
- P: Turn the telescope to the direction of the last distance measurement
- S: Search for a reflector in the given range from the current position (only valid for TCA)

Example:

- `POSIT/A/123.4567/99.8754` Turns the telescope to the circle reading 123.4567 gon Hz and 99.8754 gon Vertical.
- `POSIT/R/20/0` Turns the telescope 20 units clockwise.
- `POSIT/P/1/-1` Tuns to the last position where a distance has been measured with 1 gon offset horizontal and vertical.
- `POSIT/S/2/2` Searches for a reflector in the range of 2 gons Horizontal and vertical.

Warnings and Errors

<table>
<thead>
<tr>
<th>Message ID</th>
<th>Meaning</th>
<th>Possible reasons</th>
</tr>
</thead>
<tbody>
<tr>
<td>@W100</td>
<td>Instrument busy</td>
<td>Any other device is still interfacing the instrument; check interfacing priorities</td>
</tr>
<tr>
<td>@W127</td>
<td>Invalid command</td>
<td>The string sent to the TC could not be decoded properly or does not exist; check the syntax, or ... Input buffer overflow (max. 100 characters)</td>
</tr>
<tr>
<td>@E139</td>
<td>EDM error</td>
<td>The EDM could not proceed the requested measurement; no or weak signal; Check EDM mode and target</td>
</tr>
<tr>
<td>@E158</td>
<td>One of the instruments sensor corrections could not be assigned.</td>
<td>Instrument is not stable, not levelled or suffering of vibration; Tilt is out of range (e.g. when tilt sensor is out of range); Level instrument or switch off compensator</td>
</tr>
</tbody>
</table>

[Tab.11]
TPS1000/1100/2000/5000 Series

The TPS1000 and its successor TPS1100, TPS2000 and the industrial TPS5000 series represent the very high end level of Leica’s Total Station products. Functionality has increased and instruments do more and more support customized remote control options. Thus controlling instruments with GSI commands has come to a technical limit. However, to provide access to all implemented functions, a new interfacing tool has been developed, called GEOBASIC. As GEOBASIC will not be covered within this reference guide, we kindly ask you to consult the corresponding GEOBASIC USER MANUAL, for further information on GEOBASIC. You will find the manual on every CD-ROM’s delivered with TPS Total Stations. Following, the complete set of GSI ONLINE commands providing access to TPS1000/1100/2000/5000 GSI functions.

Supported Instruments (TPS1000 Series)
- TC1100/L, TC1500/L, TC1700/L, TC1800/L
- TCM1100/L, TCM1800/L
- TCA1100/L, TCA1800/L

Supported Instruments (TPS1100 Series)
- TC1101, TC1102, TC1103, TC1105
- TCR1101, TCR1102, TCR1103, TCR1105
- TCM1101, TCM1102, TCM1103, TCM1105
- TCRM1101, TCRM1102, TCRM1103, TCRM1105
- TCA1101, TCA1102, TCA1103, TCA1105
- TCRA1101, TCRA1102, TCRA1103, TCRA1105

Supported Instruments (TPS2000 Series)
- TC2003
- TCA2003

Supported Instruments (TPS5000 Series)
- TM5000, TDM5000, TDA5000
- TM5000, TDM5000, TDA5000
- TM5100, TM5100A

For standard recording, the instrument needs to be activated in any “Measure&Record” mode. To avoid unnecessary miscommunication, we therefore recommend to enable the autostart function for remote control applications.

Low Level commands
SYNTAX: <command>CR/LF
SYNTAX: BEEP/<value>

<table>
<thead>
<tr>
<th>&lt;Commands&gt;</th>
<th>a</th>
<th>b</th>
<th>c</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Powers on the instrument</td>
<td>Powers off the instrument</td>
<td>Clears a distance measurement</td>
</tr>
</tbody>
</table>

Example:
- BEEP/0: Short beep
- BEEP/1: Long beep
- BEEP/2: Alarm beep (TPS1000/2000/5000 series only!)
**SET**

Syntax:  SET/<SET SPEC>/<Parameter><CR/LF>

<table>
<thead>
<tr>
<th>&lt;SET SPEC&gt;</th>
<th>FUNCTION</th>
<th>&lt;PARAMETER&gt;</th>
<th>SETTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>BEEP</td>
<td>0</td>
<td>OFF</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>Loud</td>
</tr>
<tr>
<td>31</td>
<td>Display (DSP) and</td>
<td>0</td>
<td>Off</td>
</tr>
<tr>
<td></td>
<td>Crosshairs (X-hairs)-</td>
<td>1</td>
<td>DSP on, X-hairs low</td>
</tr>
<tr>
<td></td>
<td>illumination</td>
<td>2</td>
<td>DSP on, X-hairs medium</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>DSP on, X-hairs bright</td>
</tr>
<tr>
<td>32</td>
<td>Display contrast</td>
<td>0</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>Low-Medium</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>Medium-High</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>High</td>
</tr>
<tr>
<td>35</td>
<td>EGL</td>
<td>0</td>
<td>Off</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>On</td>
</tr>
<tr>
<td>40</td>
<td>Angle UNIT</td>
<td>0</td>
<td>Gon</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>Degree decimal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>Degree, sexagesimal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>Mils</td>
</tr>
<tr>
<td>41</td>
<td>Distance UNIT</td>
<td>0</td>
<td>Meter</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>US Feet, decimal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>Intl. Feet, decimal</td>
</tr>
<tr>
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<td></td>
<td>3</td>
<td>US Feet/Inch</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>Intl. Feet/Inch</td>
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<tr>
<td>42</td>
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<td>0</td>
<td>°C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>°F</td>
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<td>43</td>
<td>Pressure UNIT</td>
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<td>hPa</td>
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<td></td>
<td>1</td>
<td>mmHg</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>mbar</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>PSI</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>inchHg</td>
</tr>
<tr>
<td>50</td>
<td>Angle; displayed decimals</td>
<td>2</td>
<td>123.12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>123.123</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>123.1234 or … max. accuracy</td>
</tr>
<tr>
<td>51</td>
<td>Distance; displayed</td>
<td>0</td>
<td>123.</td>
</tr>
<tr>
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<td>decimals</td>
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<td>123.1</td>
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<td>123.12</td>
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<td>3</td>
<td>123.123</td>
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<td>4</td>
<td>123.1234</td>
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<td>123.12345</td>
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<td></td>
<td>1</td>
<td>Odd</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>Even</td>
</tr>
<tr>
<td>73</td>
<td>Terminator</td>
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<td>CR</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>CR/LF</td>
</tr>
</tbody>
</table>

[...cont.]
<table>
<thead>
<tr>
<th>&lt;SET SPEC&gt;</th>
<th>FUNCTION</th>
<th>&lt;PARAMETER&gt;</th>
<th>SETTING</th>
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</thead>
<tbody>
<tr>
<td>75</td>
<td>Protocol</td>
<td>0</td>
<td>Without GSI</td>
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<tr>
<td></td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>76</td>
<td>Data recording device</td>
<td>0</td>
<td>Memory card RS232 interface</td>
</tr>
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<td></td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>95</td>
<td>AutoOFF</td>
<td>0</td>
<td>Off</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>On</td>
</tr>
<tr>
<td>137</td>
<td>RS232 format length</td>
<td>0</td>
<td>GSI-8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>GSI-16</td>
</tr>
<tr>
<td>160</td>
<td>Setting measured distance to invalid</td>
<td>0</td>
<td>Setting WI31,32,33 and coordinates WI81,82,83 to invalid</td>
</tr>
<tr>
<td>161</td>
<td>EDM modes (SET/161/n)</td>
<td>0</td>
<td>IR Standard</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>IR Fast</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>IR Average</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>IR Precise&lt;sup&gt;1&lt;/sup&gt;/Standard&lt;sup&gt;2&lt;/sup&gt;</td>
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<tr>
<td></td>
<td></td>
<td>4</td>
<td>IR Tracking</td>
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<td></td>
<td>5</td>
<td>IR Rapid tracking</td>
</tr>
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<td></td>
<td></td>
<td>6</td>
<td>RL Stand. long range&lt;sup&gt;2&lt;/sup&gt;</td>
</tr>
<tr>
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<td></td>
<td>7</td>
<td>RL Standard&lt;sup&gt;2&lt;/sup&gt;</td>
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<td></td>
<td>9</td>
<td>RL Tracking&lt;sup&gt;2&lt;/sup&gt;</td>
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<td>10</td>
<td>IR Tape&lt;sup&gt;1&lt;/sup&gt;</td>
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<td></td>
<td></td>
<td>11</td>
<td>RL Average long range&lt;sup&gt;2&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12</td>
<td>RL Average&lt;sup&gt;2&lt;/sup&gt;</td>
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<tr>
<td>173</td>
<td>Compensator</td>
<td>0</td>
<td>Off</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>On</td>
</tr>
</tbody>
</table>

<sup>1</sup> TPS1000/2000/5000 only

<sup>2</sup> TPS1100 only

[Tab.12]
### CONF Syntax:  CONF/<CONF SPEC><CR/LF>

<table>
<thead>
<tr>
<th>&lt;CONF SPEC&gt;</th>
<th>FUNCTION</th>
<th>RESPONSE</th>
<th>CONFIGURATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>BEEP</td>
<td>0030/0000</td>
<td>OFF</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0030/0001</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0030/0001</td>
<td>Loud</td>
</tr>
<tr>
<td>31</td>
<td>Display (DSP) and Crosshairs</td>
<td>0031/0000</td>
<td>Off</td>
</tr>
<tr>
<td></td>
<td>(X-hairs)-illumination</td>
<td>0031/0001</td>
<td>DSP on, X-hairs low</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0031/0002</td>
<td>DSP on, X-hairs medium</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0031/0003</td>
<td>DSP on, X-hairs bright</td>
</tr>
<tr>
<td>32</td>
<td>Display contrast</td>
<td>0032/0000</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0032/0001</td>
<td>Low-Medium</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0032/0002</td>
<td>Medium-High</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0032/0003</td>
<td>High</td>
</tr>
<tr>
<td>35</td>
<td>EGL</td>
<td>0035/0000</td>
<td>Off</td>
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<td></td>
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<td>On</td>
</tr>
<tr>
<td>40</td>
<td>Angle UNIT</td>
<td>0040/0000</td>
<td>Gon</td>
</tr>
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<td>0040/0001</td>
<td>Degree decimal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0040/0002</td>
<td>Degree, minute, second</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0040/0003</td>
<td>Mil</td>
</tr>
<tr>
<td>41</td>
<td>Distance UNIT</td>
<td>0041/0000</td>
<td>Meter</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0041/0001</td>
<td>US Feet, decimal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0041/0002</td>
<td>Intl. Feet, decimal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0041/0003</td>
<td>US Feet/Inch</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0041/0004</td>
<td>Intl. Feet/Inch</td>
</tr>
<tr>
<td>42</td>
<td>Temperature UNIT</td>
<td>0042/0000</td>
<td>°C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0042/0001</td>
<td>°F</td>
</tr>
<tr>
<td>43</td>
<td>Pressure UNIT</td>
<td>0043/0000</td>
<td>hPa</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0043/0001</td>
<td>mmHg</td>
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<tr>
<td></td>
<td></td>
<td>0043/0002</td>
<td>mBar</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0043/0003</td>
<td>PSI</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0043/0004</td>
<td>inchHg</td>
</tr>
<tr>
<td>50</td>
<td>Angle; displayed decimals</td>
<td>0050/0002</td>
<td>123.12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0050/0003</td>
<td>123.123</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0050/0004</td>
<td>max. accuracy</td>
</tr>
<tr>
<td>51</td>
<td>Distance; displayed decimals</td>
<td>0051/0000</td>
<td>123.12</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>0051/0002</td>
<td>max. accuracy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0051/0003</td>
<td>123.123 or …</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0051/0004</td>
<td>max. accuracy</td>
</tr>
<tr>
<td>70</td>
<td>Baudrate</td>
<td>0070/0003</td>
<td>2400 Baud</td>
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<tr>
<td></td>
<td></td>
<td>0070/0004</td>
<td>4800 Baud</td>
</tr>
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<td></td>
<td></td>
<td>0070/0005</td>
<td>9600 Baud</td>
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<tr>
<td></td>
<td></td>
<td>0070/0006</td>
<td>19200 Baud</td>
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[...cont.]
<table>
<thead>
<tr>
<th>FUNCTION</th>
<th>RESPONSE</th>
<th>CONFIGURATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>71 Parity</td>
<td>0071/0000 None</td>
<td>0071/0001 Odd</td>
</tr>
<tr>
<td>73 Terminator</td>
<td>0073/0000 CR</td>
<td>0073/0001 CR/LF</td>
</tr>
<tr>
<td>75 Protocol</td>
<td>0075/0000 Without GSI</td>
<td></td>
</tr>
<tr>
<td>76 Data recording device</td>
<td>0076/0000 Memory card</td>
<td>0076/0001 Serial interface</td>
</tr>
<tr>
<td>90 Battery level</td>
<td>0090/0000 N: [1..9]; n=1: low</td>
<td></td>
</tr>
<tr>
<td>95 AutoOFF</td>
<td>0095/0000 Off</td>
<td>0095/0001 On</td>
</tr>
<tr>
<td>135 Recording mask</td>
<td>0135/0000 Mask 1</td>
<td></td>
</tr>
<tr>
<td>137 RS232 format length</td>
<td>0137/0000 GSI-8</td>
<td>0137/0001 GSI-16</td>
</tr>
<tr>
<td>149 Display MASK</td>
<td>0149/0000 Mask 1</td>
<td></td>
</tr>
<tr>
<td>160 Validity of measured distance</td>
<td>0160/0000 Distance/Coords invalid</td>
<td>0160/0001 Distance/Coords valid</td>
</tr>
<tr>
<td>161 EDM modes (SET/161/n)</td>
<td>0161/0000 IR Standard</td>
<td>0161/0001 IR Fast</td>
</tr>
<tr>
<td>170 Detect current face</td>
<td>0170/0000 Face I</td>
<td>0170/0001 Face II</td>
</tr>
<tr>
<td>171 Direction of horizontal circle reading (Hz-Angle)</td>
<td>0171/0000 Clockwise</td>
<td>0171/0001 Counterclockwise</td>
</tr>
<tr>
<td>173 Compensator</td>
<td>0173/0000 OFF</td>
<td>0173/0001 ON</td>
</tr>
<tr>
<td>182 Software version</td>
<td>0182/0000 Version n.n</td>
<td></td>
</tr>
<tr>
<td>184 Active application running</td>
<td>0184/0000 No</td>
<td>0184/0001 Yes</td>
</tr>
</tbody>
</table>

[Tab.13]
**PUT**

Syntax:  \texttt{SET/<PUT SPEC>/<Parameter>_<CR/LF>}

<table>
<thead>
<tr>
<th>&lt;PUT SPEC&gt;</th>
<th>FUNCTION</th>
<th>Access/Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>Set Pointnumber</td>
<td>\texttt{PUT/11...+00001234_&lt;CR/LF&gt;} \Rightarrow \text{puts PtID “1234”}</td>
</tr>
<tr>
<td>21</td>
<td>Hz Angle</td>
<td>\texttt{PUT/21...n+10000000_&lt;CR/LF&gt;} \n[2..4]; angle units must be specified \Rightarrow for n=2; puts Hz=&quot;100.0000 gon&quot;</td>
</tr>
<tr>
<td>58</td>
<td>Prism const</td>
<td>\texttt{PUT/58...+00000200_&lt;CR/LF&gt;} \Rightarrow \text{puts reflector constant to “20mm”}</td>
</tr>
<tr>
<td>59</td>
<td>PPM</td>
<td>\texttt{PUT/59...+02200000_&lt;CR/LF&gt;} \Rightarrow \text{puts PPM correction to “220”}</td>
</tr>
<tr>
<td>71</td>
<td>Remark</td>
<td>\texttt{PUT/71...+000012.4_&lt;CR/LF&gt;} \Rightarrow \text{puts info value “12.4”}</td>
</tr>
<tr>
<td>72</td>
<td>Remark</td>
<td>\texttt{PUT/72...+0000CAT2_&lt;CR/LF&gt;} \Rightarrow \text{puts info value “CAT2”}</td>
</tr>
<tr>
<td>73</td>
<td>Remark</td>
<td>\texttt{PUT/73...+000000NN_&lt;CR/LF&gt;} \Rightarrow \text{puts info value “NN”}</td>
</tr>
<tr>
<td>74</td>
<td>Remark</td>
<td>\texttt{PUT/74...+000000NN_&lt;CR/LF&gt;} \Rightarrow \text{puts info value “NN”}</td>
</tr>
<tr>
<td>75</td>
<td>Remark</td>
<td>\texttt{PUT/75...+000000NN_&lt;CR/LF&gt;} \Rightarrow \text{puts info value “NN”}</td>
</tr>
<tr>
<td>76</td>
<td>Remark</td>
<td>\texttt{PUT/76...+000000NN_&lt;CR/LF&gt;} \Rightarrow \text{puts info value “NN”}</td>
</tr>
<tr>
<td>77</td>
<td>Remark</td>
<td>\texttt{PUT/77...+000000NN_&lt;CR/LF&gt;} \Rightarrow \text{puts info value “NN”}</td>
</tr>
<tr>
<td>78</td>
<td>Remark</td>
<td>\texttt{PUT/78...+000000NN_&lt;CR/LF&gt;} \Rightarrow \text{puts info value “NN”}</td>
</tr>
<tr>
<td>79</td>
<td>Remark</td>
<td>\texttt{PUT/79...+000000NN_&lt;CR/LF&gt;} \Rightarrow \text{puts info value “NN”}</td>
</tr>
<tr>
<td>84 a)</td>
<td>Station Easting</td>
<td>\texttt{PUT/84...n+00100000_&lt;CRLF&gt;} \Rightarrow for n=0; puts Easting=“100.000 m”</td>
</tr>
<tr>
<td>85 a)</td>
<td>Station Northing</td>
<td>\texttt{PUT/85...n+00100000_&lt;CRLF&gt;} \Rightarrow for n=0; puts Northing=“100.000 m”</td>
</tr>
<tr>
<td>86 a)</td>
<td>Station Elevation</td>
<td>\texttt{PUT/86...n+00045000_&lt;CRLF&gt;} \Rightarrow for n=0; puts Elevation=“45.000 m”</td>
</tr>
<tr>
<td>87 a)</td>
<td>Reflector height</td>
<td>\texttt{PUT/87...n+00001700_&lt;CRLF&gt;} \Rightarrow for n=0; puts hr=“1.700 m”</td>
</tr>
<tr>
<td>88 a)</td>
<td>Instrument height</td>
<td>\texttt{PUT/88...n+00001500_&lt;CRLF&gt;} \Rightarrow for n=0; puts hi=“1.500 m”</td>
</tr>
</tbody>
</table>

[Tab.14]

\textit{a)} For WI84-88; distance unit must be specified with n[0..1]; refer to page ??.
### GET Syntax:

`GET/n/WI<GET SPEC>/<Parameter><CR/LF>`

<table>
<thead>
<tr>
<th>&lt;GET SPEC&gt;</th>
<th>FUNCTION</th>
<th>Access/Example</th>
</tr>
</thead>
</table>
| 11         | Pointnumber | GET/M/WI11<CR/LF>; e.g. 11....+00000H66  
PtNo="H66" |
| 12         | Serial number | GET/I/WI12<CR/LF>; e.g. 12....+00640054  
S.No. “640054” |
| 13         | Instrument type | GET/I/WI13<CR/LF>; 13....+00TCR305  
Instr. “TCR305” |
| 19         | Time [MM.DD.hh.mm] | GET/I/WI19; e.g. 19....+02081029  
“Feb. 8th; 10:29” |
| 21         | Horizontal Angle | GET/M/WI21<CR/LF>; e.g. 21.102+17920860  
Hz „179.086“ gon |
| 22         | Vertical Angle | GET/M/WI22<CR/LF>; e.g. 22.102+07567500  
V: „75.675“ gon |
| 31         | Slope distance | GET/M/WI31<CR/LF>; e.g. 31..00+00003387  
Sdist: „3.387“ m |
| 32         | Horizontal distance | GET/M/WI32<CR/LF>; e.g. 32..00+00003198  
Hdist: „3.198“ m |
| 33         | Height difference | GET/M/WI33<CR/LF>; e.g. 33..00+00001119  
Hdiff: „1.119“ m |
| 41         | Code-Block ID | GET/I/WI41<CR/LF>; e.g. 41....+0000013  
Code: „13“ m |
| 42         | Information 1 | GET/I/WI42<CR/LF>; e.g. 42....+000TREES  
Info1: „TREES“ |
| 43         | Information 2 | GET/I/WI43<CR/LF>; e.g. 43....+00004.5  
Info2: „4.5“ |
| 44         | Information 3 | GET/I/WI44<CR/LF>; e.g. 44....+00CAT.02  
Info3: „CAT.02“ |
| 45         | Information 4 | GET/I/WI45<CR/LF>; e.g. 45....+00000NN  
Info4: „NN“ |
| 46         | Information 5 | GET/I/WI46<CR/LF>; e.g. 46....+00000NN  
Info5: „NN“ |
| 47         | Information 6 | GET/I/WI47<CR/LF>; e.g. 47....+00000NN  
Info6: „NN“ |
| 48         | Information 7 | GET/I/WI48<CR/LF>; e.g. 48....+00000NN  
Info7: „NN“ |
| 49         | Information 8 | GET/I/WI49<CR/LF>; e.g. 49....+00000NN  
Info8: „NN“ |
| 51         | PPM/mm | GET/I/WI51<CR/LF>; e.g. 51..1.+0000+034  
“0”ppm; “34”mm |
| 58         | Prism constant | GET/I/WI58; e.g. 58..16+00000020  
Prism „2“ mm |
| 59         | PPM | GET/I/WI59; e.g. 59..16+02200000  
PPM „220“ |

[...cont.]
<table>
<thead>
<tr>
<th>&lt;GET SPEC&gt;</th>
<th>FUNCTION</th>
<th>Access/Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>71</td>
<td>Remark1</td>
<td>GET/I/WI71&lt;CR/LF&gt;; e.g. 71....+0000REM1</td>
</tr>
<tr>
<td></td>
<td>(or Attribute 1)</td>
<td>“REM1”</td>
</tr>
<tr>
<td>72</td>
<td>Remark2</td>
<td>GET/I/WI72&lt;CR/LF&gt;; e.g. 72....+0000REM2</td>
</tr>
<tr>
<td></td>
<td>(or Attribute 2)</td>
<td>“REM2”</td>
</tr>
<tr>
<td>73</td>
<td>Remark3</td>
<td>GET/I/WI73&lt;CR/LF&gt;; e.g. 73....+0000REM3</td>
</tr>
<tr>
<td></td>
<td>(or Attribute 3)</td>
<td>“REM3”</td>
</tr>
<tr>
<td>74</td>
<td>Remark4</td>
<td>GET/I/WI74&lt;CR/LF&gt;; e.g. 74....+0000REM4</td>
</tr>
<tr>
<td></td>
<td>(or Attribute 4)</td>
<td>“REM4”</td>
</tr>
<tr>
<td>75</td>
<td>Remark5</td>
<td>GET/I/WI75&lt;CR/LF&gt;; e.g. 75....+0000REM5</td>
</tr>
<tr>
<td></td>
<td>(or Attribute 5)</td>
<td>“REM5”</td>
</tr>
<tr>
<td>76</td>
<td>Remark6</td>
<td>GET/I/WI76&lt;CR/LF&gt;; e.g. 76....+0000REM6</td>
</tr>
<tr>
<td></td>
<td>(or Attribute 6)</td>
<td>“REM6”</td>
</tr>
<tr>
<td>77</td>
<td>Remark7</td>
<td>GET/I/WI77&lt;CR/LF&gt;; e.g. 77....+0000REM7</td>
</tr>
<tr>
<td></td>
<td>(or Attribute 7)</td>
<td>“REM7”</td>
</tr>
<tr>
<td>78</td>
<td>Remark8</td>
<td>GET/I/WI78&lt;CR/LF&gt;; e.g. 78....+0000REM8</td>
</tr>
<tr>
<td></td>
<td>(or Attribute 8)</td>
<td>“REM8”</td>
</tr>
<tr>
<td>79</td>
<td>Remark9</td>
<td>GET/I/WI79&lt;CR/LF&gt;; e.g. 79....+0000REM9</td>
</tr>
<tr>
<td></td>
<td>(or Attribute 9)</td>
<td>“REM9”</td>
</tr>
<tr>
<td>81</td>
<td>Target</td>
<td>GET/M/WI81; e.g. 81....+01999507</td>
</tr>
<tr>
<td></td>
<td>Easting</td>
<td>E: “1999.507”m</td>
</tr>
<tr>
<td></td>
<td>(E)</td>
<td></td>
</tr>
<tr>
<td>82</td>
<td>Target</td>
<td>GET/M/WI82; e.g. 82....+00213159</td>
</tr>
<tr>
<td></td>
<td>Northing</td>
<td>N: “2139.159”m</td>
</tr>
<tr>
<td></td>
<td>(N)</td>
<td></td>
</tr>
<tr>
<td>83</td>
<td>Target</td>
<td>GET/M/WI83; e.g. 83....-00032881</td>
</tr>
<tr>
<td></td>
<td>Elevation</td>
<td>H: “32.881”m</td>
</tr>
<tr>
<td></td>
<td>(H)</td>
<td></td>
</tr>
<tr>
<td>84</td>
<td>Station</td>
<td>GET/I/WI84; e.g. 84....+00393700</td>
</tr>
<tr>
<td></td>
<td>Easting</td>
<td>E: “393.700”m</td>
</tr>
<tr>
<td></td>
<td>(E0)</td>
<td></td>
</tr>
<tr>
<td>85</td>
<td>Station</td>
<td>GET/I/WI85; e.g. 85....+06561220</td>
</tr>
<tr>
<td></td>
<td>Northing</td>
<td>N: “6561.220”m</td>
</tr>
<tr>
<td></td>
<td>(N0)</td>
<td></td>
</tr>
<tr>
<td>86</td>
<td>Station</td>
<td>GET/I/WI86; e.g. 86....+00065618</td>
</tr>
<tr>
<td></td>
<td>Height</td>
<td>H: “65.618”m</td>
</tr>
<tr>
<td></td>
<td>(H0)</td>
<td></td>
</tr>
<tr>
<td>87</td>
<td>Reflect</td>
<td>GET/I/WI87; e.g. 87....+00001700</td>
</tr>
<tr>
<td></td>
<td>or height</td>
<td>hr: “1.700” m</td>
</tr>
<tr>
<td></td>
<td>(hr)</td>
<td></td>
</tr>
<tr>
<td>88</td>
<td>Instrument</td>
<td>GET/I/WI88; e.g. 88....+00001550</td>
</tr>
<tr>
<td></td>
<td>height</td>
<td>hi: “1.550” m</td>
</tr>
<tr>
<td></td>
<td>(hi)</td>
<td></td>
</tr>
</tbody>
</table>

[Tab.15]
## Telescope positioning (TM, TCM/TDM and TCA/TDA models only)

<table>
<thead>
<tr>
<th>Command</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>PASSWORD</td>
<td>Allows the use of the following commands. It must be sent at least once after the instrument is switched on</td>
</tr>
<tr>
<td>CFACE</td>
<td>Turns the telescope to the opposite face</td>
</tr>
<tr>
<td>POSIT/&lt;spec&gt;Hz/V</td>
<td>Turns the telescope to the given direction horizontally and vertically. Hz and V are given in the unit set in the instruments</td>
</tr>
</tbody>
</table>

### List of <spec>

- **A**: Absolute positioning to the given values
- **R**: Relative positioning from the current position
- **P**: Turn the telescope to the direction of the last distance measurement
- **S**: Search for a reflector in the given range from the current position (only valid for TCA/TDA)

### Example:

<table>
<thead>
<tr>
<th>Command</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>POSIT/A/123.4567/99.8754</td>
<td>Turns the telescope to the circle reading 123.4567 gon Hz and 99.8754 gon Vertical.</td>
</tr>
<tr>
<td>POSIT/R/20/0</td>
<td>Turns the telescope 20 units clockwise.</td>
</tr>
<tr>
<td>POSIT/P/1/-1</td>
<td>Turns to the last position where a distance has been measured with 1 gon offset horizontal and vertical.</td>
</tr>
<tr>
<td>POSIT/S/2/2</td>
<td>Searches for a reflector in the range of 2 gons Horizontal and vertical.</td>
</tr>
</tbody>
</table>
Errors, initiated by an interface command are not always transferred to the interface. Instead of the error message the warning @W127 will be sent and the TPS will be ready to receive the next command.

<table>
<thead>
<tr>
<th>Message ID</th>
<th>Meaning</th>
<th>Possible reasons</th>
</tr>
</thead>
<tbody>
<tr>
<td>@W100</td>
<td>Instrument busy</td>
<td>Any other device is still interfacing the instrument; check interfacing priorities</td>
</tr>
<tr>
<td>@W127</td>
<td>Invalid command</td>
<td>The string sent to the TC could not be decoded properly or does not exist; check the syntax, or… Input buffer overflow (max. 100 characters)</td>
</tr>
<tr>
<td>@E112</td>
<td>Battery low</td>
<td>Low Battery; check voltage</td>
</tr>
<tr>
<td>@E117</td>
<td>Initialization error</td>
<td>Contact service</td>
</tr>
<tr>
<td>@E119</td>
<td>Temperature out of range</td>
<td>Refer to manual for temperature range</td>
</tr>
<tr>
<td>@E139</td>
<td>EDM error</td>
<td>The EDM could not proceed the requested measurement; no or weak signal; Check EDM mode and target</td>
</tr>
<tr>
<td>@E144</td>
<td>V or Hz collimation error</td>
<td>Check calibration data</td>
</tr>
<tr>
<td>@E150</td>
<td>Angle error</td>
<td>Call service</td>
</tr>
<tr>
<td>@E158</td>
<td>One of the instruments sensor corrections could not be assigned.</td>
<td>Instrument is not stable, not levelled or suffering of vibration; Tilt is out of range (e.g. when tilt sensor is out of range); Level instrument or switch off compensator</td>
</tr>
<tr>
<td>@E182</td>
<td>Telescope position out of range</td>
<td>Positioning timeout; Instrument could not position; Try again</td>
</tr>
<tr>
<td>@E190</td>
<td>General motorisation Error</td>
<td>If frequently occurs call service</td>
</tr>
<tr>
<td>@E191</td>
<td>Data error</td>
<td>Check record mask</td>
</tr>
<tr>
<td>@E194</td>
<td>General error</td>
<td>If frequently occurs call service</td>
</tr>
<tr>
<td>@E197</td>
<td>ATR error</td>
<td>ATR not enabled; check ATR function</td>
</tr>
</tbody>
</table>

[Tab.16]
**DNA Section**

**GSI data format**

GSI data is transmitted in blocks with each block ending with a terminator (CR or CR/LF). Every block consists of several data words (see the examples below). The data word begins with a two or three character **Word Index**, the WI code, specifying the data type within this block. The GSI-8 block has in total 16 characters, consisting of 7 information characters (e.g. WI, sign), 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 IDs.

Example 1 shows a GSI-8 block sequence with the words for point ID (11), horizontal distance (32) and the staff reading (330). Example 2 shows a GSI-16 block sequence with the words for point ID (11), horizontal distance (32), backsight (331), intermediate sight (333), foresight (332) and the point height (83).

**Example 1: GSI-8 measurement blocks**

| ←---- Word 1 ----→ | ←---- Word 2 ----→ | ←---- Word 3 ----→ |
| 1234567890123456 | (16 characters per word) |
| 110001+0000A110 32...8+02505387 330.08+00125972 |
| 110002+0000A111 32...8+02637586 330.08+0143031 |
| 110003+0000A112 32...8+02594636 330.08+00163780 |
| 110004+0000A113 32...8+02413839 330.08+00183292 |
| 110005+0000A114 32...8+02801241 330.08+00121344 |

**GSI-8 data word structure:**

- Pos. 1-2/3: Word Index (WI) e.g. "11" (WI for PtID)
- Pos. 3/4-6: Information related to data e.g. "0003" (block number in word 1)
- Pos. 7: Sign e.g. "+" or "–"
- Pos. 8-15: Data (8 digits) e.g. "0000A113" (PtID)
- Pos. 16: Blank (= separating character)

**Example 2: GSI-16 measurement blocks**

| ←-------- Word 1 --------→ | ←-------- Word 2 --------→ | ←-------- Word 3 --------→ |
| 123456789012345678901234 | (24 characters per word) |
| *110004+0000000000000001 32...8+00000000003417147 331.08+000000000147534 |
| *110005+0000000000000000P355 32...8+000000000003417147 333.08+000000000269405 |
| *110006+0000000000000000P355 83...08+0000000041269345 |
| *110007+00000000000000000A2 32...8+00000000003618502 332.08+000000000182331 |

**GSI-16 data word structure:**

- Pos. 1-2/3: Word Index (WI) e.g. "331" (WI for backsight)
- Pos. 3/4-6: Information related to data e.g. "08" (flag for measurement and unit)
- Pos. 7: Sign e.g. "+" or "–"
- Pos. 8-23: GSI-16 data (16 digits) e.g. "0000000003618502"; Distance
- Pos. 24: Blank (= separating character)
**DNA Section**

**GSI word information**

The flags at positions 5 to 6 in the data word are used for additional information.

Example with a GSI-8 data word:

```
Position:     1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6
               . . . . . ± n n n n n n n n n x
```

- **Position 1-3:** Word index.
- **Position 4:** empty, marked as dot (.)
- **Position 5:** Information about the measurement and earth-curvature correction.
  - 0 = measured; without earth-curvature correction.
  - 1 = entered manually; without earth-curvature correction.
  - 2 = measured; with earth-curvature correction.
  - 5 = entered manually; with earth-curvature correction.
- **Position 6:** Units and decimal places. **Note:** The data is stored in the unit and resolution that is defined by the "Unit" and "Decimal" settings on the instrument during data export.
  - 6 = metre, last place 0.1mm.
  - 1 = foot, last place 0.001ft.
  - 0 = metre, last place 1mm.
  - 7 = foot, last place 0.0001ft (only DNA03).
  - 8 = metre, last place 0.01mm (only DNA03).
- **Position 7-15:** Measurement data (n)
- **Position 16:** Space character, ASCII-Code 32 (\(\times\))

**Word list**

A block (record) is either of the type "Measurement" or of the type "Code". The measurement block begins with "11" which is the WI for the PtID. The code block begins with WI "41".

The measurement block consists of between 2 and 6 fixed data words. Individual words can not be selected. The code record consists of 9 words.

1) **General data words**

The following data words are used in the measurement and code blocks:

- **WI = 11**  
  Point ID.
- **WI = 32**  
  Horizontal distance to staff.
- **WI = 330**  
  Staff reading in "Meas Only".
- **WI = 331**  
  Staff reading, backsight or B1.
- **WI = 332**  
  Staff reading, foresight or F1.
- **WI = 335**  
  Staff reading, B2.
- **WI = 336**  
  Staff reading, F2.
- **WI = 333**  
  Staff reading, intermediate sight.
- **WI = 334**  
  Staff reading, setting-out sight.
- **WI = 374**  
  Setting-out difference of height measurements.
- **WI = 35**  
  Setting-out difference of distance measurement.
- **WI = 390**  
  Count of repeated measurements.
- **WI = 391**  
  Mean mode: Standard deviation of the single measurement.
**DNA Section**

WI = 392  Median mode: Spread of measurements.
WI = 41   Code number.
WI = 42 – 49 Info1 to Info8
WI = 571  Station difference
WI = 572  Cumulative station difference
WI = 573  Distance balance
WI = 574  Total distance (= line length)
WI = 71   Remark
WI = 83   Ground height (starting point height or measured height)

2) Special data words

The following data words are generated by on-line command only:

WI = 12   Serial number
WI = 13   Instrument type
WI = 17   Date, year
WI = 19   Day, time
WI = 95   Instrument temperature [°C]

WI = 560  Time
WI = 561  Date
WI = 562  Year
WI = 599  Software version

For further information see "GET" command.

3) Special code blocks

The levelling technique is tagged by means of a special code block (WI = 41). It is recognizable by the "?" at the eighth position in the word.

<table>
<thead>
<tr>
<th>Block list</th>
<th>Line levelling method BF</th>
<th>410000+?......1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block list</td>
<td>Line levelling method BFFB</td>
<td>410000+?......2</td>
</tr>
<tr>
<td>Block list</td>
<td>Line levelling method aBF</td>
<td>410000+?......3</td>
</tr>
<tr>
<td>Block list</td>
<td>Line levelling method aBFFB</td>
<td>410000+?......4</td>
</tr>
<tr>
<td>Block list</td>
<td>Check &amp; Adjust</td>
<td>410000+?......10</td>
</tr>
</tbody>
</table>

**Block list**

The measured values (e.g. distance, staff reading etc.) and the results (e.g. ground height) are stored in separate blocks according to their type.

The data blocks in the various measurement programs:

1) Measure & Record

The structure is similar to the line levelling BF.

The start of a new line is indicated with the special code block for the line levelling method BF.
DNA Section

Different from line levelling:

- **The first backsight display**: Any number of single backsights can be recorded. The <CONT> function will close the display and record a start levelling code and a copy of the last backsight measurement.
- **The foresight displays**: Any number of single foresights can be recorded. The <CONT> function will close the display and record a result line for the last foresight measurement.
- **The backsight displays**: Any number of single backsights can be recorded until <CONT> is pressed.
- **In all displays**: The PtID remains unchanged for all measurements of a display unless it is changed by the user for individual measurements.

**Measure & Record** block sequence:

<table>
<thead>
<tr>
<th>Block recorded</th>
<th>Data words (WI)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Backsight</td>
<td>11, 32, 331</td>
<td>1. backsight</td>
</tr>
<tr>
<td>Backsight</td>
<td>11, 32, 331</td>
<td>additional backsight</td>
</tr>
<tr>
<td>Backsight</td>
<td>11, 32, 331</td>
<td>additional backsight</td>
</tr>
<tr>
<td>Backsight</td>
<td>11, 32, 331</td>
<td>last backsight</td>
</tr>
<tr>
<td>&lt;CONT&gt; pressed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Method</td>
<td>41</td>
<td>Special code block</td>
</tr>
<tr>
<td>Start height</td>
<td>11, 83</td>
<td></td>
</tr>
<tr>
<td>Backsight</td>
<td>11, 32, 331</td>
<td>Copy of last backsight</td>
</tr>
<tr>
<td>Foresight</td>
<td>11, 32, 332</td>
<td>1. foresight</td>
</tr>
<tr>
<td>Foresight</td>
<td>11, 32, 332</td>
<td>additional foresight</td>
</tr>
<tr>
<td>Foresight</td>
<td>11, 32, 332</td>
<td>additional foresight</td>
</tr>
<tr>
<td>Last foresight</td>
<td>11, 32, 332</td>
<td>last foresight *)</td>
</tr>
<tr>
<td>&lt;CONT&gt; pressed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Result</td>
<td>11, 573, 574, 83</td>
<td>*)</td>
</tr>
<tr>
<td>Backsight</td>
<td>11, 32, 331</td>
<td>1. backsight</td>
</tr>
<tr>
<td>Backsight</td>
<td>11, 32, 331</td>
<td>additional backsight</td>
</tr>
<tr>
<td>Backsight</td>
<td>11, 32, 331</td>
<td>additional backsight</td>
</tr>
<tr>
<td>...</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;CONT&gt; pressed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Foresight</td>
<td>11, 32, 332</td>
<td>1. foresight</td>
</tr>
<tr>
<td>etc</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*)

- Press <CONT> at the end of the line levelling in order to record the result block of the last foresight.
- If Intermediate or Setting-out sights are recorded after the foresight measurement and if <CONT> is pressed without remeasuring the foresight then the result line is not placed immediately after the last foresight. In such a case edit the data and move the last foresight measurement before the result line in order to have a consistent data set.
### DNA Section

#### 2) Measure Only

<table>
<thead>
<tr>
<th>Block recorded</th>
<th>Data words (WI)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement</td>
<td>11, 32, 330</td>
<td></td>
</tr>
<tr>
<td>Measurement</td>
<td>11, 32, 330</td>
<td></td>
</tr>
<tr>
<td>Measurement</td>
<td>11, 32, 330</td>
<td></td>
</tr>
</tbody>
</table>

#### 3) Line levelling BF

<table>
<thead>
<tr>
<th>Block recorded</th>
<th>Data words (WI)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Method</td>
<td>41</td>
<td></td>
</tr>
<tr>
<td>Start height</td>
<td>11, 83</td>
<td></td>
</tr>
<tr>
<td>Backsight</td>
<td>11, 32, 331</td>
<td></td>
</tr>
<tr>
<td>Foresight</td>
<td>11, 32, 332</td>
<td></td>
</tr>
<tr>
<td>Result</td>
<td>11, 573, 574, 83</td>
<td></td>
</tr>
<tr>
<td>Backsight</td>
<td>11, 32, 331</td>
<td></td>
</tr>
<tr>
<td>Foresight</td>
<td>11, 32, 332</td>
<td></td>
</tr>
<tr>
<td>Result</td>
<td>11, 573, 574, 83</td>
<td></td>
</tr>
</tbody>
</table>

#### 4) Line levelling aBF

<table>
<thead>
<tr>
<th>Block recorded</th>
<th>Data words (WI)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Method</td>
<td>41</td>
<td></td>
</tr>
<tr>
<td>Start height</td>
<td>11, 83</td>
<td></td>
</tr>
<tr>
<td>Backsight</td>
<td>11, 32, 331</td>
<td>even station: BF</td>
</tr>
<tr>
<td>Foresight</td>
<td>11, 32, 332</td>
<td>odd station: FB</td>
</tr>
<tr>
<td>Result</td>
<td>11, 573, 574, 83</td>
<td></td>
</tr>
<tr>
<td>Backsight</td>
<td>11, 32, 331</td>
<td>even station: BF</td>
</tr>
<tr>
<td>Foresight</td>
<td>11, 32, 332</td>
<td>odd station: FB</td>
</tr>
<tr>
<td>Result</td>
<td>11, 573, 574, 83</td>
<td></td>
</tr>
</tbody>
</table>
### DNA Section

#### 5) Line levelling BFFB

<table>
<thead>
<tr>
<th>Block recorded</th>
<th>Data words (W1)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Method</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Start height</td>
<td>41</td>
<td></td>
</tr>
<tr>
<td>11, 83</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B1</td>
<td>11, 32, 331</td>
<td></td>
</tr>
<tr>
<td>F1</td>
<td>11, 32, 332</td>
<td></td>
</tr>
<tr>
<td>F2</td>
<td>11, 32, 336</td>
<td></td>
</tr>
<tr>
<td>B2</td>
<td>11, 32, 335</td>
<td></td>
</tr>
<tr>
<td>Result</td>
<td>11, 571, 572, 573, 574, 83</td>
<td></td>
</tr>
<tr>
<td>B1</td>
<td>11, 32, 331</td>
<td></td>
</tr>
<tr>
<td>F1</td>
<td>11, 32, 332</td>
<td></td>
</tr>
<tr>
<td>F2</td>
<td>11, 32, 336</td>
<td></td>
</tr>
<tr>
<td>B2</td>
<td>11, 32, 335</td>
<td></td>
</tr>
<tr>
<td>Result</td>
<td>11, 571, 572, 573, 574, 83</td>
<td></td>
</tr>
</tbody>
</table>

#### 6) Line levelling aBFFB

<table>
<thead>
<tr>
<th>Block recorded</th>
<th>Data words (W1)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Method</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Start height</td>
<td>41</td>
<td></td>
</tr>
<tr>
<td>11, 83</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B1</td>
<td>11, 32, 331</td>
<td></td>
</tr>
<tr>
<td>F1</td>
<td>11, 32, 332</td>
<td>even station: BFFB</td>
</tr>
<tr>
<td>F2</td>
<td>11, 32, 336</td>
<td></td>
</tr>
<tr>
<td>B2</td>
<td>11, 32, 335</td>
<td></td>
</tr>
<tr>
<td>Result</td>
<td>11, 571, 572, 573, 574, 83</td>
<td></td>
</tr>
<tr>
<td>F1</td>
<td>11, 32, 332</td>
<td>odd station: FBBF</td>
</tr>
<tr>
<td>B1</td>
<td>11, 32, 331</td>
<td></td>
</tr>
<tr>
<td>B2</td>
<td>11, 32, 335</td>
<td></td>
</tr>
<tr>
<td>F2</td>
<td>11, 32, 336</td>
<td></td>
</tr>
<tr>
<td>Result</td>
<td>11, 571, 572, 573, 574, 83</td>
<td></td>
</tr>
<tr>
<td>B1</td>
<td>11, 32, 331</td>
<td>even station: BFFB</td>
</tr>
<tr>
<td>F1</td>
<td>11, 32, 332</td>
<td></td>
</tr>
<tr>
<td>F2</td>
<td>11, 32, 336</td>
<td></td>
</tr>
<tr>
<td>B2</td>
<td>11, 32, 335</td>
<td></td>
</tr>
<tr>
<td>Result</td>
<td>11, 571, 572, 573, 574, 83</td>
<td></td>
</tr>
<tr>
<td>F1</td>
<td>11, 32, 332</td>
<td>odd station: FBBF</td>
</tr>
<tr>
<td>B1</td>
<td>11, 32, 331</td>
<td></td>
</tr>
<tr>
<td>B2</td>
<td>11, 32, 335</td>
<td></td>
</tr>
<tr>
<td>F2</td>
<td>11, 32, 336</td>
<td></td>
</tr>
<tr>
<td>Result</td>
<td>11, 571, 572, 573, 574, 83</td>
<td></td>
</tr>
</tbody>
</table>
### DNA Section

#### 7) Check & Adjust

<table>
<thead>
<tr>
<th>Block recorded</th>
<th>Data words (WI)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Method</td>
<td>41</td>
<td></td>
</tr>
<tr>
<td>B1</td>
<td>11, 32, 331</td>
<td>Staff A1</td>
</tr>
<tr>
<td>F1</td>
<td>11, 32, 332</td>
<td>Staff B1</td>
</tr>
<tr>
<td>F2</td>
<td>11, 32, 336</td>
<td>Staff B2</td>
</tr>
<tr>
<td>B2</td>
<td>11, 32, 335</td>
<td>Staff A2</td>
</tr>
</tbody>
</table>

#### 8) Other blocks

<table>
<thead>
<tr>
<th>Block recorded</th>
<th>Data words (WI)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intermediate sight</td>
<td>11, 32, 333</td>
<td></td>
</tr>
<tr>
<td>Result</td>
<td>11, 32, 334</td>
<td>dh = Height difference</td>
</tr>
<tr>
<td>SetOut Height or dh</td>
<td>11, 32, 334</td>
<td>dh = Height difference</td>
</tr>
<tr>
<td>Result</td>
<td>11, 32, 334</td>
<td></td>
</tr>
<tr>
<td>SetOut Distance</td>
<td>11, 32, 334</td>
<td>11, 35</td>
</tr>
<tr>
<td>Result</td>
<td>11, 32, 334</td>
<td></td>
</tr>
<tr>
<td>Code with Info1 – Info8</td>
<td>41, 42, 43, 44, ... 49</td>
<td></td>
</tr>
</tbody>
</table>

#### 9) Measure modes

Example with Backsight:

<table>
<thead>
<tr>
<th>Block recorded</th>
<th>Data words (WI)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single mode</td>
<td>11, 32, 331</td>
<td></td>
</tr>
<tr>
<td>Mean / Mean_s mode</td>
<td>11, 32, 331, 390, 391</td>
<td></td>
</tr>
<tr>
<td>Median mode</td>
<td>11, 32, 331, 390, 392</td>
<td></td>
</tr>
<tr>
<td>Rep. single mode</td>
<td>11, 32, 331, 390</td>
<td></td>
</tr>
</tbody>
</table>
## Differences between DNA and NA series

<table>
<thead>
<tr>
<th>Item</th>
<th>DNA03 / DNA10</th>
<th>NA3003 / NA2002</th>
</tr>
</thead>
<tbody>
<tr>
<td>Repeating (undoing) a measurement or a station by stepping back</td>
<td>Key: &lt;&lt;Back &lt;br&gt;- Original backsight and foresight data in line levellings and measurements in &quot;Meas Only&quot; are deleted. &lt;br&gt;- Original data in &quot;Meas &amp; Rec&quot; and all intermediate sights are not deleted.</td>
<td>Key: REP &lt;br&gt;Code block to indicate start of repeated measurement: &quot;410000+!...nnn&quot; &lt;br&gt;nnn = 331 / 332 / 333 / ...</td>
</tr>
<tr>
<td>Code block</td>
<td>WI 41-49: total 9 words</td>
<td>WI 41-45: total 5 words</td>
</tr>
<tr>
<td>Remark word (REM1)</td>
<td>WI 71</td>
<td>--</td>
</tr>
<tr>
<td>Set out of</td>
<td>set-out difference is WI 374</td>
<td>SO difference is WI 374</td>
</tr>
<tr>
<td>Height</td>
<td>set-out difference is WI 374</td>
<td>--</td>
</tr>
<tr>
<td>Height difference</td>
<td>set-out difference is WI 35 &lt;br&gt;(Example: 35...8+00000012)</td>
<td>--</td>
</tr>
<tr>
<td>Resolution of all measurement values</td>
<td>Highest possible resolution depending on the &quot;Decimal&quot; setting during data export and adaptable in case of data overflow. &lt;br&gt;32...8+03212345 (DNA03)</td>
<td>Different and fixed resolution for individual words. &lt;br&gt;32..00+00032120</td>
</tr>
<tr>
<td>Example: Distance = 32.12m</td>
<td>WI 390 (n) and WI 391 (s)</td>
<td>WI 52</td>
</tr>
<tr>
<td>Mean mode with n and s (standard deviation)</td>
<td>390...+00000004 391.06+00000012</td>
<td>52...06+0004+012</td>
</tr>
<tr>
<td>Example: n = 4 and s = 1.2mm</td>
<td>WI 390 (n) and WI 392 (B)</td>
<td>WI 521</td>
</tr>
<tr>
<td>Median mode with n and B (band width or spread)</td>
<td>390...+00000004 392.06+00000012</td>
<td>521.06+0004+012</td>
</tr>
<tr>
<td>Example: n = 4 and B = 1.2mm</td>
<td>Marked with WI 390 (n = number of last measurement when halted). Example: 390...+00000012 &lt;br&gt;(measurement no. 12 was recorded)</td>
<td>--</td>
</tr>
<tr>
<td>Repeated single measure mode</td>
<td>Example: WI 11, 32, 331, 390, 391, 71</td>
<td>WI 11, 32, 331, 52</td>
</tr>
<tr>
<td>Example of a backsight as a mean value and with a remark</td>
<td>WI: Display of US-ft and Inches with decimals. &lt;br&gt;Data are recorded as US-ft.</td>
<td>WI: Displayed and recorded as Inch (pos. 6 with &quot;9&quot;).</td>
</tr>
<tr>
<td>Unit &quot;Inch&quot;</td>
<td>Display of US-ft and Inches with decimals. &lt;br&gt;Data are recorded as US-ft.</td>
<td>WI 57</td>
</tr>
<tr>
<td>Integration time</td>
<td>--</td>
<td>WI 57</td>
</tr>
<tr>
<td>Pos. 5 in word 32 (Distance)</td>
<td>Empty (&quot;.&quot;). 32...8+03212345</td>
<td>With meas. flag &quot;0&quot;: 32...00+00032120</td>
</tr>
<tr>
<td>Example:</td>
<td>With meas. flag &quot;0&quot;: 32...00+00032120</td>
<td>With compensator flag &quot;1&quot; 33108+00125846</td>
</tr>
<tr>
<td>Pos. 4 in word 33x (Staff reading)</td>
<td>Empty (&quot;.&quot;). 331.08+00125846</td>
<td>Flags: 0, 1, 2, 4, 5, 6 and 7</td>
</tr>
<tr>
<td>Example:</td>
<td>WI 334: 0, 1, 2 or 5. 374.28+00012345</td>
<td>&quot;0&quot;: 374.08+00012345</td>
</tr>
<tr>
<td>Pos. 5 in word 33x (Staff reading) for measurement flags:</td>
<td>Reduced set of flags: 0, 1, 2 and 5. Example: 331.28+12345678</td>
<td>&quot;1&quot;: 374.08+00012345</td>
</tr>
<tr>
<td>Pos. 5 in word 374 (Set-Out difference)</td>
<td>Value according to WI 334: 0, 1, 2 or 5. Example: 374.28+00012345</td>
<td>&quot;0&quot;: 374.08+12345678</td>
</tr>
<tr>
<td>Pos. 5 in word 83 (Height):</td>
<td>Empty (&quot;.&quot;). 83...8+12345768</td>
<td>&quot;1&quot;: 83..18+12345678</td>
</tr>
<tr>
<td>- Start height</td>
<td>Same flag as in word 33x: 83..28+12345768</td>
<td>&quot;0&quot;: 83..08+12345678</td>
</tr>
<tr>
<td>- Ground height</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GSI-16</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>
DNA Section

Sample GSI-8 data

Examples of data records in the various measurement programs:

**MEAS ONLY**

```
Block number  Distance  Staff reading  Point ID
110014+00000124  32..6+00241234  330.06+00010509
```

**Start Levelling**

```
Point ID  Ground height
410015+?......1 (Method BF)
110016+0000P135  83..6+04026500
```

**Backsight**

```
Point ID  Distance  Backsight
110017+00000035  32..6+00241234  331.06+00012554
```

**Foresight (first block for measurements, second block for results)**

```
Point ID  Distance  Foresight
110018+00000036  32..6+00241234  332.06+00010473
```

**Intermediate sight (first block for measurements, second block for results)**

```
Point ID  Distance  Intermediate sight
110020+00000101  32..6+00241234  333.06+00013286
```

**Setting-out height (first block for measurements, second block for results)**

```
Point ID  Distance  Staff reading (setting-out)
110022+00005501  83..6+00000012  83..06+04027030
```

**Mean value and remark**

```
Point number  Distance  Staff reading  1)  2)  Remark
110024+00000016  32...6+00241234  330.06+00010509  390..6+00000005  391.06+00000012  71....+0SURFACE
```

1) = Count of rep. measurements (5)
2) = Standard deviation of a single measurement (1.2mm)

**Code block**

```
Code  Info1  Info2  Info3  Info4  Info8
410025+00000099  42....+000020692  43....+00001122  44....+00000115  45....+00000788  ....  49....+0000ABCDE
```
**DNA Section**

**Conversion from new GSI format (DNA) to old GSI format (NA)**

The DNA03/DNA10 produce a GSI format that is different from the GSI format of the NA3003/NA2002. Therefore a conversion tool is offered in Leica Survey Office to convert the GSI data of the DNA into the GSI format of the NA series. In Leica Survey Office go to "DNA Tools" and then open the "DNA GSI Converter" program.

Proceed as follows:

1. Select the source file (DNA03/DNA10 measurements). The default extension is ".gsi".
2. Select the destination file. The default extension is ".raw".
3. Select the instrument type of the source data: DNA03 or DNA10.
4. Press "Convert"

**Conversion rules**

- The definitions with respect to the positions 4 to 6 in the data words are reinstalled to NA style.
- New words coming from new features, such as WI 71 (remark word), WI 35 (set-out difference of distance) or WI 390 (number of measurements in the "Rep. single" measure mode) are not removed from the measurement block.
- Measurements from new line levelling methods (aBF, aBFFB) and from Check&Adjust remain unchanged.
- New word combinations such as WI 390 + WI 391 or WI 390 + WI 392 are converted to WI 52 / WI 521.
- The additional new words of the code block (WI 46 to WI 49) are not removed.
- GSI-16 data are converted to GSI-8 data. Strings such as PtID, remarks and codes are reduced to 8 characters (the first 8 characters from the left are cut off).
DNA Section

Online command structure

Commands overview

- **SET**: Set instrument parameters
- **CONF**: Read internal parameter settings
- **PUT**: Write/change values within the instrument
- **GET/I…**: Get instant values from the instrument (last valid value)
- **GET/M…**: Release a measurement and get value
- **GET/C…**: Release continuous measurements and collect values until halted by key press [CE] on instrument or by external command "c".

Examples:

**SET commands**

SYNTAX: \texttt{SET/<set spec>_<parameter><CR/LF>}

EXAMPLE: \texttt{SET/30/0}

RESPONSE: ?

| Instrument BEEP: | SET/30/0 OFF (disable) | SET/30/1 ON (enable) |

**CONF commands**

SYNTAX: \texttt{CONF/<conf spec><CR/LF>}

EXAMPLE: \texttt{CONF/30}

RESPONSE: 0030/000

| CONF/30 reads the BEEP setting | 0030/0000 Beep disabled | 0030/0001 Beep enabled |

**PUT commands**

SYNTAX: \texttt{PUT/<put spec> <Value><CR/LF>}

EXAMPLE: \texttt{PUT/11….+00000012}

RESPONSE: ?

CONFIRMATION: <CR/LF>

Writes Pointnumber PUT/11….+00000012

\textsuperscript{☞} Make sure you put a space (\_), behind <Value>!

**GET commands**

SYNTAX: \texttt{GET/n/WI<get spec><CR/LF> \quad n = M / I / C}

EXAMPLES: \texttt{GET/M/WI32}

RESPONSE: 32…0+00014940

<table>
<thead>
<tr>
<th>Read Distance value</th>
<th>GET/I/WI32</th>
</tr>
</thead>
<tbody>
<tr>
<td>Read distance and staff reading</td>
<td>GET/I/WI32/WI330</td>
</tr>
</tbody>
</table>

Combine several words in one command:

EXAMPLE: \texttt{GET/M/WI11/WI32/WI330/WI95}

**Low Level commands**

SYNTAX: \texttt{<command>CR/LF}

<table>
<thead>
<tr>
<th>&lt;Command&gt;</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>Powers on the instrument</td>
</tr>
<tr>
<td>b</td>
<td>Powers off the instrument</td>
</tr>
<tr>
<td>c</td>
<td>Clear</td>
</tr>
<tr>
<td>BEEP/0</td>
<td>Short beep</td>
</tr>
<tr>
<td>BEEP/1</td>
<td>Long beep</td>
</tr>
<tr>
<td>BEEP/2</td>
<td>Alarm beep (short beep, 3 times)</td>
</tr>
</tbody>
</table>
**DNA Section**

**Output to serial interface**
The table shows the output to RS232 for different measurement launching methods and for different measure mode settings:

<table>
<thead>
<tr>
<th>Measure modes</th>
<th>Press measure button at instrument</th>
<th>Command: GET/M/WI330 (single mode)</th>
<th>Command: GET/C/WI330 (continuous mode) **)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single</td>
<td>1 measurement</td>
<td>1 measurement</td>
<td>continuous measuring</td>
</tr>
<tr>
<td>Mean</td>
<td>1 meas. = last mean value</td>
<td>1 measurement *)</td>
<td>continuous measuring</td>
</tr>
<tr>
<td>Median</td>
<td>1 meas. = last median value</td>
<td>1 measurement *)</td>
<td>continuous measuring</td>
</tr>
<tr>
<td>Mean s</td>
<td>1 meas. = last mean value</td>
<td>1 measurement *)</td>
<td>continuous measuring</td>
</tr>
<tr>
<td>Repeated single</td>
<td>1 meas. = last measurement when measuring stopped.</td>
<td>1 measurement *)</td>
<td>continuous measuring</td>
</tr>
</tbody>
</table>

*) Only one single measurement is released and recorded.
**) Continuous measuring is halted by keyboard press [CE] or by external command "c".
<table>
<thead>
<tr>
<th>SET SPEC</th>
<th>CONF SPEC</th>
<th>FUNCTION</th>
<th>PARAMETER</th>
<th>RESPONSE</th>
<th>SETTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>30</td>
<td>BEEP</td>
<td>0</td>
<td>0030/0000</td>
<td>OFF</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>0030/0001</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>0030/0002</td>
<td>Loud</td>
</tr>
<tr>
<td>--</td>
<td>31</td>
<td>Display illumination</td>
<td>0</td>
<td>0031/0000</td>
<td>Off</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>0031/0002</td>
<td>Circ. level</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>0031/0003</td>
<td>Display + Circ. level</td>
</tr>
<tr>
<td>32</td>
<td>32</td>
<td>Display contrast</td>
<td>[0..100]</td>
<td>0032/0nn</td>
<td>[range]</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>50</td>
<td></td>
<td>Low contrast</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>100</td>
<td></td>
<td>Medium contrast</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>High contrast</td>
</tr>
<tr>
<td>41</td>
<td>41</td>
<td>Distance UNIT</td>
<td>0</td>
<td>0041/0000</td>
<td>Meter</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>0041/0001</td>
<td>US Feet, decimal</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>0041/0002</td>
<td>Intl. Feet, decimal</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5</td>
<td>0041/0005</td>
<td>US Feet/Inch decimal</td>
</tr>
<tr>
<td>42</td>
<td>42</td>
<td>Temperature UNIT</td>
<td>0</td>
<td>0042/0000</td>
<td>Degree Celsius</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>0042/0001</td>
<td>Degree Fahrenheit</td>
</tr>
<tr>
<td>51</td>
<td>51</td>
<td>Decimals of staff readings in displays (depending on units and instr. type)</td>
<td>2</td>
<td>0051/0002</td>
<td>2 decimals</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>0051/0003</td>
<td>3 decimals</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4</td>
<td>0051/0004</td>
<td>4 decimals</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5</td>
<td>0051/0005</td>
<td>5 decimals</td>
</tr>
<tr>
<td>70</td>
<td>70</td>
<td>Baudrate</td>
<td>2</td>
<td>0070/0002</td>
<td>1200 Baud</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>0070/0003</td>
<td>2400 Baud</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4</td>
<td>0070/0004</td>
<td>4800 Baud</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5</td>
<td>0070/0005</td>
<td>9600 Baud</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>6</td>
<td>0070/0006</td>
<td>19200 Baud</td>
</tr>
<tr>
<td>71</td>
<td>71</td>
<td>Parity</td>
<td>0</td>
<td>0071/0000</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>0071/0001</td>
<td>Odd</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>0071/0002</td>
<td>Even</td>
</tr>
<tr>
<td>73</td>
<td>73</td>
<td>Terminator</td>
<td>0</td>
<td>0073/0000</td>
<td>CR</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>0073/0001</td>
<td>CR/LF</td>
</tr>
<tr>
<td>75</td>
<td>75</td>
<td>Protocol</td>
<td>0</td>
<td>0075/0000</td>
<td>Off</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>0075/0001</td>
<td>On</td>
</tr>
<tr>
<td>76</td>
<td>76</td>
<td>Data recording device</td>
<td>0</td>
<td>0076/0000</td>
<td>Internal Memory</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>0076/0001</td>
<td>RS232</td>
</tr>
<tr>
<td>78</td>
<td>78</td>
<td>Delay between 2 strings sent</td>
<td>[0..50]</td>
<td>[0..50]</td>
<td>Increase of 10ms/unit</td>
</tr>
<tr>
<td>--</td>
<td>90</td>
<td>Battery level</td>
<td>--</td>
<td>0090/00nn</td>
<td>n:[0..10]</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0: Empty</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>10: Full</td>
</tr>
<tr>
<td>--</td>
<td>91</td>
<td>Internal temp.</td>
<td>--</td>
<td>0091/0nnn</td>
<td>[0..±100] °C</td>
</tr>
<tr>
<td>95</td>
<td>95</td>
<td>AutoOFF</td>
<td>0</td>
<td>0095/0000</td>
<td>Off</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>0095/0001</td>
<td>On</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>0095/0002</td>
<td>Sleep mode</td>
</tr>
<tr>
<td>106</td>
<td>106</td>
<td>Display heater</td>
<td>0</td>
<td>0106/0000</td>
<td>Off</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>0106/0001</td>
<td>On</td>
</tr>
<tr>
<td>125</td>
<td>125</td>
<td>Earth curvature correction</td>
<td>0</td>
<td>0125/0000</td>
<td>Off</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>0125/0001</td>
<td>On</td>
</tr>
</tbody>
</table>
## DNA Section

<table>
<thead>
<tr>
<th>&lt;SET SPEC&gt;</th>
<th>&lt;CONF SPEC&gt;</th>
<th>FUNCTION</th>
<th>&lt;PARAMETER&gt;</th>
<th>RESPONSE</th>
<th>SETTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>127</td>
<td>127</td>
<td>Staff mode</td>
<td>0</td>
<td>0127/0000</td>
<td>normal</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>0127/0001</td>
<td>inverted</td>
</tr>
<tr>
<td>137</td>
<td>137</td>
<td>RS232 format length</td>
<td>0</td>
<td>0137/0000</td>
<td>GSI-8</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>0137/0001</td>
<td>GSI-16</td>
</tr>
<tr>
<td>138</td>
<td></td>
<td>Quick code recording</td>
<td>0</td>
<td>0138/0000</td>
<td>Before measurement</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>0138/0001</td>
<td>After measurement</td>
</tr>
</tbody>
</table>
**DNA Section**

**PUT and GET**

<table>
<thead>
<tr>
<th>PUT SPEC</th>
<th>GET SPEC</th>
<th>FUNCTION</th>
<th>Access/Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>11</td>
<td>Running PtID</td>
<td>PUT/11….+00001234_&lt;CR/LF&gt; GET/M/WI11&lt;CR/LF&gt;</td>
</tr>
<tr>
<td>71</td>
<td>71</td>
<td>Remark</td>
<td>PUT/71….+00001234_&lt;CR/LF&gt; GET/M/WI71&lt;CR/LF&gt;</td>
</tr>
<tr>
<td>560</td>
<td>560</td>
<td>Time: [hh.mm.ss]</td>
<td>PUT/560..6+00113059_&lt;CRLF&gt; GET/I/WI560&lt;CRLF&gt;</td>
</tr>
<tr>
<td>561</td>
<td>561</td>
<td>Date: [mm.dd]</td>
<td>PUT /561..6+00022500_&lt;CRLF&gt; GET/I/WI561&lt;CRLF&gt;</td>
</tr>
<tr>
<td>562</td>
<td>562</td>
<td>Year: [yyyy]</td>
<td>PUT/562….+00002002_&lt;CR/LF&gt; GET/I/WI562&lt;CRLF&gt;</td>
</tr>
<tr>
<td></td>
<td>32</td>
<td>Horiz. distance</td>
<td>GET/M/WI32&lt;CR/LF&gt;</td>
</tr>
<tr>
<td></td>
<td>330</td>
<td>Staff reading</td>
<td>GET/M/WI330&lt;CR/LF&gt;</td>
</tr>
<tr>
<td></td>
<td>95</td>
<td>Internal temp. [°C]</td>
<td>GET/M/WI95&lt;CR/LF&gt;</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>Serial number</td>
<td>GET/I/WI12&lt;CR/LF&gt;</td>
</tr>
<tr>
<td></td>
<td>13</td>
<td>Instrument type</td>
<td>GET/I/WI13&lt;CR/LF&gt;</td>
</tr>
<tr>
<td></td>
<td>17</td>
<td>Date, Year: [DD.MM.YYYY]</td>
<td>GET/I/WI17&lt;CR/LF&gt;</td>
</tr>
<tr>
<td></td>
<td>19</td>
<td>Day, Time: [MM.DD.hh.mm]</td>
<td>GET/I/WI19&lt;CR/LF&gt;</td>
</tr>
<tr>
<td></td>
<td>599</td>
<td>SW Version of system</td>
<td>GET/I/WI599&lt;CR/LF&gt;</td>
</tr>
</tbody>
</table>

**Warnings and Errors**

<table>
<thead>
<tr>
<th>Message ID</th>
<th>Meaning</th>
<th>Possible reasons</th>
</tr>
</thead>
<tbody>
<tr>
<td>@W400</td>
<td>Instrument busy</td>
<td>Any other device is still interfacing the instrument; check interfacing priorities</td>
</tr>
<tr>
<td>@W427</td>
<td>Invalid command</td>
<td>The string sent to the instrument could not be decoded properly or does not exist; check the syntax, or … Input buffer overflow (max. 100 characters)</td>
</tr>
<tr>
<td>@E458</td>
<td>Tilt sensor out of range</td>
<td>Instrument is not levelled-up.</td>
</tr>
<tr>
<td>@E439</td>
<td>Measurement not possible</td>
<td>For example no staff present or inverted staff or picture too dark.</td>
</tr>
</tbody>
</table>