TPS300 Basic Series

User Manual TC(R)303/305/307

Version 3.5
English

Leica Geosystems

Electronical Total Station

Congratulations on your purchase of a new Leica Geosystems Total Station.

This manual contains important safety directions *(refer to section "Safety directions")* as well as instructions for setting up the instrument and operating it. Please read this User Manual carefully to achieve maximum efficiency from your Instrument.

Product identification

The type and the serial number of your instrument indicated on the label in the battery compartment.
Write the type and serial number of your instrument in the space provided below, and always quote this information when you need to contact your agency or service workshop.

Type:_____ Serial no.: _____

Symbols used in this manual

The symbols used in this User Manual have the following meanings:

DANGER:
Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

WARNING:
Indicates a potentially hazardous situation or an unintended use which, if not avoided, could result in death or serious injury.

CAUTION:
Indicates a potentially hazardous situation or an unintended use which, if not avoided, may result in minor or moderate injury and / or appreciable material, financial and environmental damage.

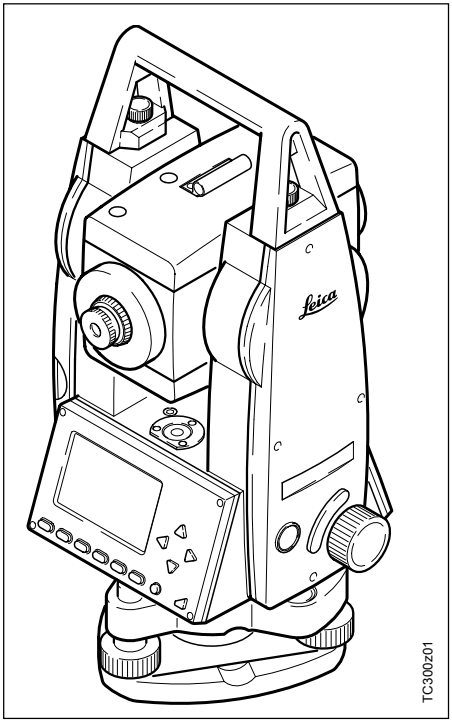
Important paragraphs which must be adhered to in practice as they enable the product to be used in a technically correct and efficient manner.

Contents

The Leica Geosystems TC(R)303/ 305/307 is a high-quality electronic total station designed for the construction site.
Its innovative technology makes the daily surveying jobs easier.

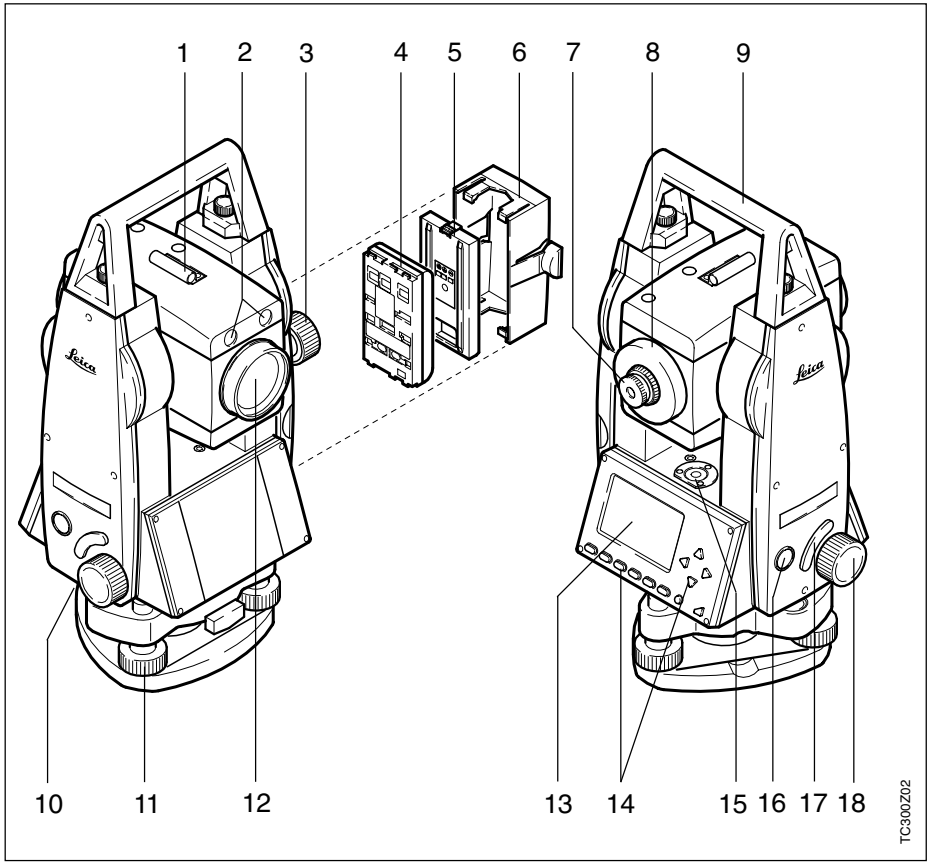
The instrument is ideally suited for simple construction surveys and setting out tasks.

The easy operation of the instrument functions can be learned without problems in no time.

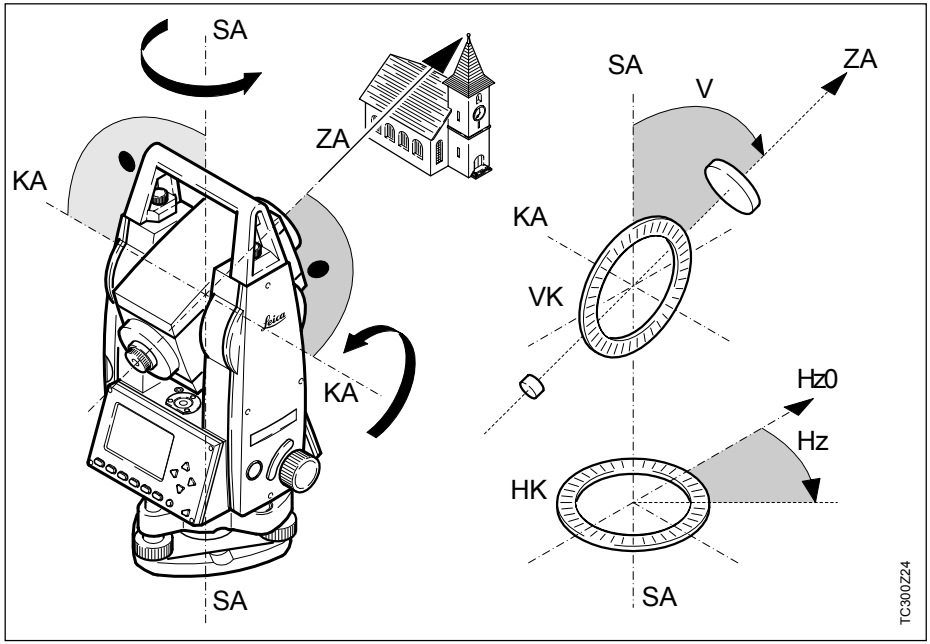


Special features

- Easy and quickly to learn !
- Interactive keys; with large and clear LCD.
- Small, light-weight and easy-to-use.
- Measurements without reflector with the integrated visible laser beam (TCR instruments).
- Additional trigger key on side cover.
- Continuous drives for horizontal and vertical angles (tangent screws)
- With laser plummet as standard.



1 Optical sight
2 Integrated guide light EGL (optional)
3 Vertical drive
4 Battery (optional)
5 Battery stand for GEB111
6 Battery cover
7 Eyepiece; focussing graticule
8 Focussing telescope image
9 Detachable carrying handle with mounting screws
10 Serial interface RS232
11 Foot screw
12 Objective with integrated Electronic Distance Measurement (EDM); Beam exit
13 Display
14 Keyboard
15 Circular level
16 On/Off key
17 Trigger key
18 Horizontal drive



ZA = Line of sight / collimation axis
Telescope axis = line from the reticle to the centre of the objective.

SA = Standing axis
Vertical rotation axis of the telescope.

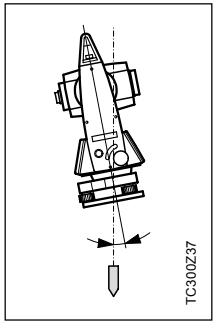
KA = Tilting axis
Horizontal rotation axis of the telescope (Trunion axis).

V = Vertical angle / zenith angle

VK = Vertical circle
With coded circular division for reading the V-angle.

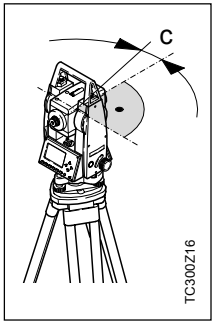
Hz = Horizontal angle

HK = Horizontal circle
With coded circular division for reading the Hz-angle.



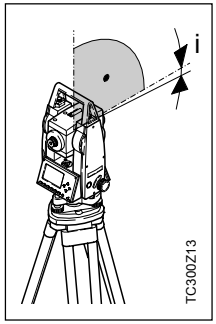
Standing axis inclination

Angle between plumb line and standing axis.



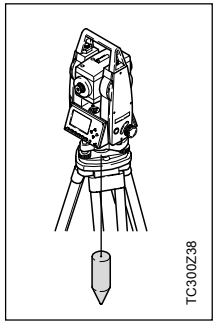
Line-of-sight error (Hz-collimation)

The line-of-sight error is the deviation from the perpendicular between tilting axis and line-of-sight. This could be eleminated by measuring in both faces.



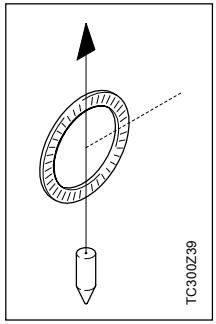
V-index (Vertical index error)

With horizontal line-of-sight the V-circle reading should be exactly 90°(100gon). The deviation from this values is termed V-index (i).



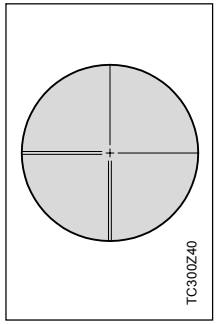
Plumb line / Compensator

Direction of gravity. The compensator defines the plumb line within the instrument.



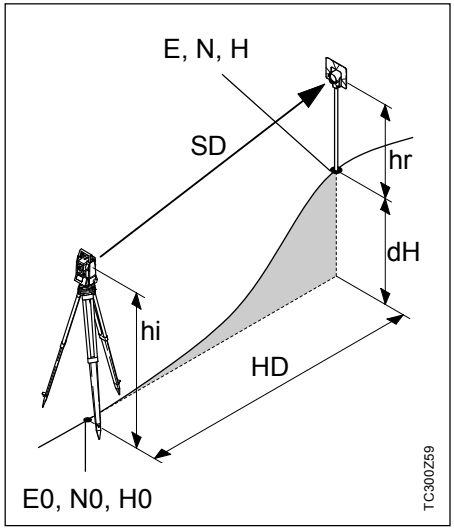
Zenith

Point on the plumb line above the observer.



Reticle

Glass plate within the telescope with reticle.



SD	Indicated meteorological corrected slope distance between instrument tilting axis and centre of prism/laser spot (TCR)
HD	Indicated meteorological corrected horizontal distance
dH	Height difference between station and target point
hr	Reflector height above ground
hi	Instrument height above ground
E0	Station coordinate (Easting)
N0	Station coordinate (Northing)
H0	Station height
E	Easting of target point
N	Northing of target point
H	Height of target point

Area of applicability

This User Manual is valid for all instruments of the TPS300 Basic Series.

TC Instruments are equipped with an invisible infrared EDM and TCR Instruments with a visible red laser for reflectorless measuring.

"J" types are Japanese versions and "S" types are equipped with a shiftable tribrach.

Sections only valid for TCR instruments are marked accordingly.

The program package Leica SurveyOffice is used for the data exchange between the TPS300 and the PC. It contains several auxiliary programs in order to support your use of the Instrument.

Installation on the PC
The installation program for the Leica SurveyOffice can be found on the CD-ROM supplied. Please note that the Leica SurveyOffice can only be installed under the operating systems MS Windows 95/ 98, Windows 2000, Windows NT4.0 and Windows ME .

For the installation call program "**setup.exe**" in the directory **\SOffice\"Language"\Disk1** on the CD-ROM and follow the input instructions of the installation program. When using TPS300 instruments, select option "Standard" or "User defined" and select TPS300 Tools additionally.

Program content

After successful installation the following programs appear:

- **Data Exchange Manager**:
  For data exchange of coordinates, measurements, codelists and output formats between instrument and PC.
- **Codelist Manager**:
  For creating and processing of codelists.
- **Software Upload**:
  For loading/deleting system software, application programs and EDM-software as well as system/application texts.

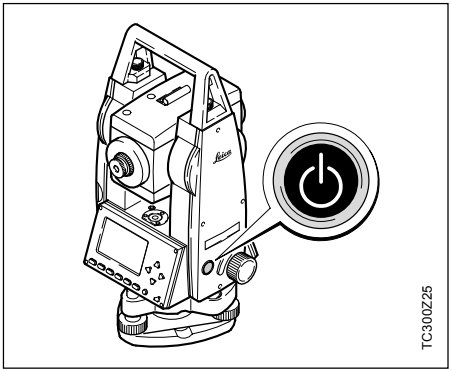

Before the Software Upload, always insert a charged battery into the instrument.

- **Coordinate Editor**:
  Import/Export as well as creating and processing of coordinate files.
- **Settings**:
  For general settings of all applications of Survey Office (e.g. interface parameter).
- **External Tools**:
  Access to Format Manager (user-defined output formats) and TPS Setup (user-defined basic settings). Here your output software can be called directly, as an example.
- **Exit**:
  Quits the SurveyOffice.
- **Register**:
  Registering type of instrument and additional objects (e.g. formats) or programs.

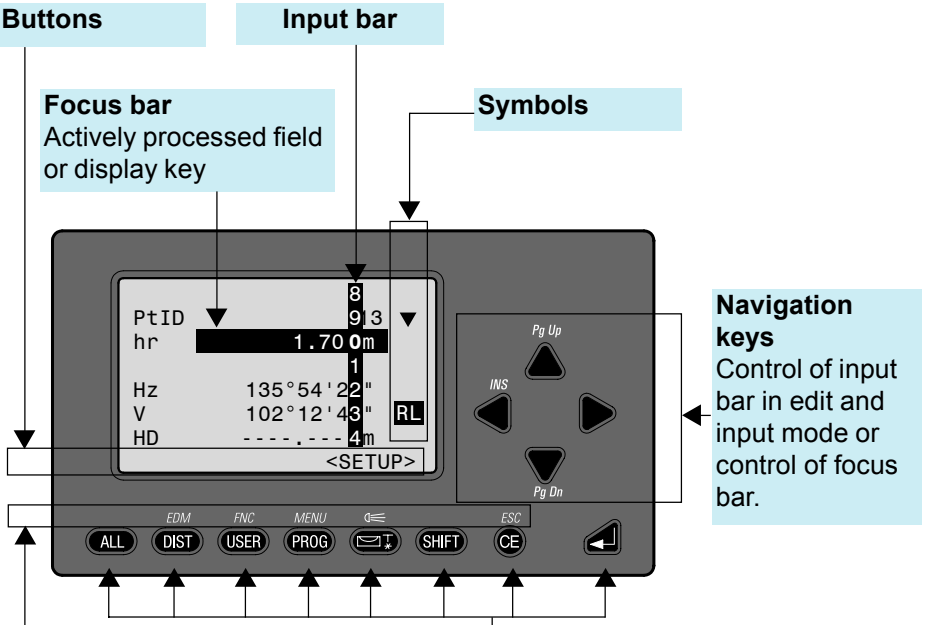

For more informationen about Leica SurveyOffice refer to the comprehensive Online Help.

Keypad

The **On/Off key** is located on the side cover of the TC(R)303/305/307 avoiding inadvertently switching the Instrument off.



All shown displays are examples. It is possible that local software versions are different to the basic version.



Fix keys

Measure distance and angle; record measured values.

Measure distance and angles; display measured values without recording.

Key, programmable with function from the FNC menu.

Calling the application programs.

Switching on/off electronic level. The laser plummet is activated simultaneously.

Switching to the second key level (EDM, FNC, MENU, illumination, ESC) and switching between alphanumeric/numeric character set.

Erasing character/field; stopping EDM.

Confirming an input; continue to the next field.

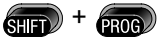
Key combinations

EDM -> 

Access to distance measuring functions and distance corrections (ppm).

FNC -> 

Quick-access to measurement-supporting functions.

MENU -> 

Access to Data Manager, instrument settings and adjustments.

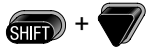
Switching on/off the display illumination and activating the display heating (if instrument temperature below -5°C).

ESC -> 

Quit a dialog or the edit mode with activation of the "previous" value. Return to next heigher level.

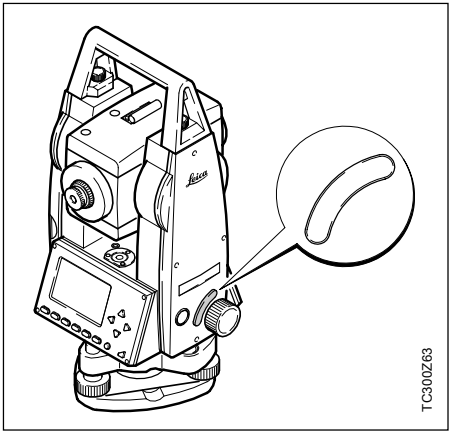
PgUP-> 

"Page Up" = scrolling upwards if several displays available in one dialog.

PgDN-> 

"Page Down" = scrolling downwards if several displays available in one dialog.

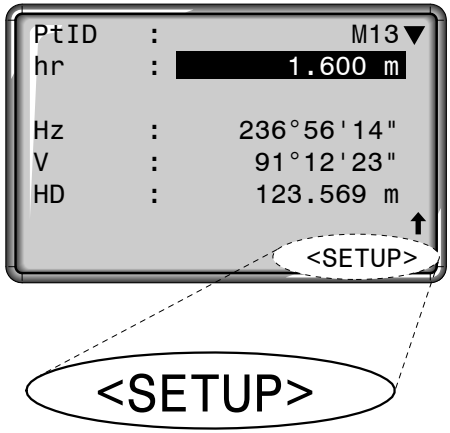
Trigger key



On the trigger key three settings are possible. Function **ALL** or **DIST** can be assigned to the key or **switched off**.

The key can be activated in the configuration menu (see "Menu/System settings").

Buttons



Buttons are a range of commands appearing in the bottom line of the display. They can be selected with the navigation keys and activated with . Depending on the active function/application other buttons may become available.

Important buttons :

SET	Set displayed value and quit dialog.
OK	Set displayed message or dialog and quit dialog.
EXIT	Early quit of a function/ application or a menu. Changed values are not set.
PREV	Back to last active dialog.
NEXT	Continue to next dialog.

Find further information about menu/application-specific buttons in the relevant sections.

Depending on software version different symbols are displayed indicating a particular operating status.

◀ ▶ A double arrow indicates choice fields.

Using the navigation keys the desired parameter can be selected. Choice fields can be quit with as well as with or .

▲,▼,▲▼ Indicates that several pages are available which can be selected with SHIFT and SHIFT .

I, II Indicates telescope position I or II *(refer also to "System settings").*

Indicates that Hz is set to "left side angle measurement" (anti-clockwise).

Status symbol "EDM type"

IR **Infrared EDM** (invisible) for measuring against prisms and reflective targets.

RL **Reflectorless EDM** (visible) for measuring against all targets.

Status symbol "Battery capacity"

The battery symbol indicates the level of the remaining battery capacity (75% full shown in the example).

Status symbol "Shift"

⬆ SHIFT was pressed or switching between alphanumeric/numeric character set.

SHIFT + PROG

```
      MENU
❶ QUICK SETTINGS
❷ ALL SETTINGS
❸ DATA MANAGER
❹ CALIBRATION
❺ SYSTEM INFO

 <EXIT>
```

Menu selection.

Execute.

<EXIT> Leave the menu. Back to "Measure".

Depending on user interface sequence and arrangement of menu items may be different.

```
❶ QUICK SETTINGS

Contrast   :      50% ◀ ▶
Tilt Corr  :   1-axis ◀ ▶
USER Key   :   IR-RL  ◀ ▶
TRIGGER Key:     ALL ◀ ▶
```

```
❷ SETTINGS

SYSTEM SETTINGS
ANGLE SETTINGS
UNIT SETTINGS
EDM SETTINGS
COMMUNICATION
TIME & DATE
```

```
❸ DATA MANAGER

VIEW/EDIT DATA
INITIALIZE MEMORY
DATA DOWNLOAD
MEMORY STATISTIC
```

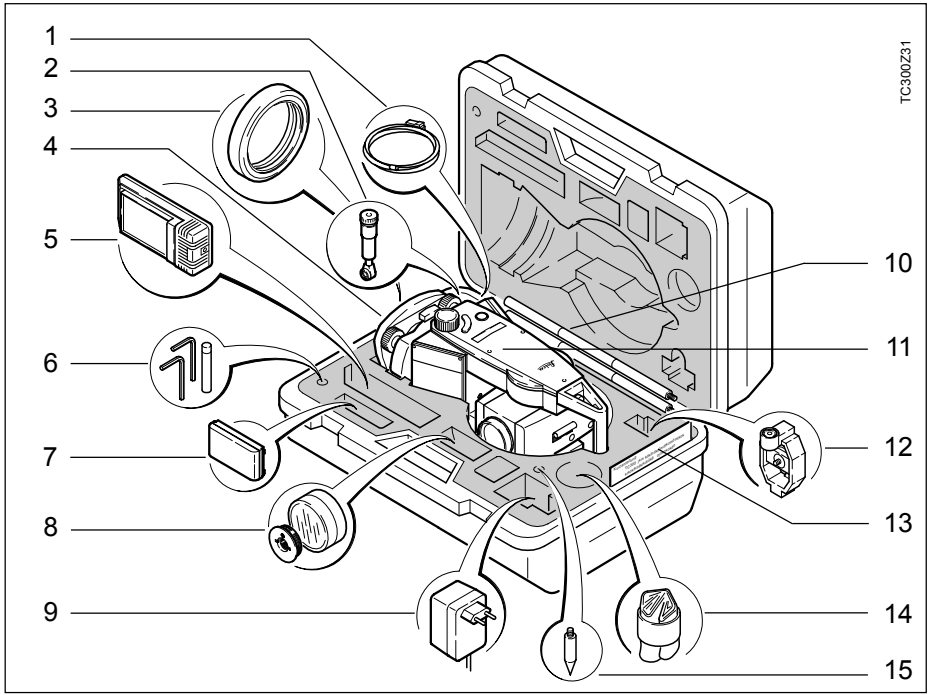
```
❹      CALIBRATION

HZ-COLLIMATION
V-INDEX
```

```
❺ SYSTEM INFO
Free Jobs      :        3
Tilt Corr      :      OFF
USER Key       :      REC
TRIGGER Key    :     DIST
Battery        :      50%
```

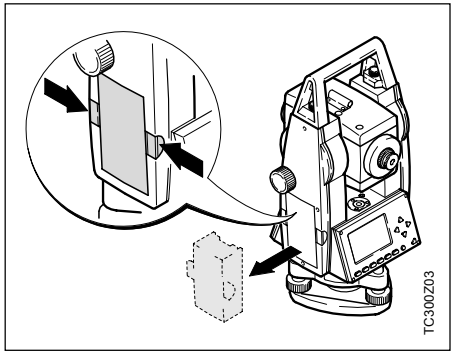
```
Instr. Temp.   :     21°C
DSP Heater     :      OFF
```

```
Hz-Collimation:  -0.015g
V-Index        :  +0.008g
```

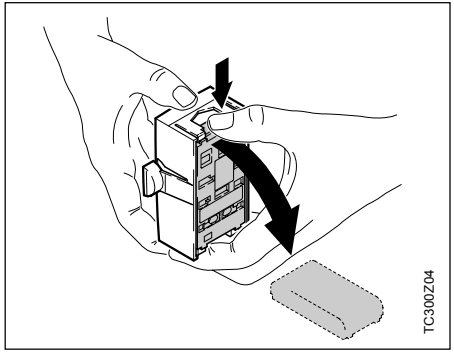
RemoveTC(R)303/305/307 from transport case and check for completeness:



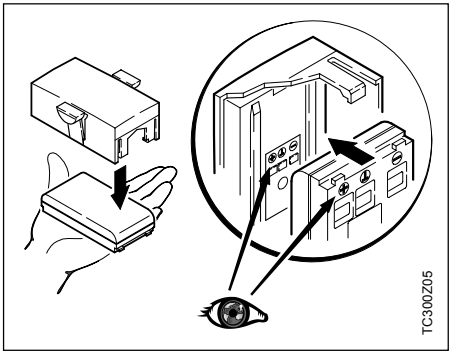
1 PC cable (optionally)
2 Zenith eyepiece or eyepiece for steep angles (optionally)
3 Counterweight for eyepiece for steep angles (optionally)
4 Removable tribrach GDF111 (optionally)
5 Battery charger and accessories (optionally)
6 Allen key (2x)
Adjusting pins (2x)
7 Spare battery GEB111(optionally)
8 Sun filter / plug adaptor tribrach (optionally)
9 Mains unit for battery charger (optionally)
10 Mini prism rod (optionally)
11 Total station
12 Mini prism + holder (optionally)
13 QuickStart Manual/ Mini target plate (only for TCR instruments)
14 Protective cover / Lens hood
15 Tip for mini prism(optionally)



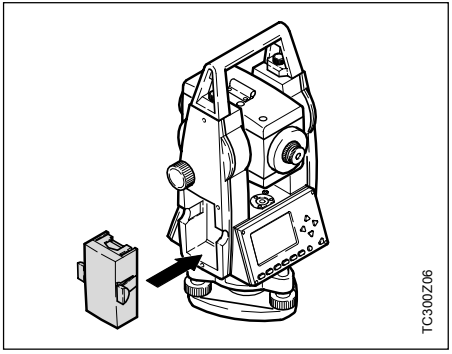
1. Remove battery holder.



2. Remove battery and replace.



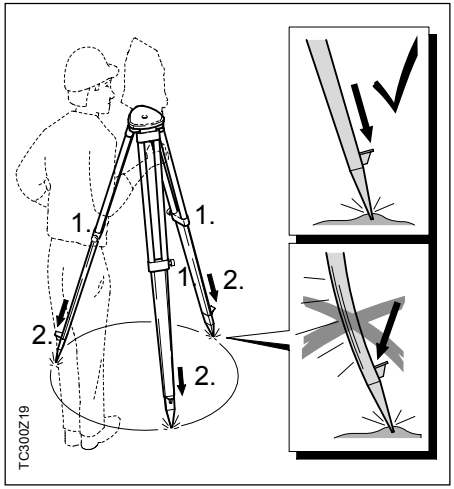
3. Insert battery into battery holder.



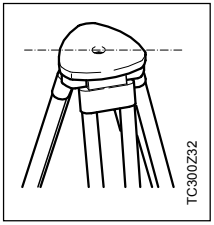
4. Insert battery holder into instrument.

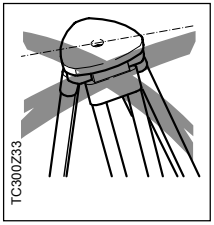
Insert battery correctly (note pole markings on the inside of the battery cover). Check and insert battery holder true to side into the housing.

- For type of battery *see chapter "Technical Data".*
- For charging battery *see chapter "Charging the batteries".*



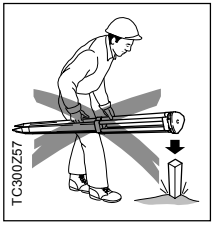
1. Loosen screws of tripod legs, pull out to required length and tighten screws.
2. In order to guarantee a firm foothold sufficiently press the tripod legs into the ground.
   When pressing the legs into the ground note that the force must be applied along the legs.

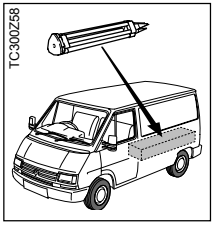




When setting up the tripod pay attention to a horizontal position of the tripod plate.

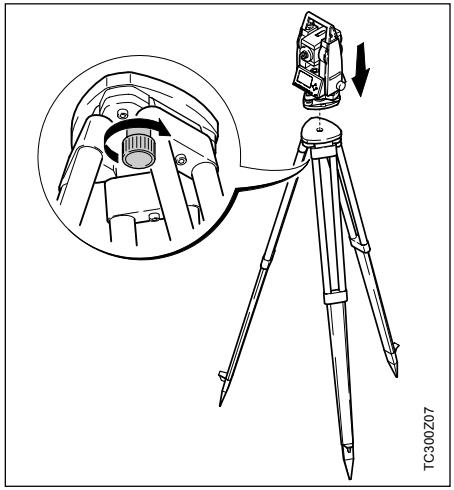
Heavy inclinations of the tripod must be corrected with the footscrews of the tribrach.

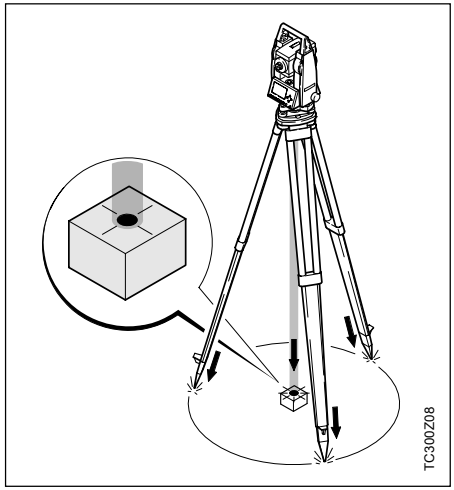


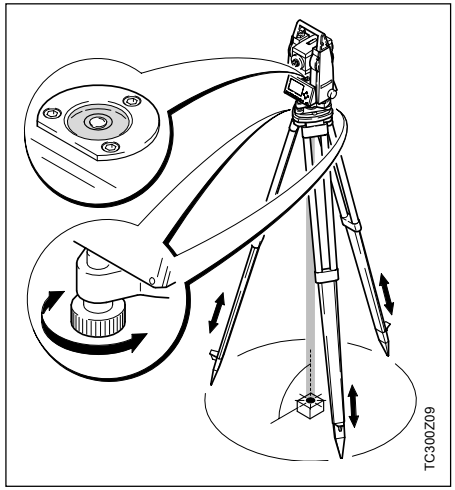


Careful handling of tripod

- Check all screws and bolts for correct fit.
- During transport always use the cover supplied.
  Scratches and other damages can result in poor fit and measuring inaccuracies.
- Use the tripod only for surveying tasks.



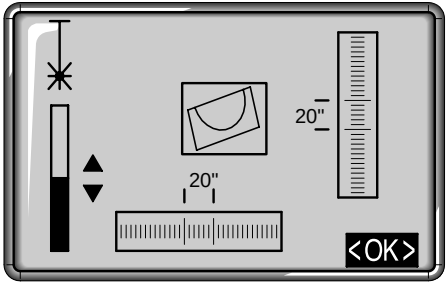




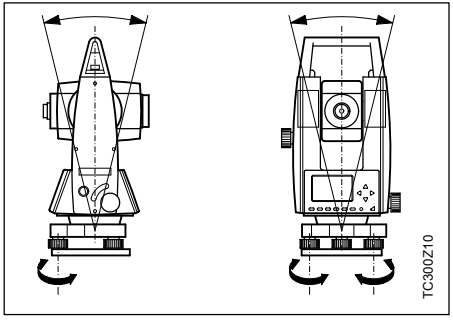
1. Place the instrument onto the tripod head. Tighten central fixing screw of tripod slightly .
2. Turn footscrews of tribrach into its centre position.
3. Switch on laser plummet with  The electronic level appears in the display.
4. Position tripod legs so that the laser beam is aimed to the ground point.
5. Firmly press in tripod legs.
6. Turn the footscrews of the tribrach to centre the laser beam exactly over the ground point.
7. Move the tripod legs to centre the circular level. Now the instrument is roughly levelled-up.

Accurate levelling-up with electronic level

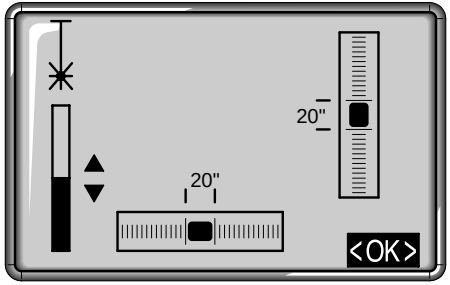
1. Switch on electronic level with . In case of insuffient levelling-up an inclined level symbol appears.



2. By turning the footscrews centre the electronic level.



If the electronic level is centered the instrument is levelled-up.



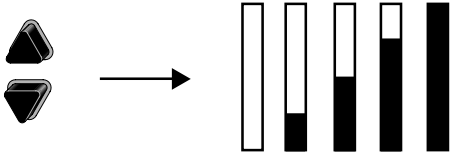
3. Check centring with the laser plummet and re-centring if necessary.

4. Switch off the electronic level and the laser plummet with .

Laser intensity

Changing the laser intensity

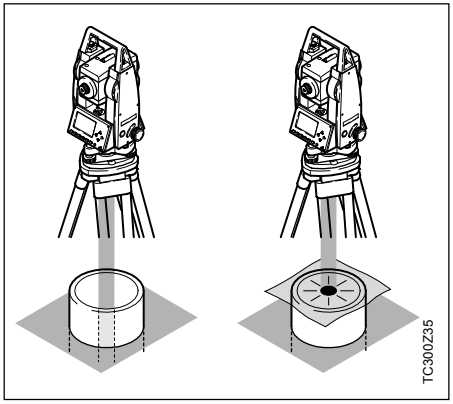
External influences and the surface conditions may require the adjustment of the intensity of the laser. As required, the laser plummet can be adjusted in 25% steps.



Min. 50% Max

5. With the <OK> button the indicated laser intensity is set and the function terminated.

Laser plummet and electronic level are activated together with .

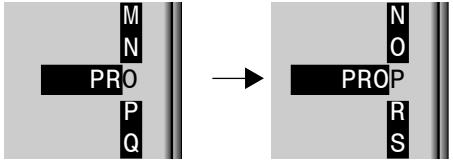


Positioning over pipes or depressions

Under some circumstances the laser spot is not visible (e.g. over pipes). In this case, the laser spot can be made visible by putting on a transparent plate. So the the laser spot can be easily aligned to the centre of the pipe.

Input mode

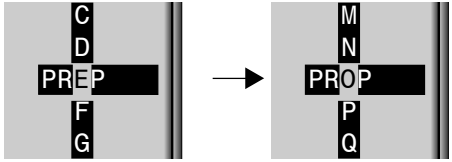
In the input mode erased fields are filled with text or numerical values.



1. Erase input field and activate vertical input bar.
2. Select characters/numbers in the input field.
3. Confirm selected character. Character moves to left.
4. Erase a character.
5. Confirm input.

Edit mode

In the edit mode already existing characters are overwritten, deleted or changed.



1. Start edit mode. Vertical edit bar is positioned flush right.
2. Edit bar is positioned flush left.
3. Overwrite the relevant character.
4. Erase a character.
5. Confirm input.

Erasing characters

- Method 1:

1. Place bar onto the character to be erased.
2. Erase individual characters by pressing CE.

3. If all characters are erased the previous value can be activated again by pressing CE once more.

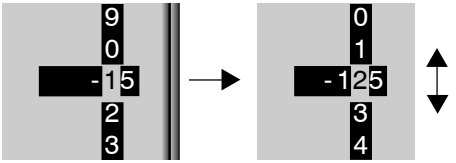
- Method 2:

SHIFT CE deletes the edited value and restores the previous value.

Inserting characters

If a character was skipped (e.g. -15 instead of -125) you can insert it later.

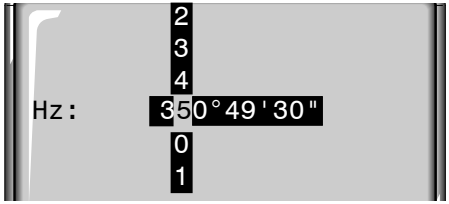
1. Place bar onto number "1".



2. With SHIFT a character is inserted right of number "1".
3. ▲ ▼ : Edit the inserted value with the vertical edit bar.
4. Confirm input/change using ◢ .

E.g. angle values, reflector, instrument heights and coordinates, etc.

Example: 350°49'30"



In case of inputs which are within certain limits due to their representation (e.g. angle unit sexadecimal) the selection in the vertical bar is automatically limited to valid numbers.

As an example, if the angle unit "Sexagesimal" is set the entry of 370° is not possible at all.

After entry of "3" only numbers <6 are approved because entering 370 is not permitted.

A vertical bar appears in the active input field containing alphanumeric and additional characters.

SHIFT Switch between numeric/ alphanumeric character set.

▲ ▼ Selection of characters in the input bar.

Mixed entries (numerical/ alphanumerical) are possible into alphanumerical data fields.

Character set

The vertical bar contains the following characters for the numeric/ alphanumeric input mode.

Numerical character set	Alphanumerical character set
" + " (ASCII 43) " - " (ASCII 45) " . " (ASCII 46) " 0 - 9 " (ASCII 48 - 57)	" " (ASCII 32) [space] " ! " (ASCII 33) " # " (ASCII 35) " $ " (ASCII 36) " % " (ASCII 37) " & " (ASCII 38) " * " (ASCII 42) " + " (ASCII 43) " - " (ASCII 45) " . " (ASCII 46) " / " (ASCII 47) " ? " (ASCII 63) " @ " (ASCII 64) " A - Z" (ASCII 65 .. 90) " _ " (ASCII 95) [Underscore]

Within data fields where point numbers or codes can be searched the character entry "*" is additionally possible.

Signs

+/- In the alphanumeric character set "+" and "-" are treated as normal alphanumeric characters with no mathematical function.

Additional characters

***** Place holder during Wildcard point search *(see chapter "Wildcard search").*

"+" / "-" appears only in the front position of an input.

In the edit mode the position of the decimal place cannot be changed. The decimal place is skipped.

The point search is a global function used by applications to search for internally stored measuring points or coordinates.
It is possible for the user to limit the point search to a particular job or to search the whole storage.

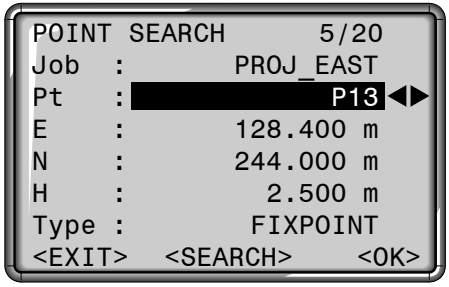
Fixed points are always displayed first matching the relevant search criteria. If several points meet the search conditions then the points are arranged depending on "age". The instrument always finds the current fixed point first.

Direct search

By entering an actual point number (e.g. "P13) all points with the corresponding point number are found.

Example:

Input: "P13"
As an example, 2 fixed points and 2 measurements are found. You can page through the match selection using ◀ ▶. As an example, a possible sequence is shown below.



Definitions

FIXPT	The point found is a fixed point.
MEAS	The point found is a measured point.
5/20	The point found is point no. 5 of a total of 20 points in this relevant job.
◀ ▶	Scroll within all points matched.
<SEARCH>	Re-enter the search criteria.

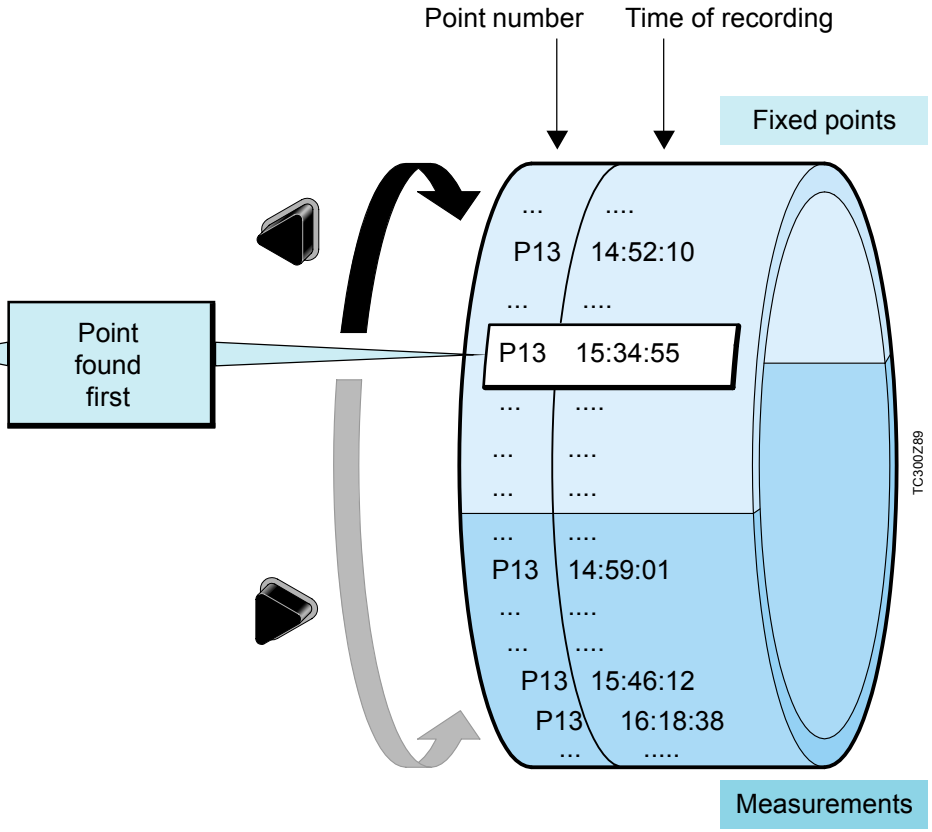
If no suitable point can be found the user is notified by the error message "Point not found" or "Database empty".

Point search is always started with the last recorded point.
So the last entered/measured points are displayed first; fixed points before measured points.

Scrolling through the list of points found.

Found:

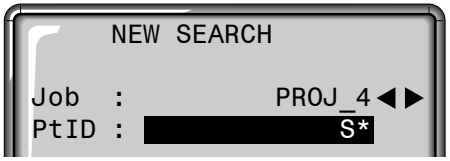
- P13, fixed point, time: 15:34:55
- P13, measurement, time: 14:59:01
- P13, measurement, time: 15:46:12
- P13, measurement, time: 16:18:38
- P13, fixed point, time: 14:52:10
- to start of list !



At the end of the measured points the search returns to the beginning ofthe fixed points.

The Wildcard search is indicated by a "*" . The asterisk is a place holder for any following sequence of characters.

Wildcards are always used if the point number is not fully known, or if a batch of points is to be searched for.



Starts point search.

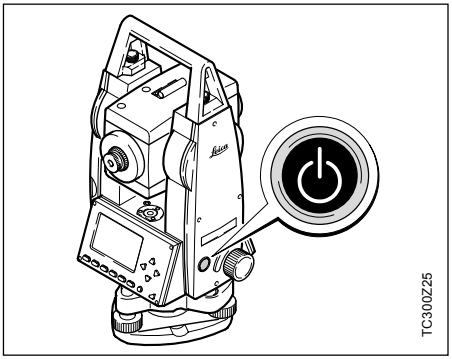
Examples:

*	all points of any length are found.
A	All points with exactly the point number "A" are found.
A*	all points of any length starting with "A" are found (e.g.: A9, A15, ABCD)
*1	all points of any length with a "1" at the second place are found (e.g.: A1, B12, A1C)
A*1	all points of any length with an "A" at the first place and a "1" at the third place are found (e.g.: AB1, AA100, AS15)

Definitions

FIXPT	The point found is a fixed point.
MEAS	The point found is a measured point.
5/20	The point found is point no. 5 of a total of 20 points in this relevant job.
	Scrolling within all points found.
<SEARCH>	Re-enter the search criteria.

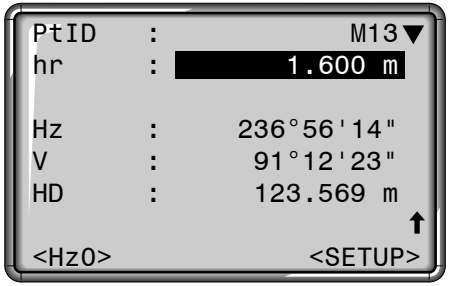
After switching on and setting up correctly, the total station is immediately ready for measuring.



In the measuring display calling all functions/applications under FNC, EDM, PROG, MENU, LIGHT, LEVEL- and LASER-PLUMMET is possible.

All shown displays are examples. It is possible that local software versions are different to the basic version.

Example of a possible measuring display:



Displays

▼ Indicating more displays with additional data (e.g. dH, SD, E, N, H, ...)

SHIFT ▼ : Changing the display.

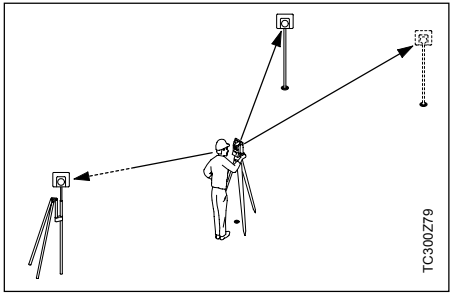
<Hz0> Hz-orientation is set to 0°00'00" / 0 gon.

ALL Angles are permanently displayed. At the time of pressing the key a distance measurement is triggered. The angle values and distance are stored in the internal memory or downloaded via serial interface.

DIST A distance measurement is triggered and shown in the display. Angles are displayed independently of the distance measurement. The displayed distance remains valid until it is replaced by a new distance measurement.

This dialog generates a station block without coordinates which can be evaluated by software.

In the data output the data is made available depending on the evaluation possiblities The orientation is manual.



Procedure:
<SETUP> This button in the measuring display activates the definition of station and orientation.

```
        SETUP
StID :              100
hi   :          1.500 m

BsPt :              101
BsBrg:         0°00'00"

<EXIT><Hz0> <STAT> <SET>
```

Station:
The station can be defined with a station name.

1) Move cursor to "StID" and enter station number as well as instrument height "hi". Close entry with .

Orientation:
The orientation is designated again with number and description of the target point.

2) Move cursor to "BsPt" and enter orientation point number. Close entry with .
3) Manual input of a Hz value as orientation or set <Hz0>.

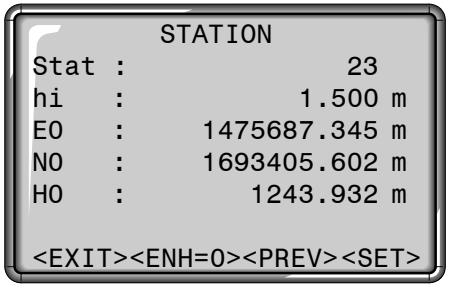
The orientation is continuously displayed but can be modified in the edit mode.

Buttons:

<Hz0>	The Hz-angle is set to 0° or 0 gon.
<SET>	The entries are registered and the measuring display is activated again.
<STAT>	Starts manual input of the station coordinates.

Manual input of the station coordinates:

Within this dialog, the name, the height and the station coordinates of the instrument can be set manually.



1. Move cursor to the required line.
   Close entry with  .

2. <SET>: The entries are registered and the measuring display is activated again.

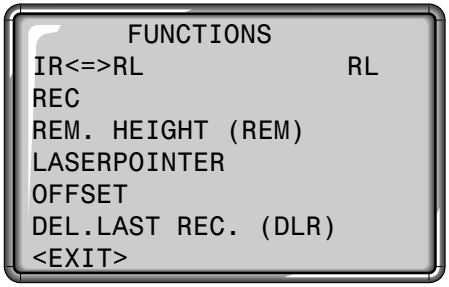
<ENH=0> the station coordinates are set to (0/0/0).

<PREV> Back to setup display.

<EXIT> Back to measuring display without saving

FNC Key

With "FNC" (SHIFT + USER) different functions are available.



Application of individual functions are described in this chapter.

Functions can also be started directly from the different applications.

Each function from the FNC menu can be assigned to the USER key *(see chapter "Menu/ Settings").*

EDM change

Move cursor to EDM selection (IR<=>RL).

Start function.

Change between the two EDM types IR (Infrared) and RL (Reflectorless). New setting is displayed for about one second.

IR: Infrared: Distance measurements with prisms.

RL: Visible laser: Distance measurements without prisms up to 80m; with prisms from 1 km up.

Find more information in chapter *"EDM Settings"*.

REC (Storing)

Move cursor to REC function.

Start function.

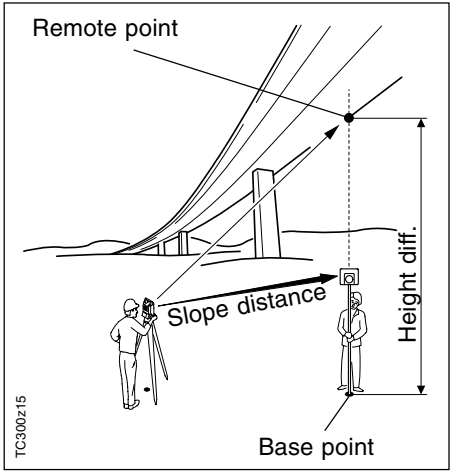
Actual measured data is stored by "REC" to the internal memory or via the serial interface.

By activating "REC" the following actions are carried out:

- Recording a measurement block.
- Incrementing of current point number.

Move cursor to "REM. HEIGHT (REM)" function.

Start function.



Points directly above the base prism can be determined without a prism at the target point.

Measure base point:

1. Enter point number and prism height.

```
BASE POINT Pt1

Pt1  :          BH001
Hr   :          1.650 m
HD   :       ----.--- m


<EXIT>              <MEAS>
```

2. Trigger distance measurement and indication of horizontal distance (HD) with <MEAS>.

<MEAS> Measure and record the base point.

Determine remote point:

3. Aim at the remote point with the telescope .

```
BASE POINT Pt2
Pt1  :              100
Pt2  :              101
dH   :            8.346 m
H    :          512.042 m
HD   :           70.571 m

<EXIT> <NEWBASE>   <MEAS>
```

4. Store with "MEAS" measured data of the remote point. No new distance measurement is carried out.

Height (H) and height difference (dH) as function of actual V-angle and measured distance to base point are computed and displayed immediately.

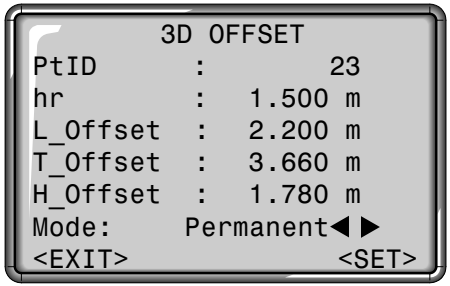
<NEWBASE> Enter and measure a new base point.

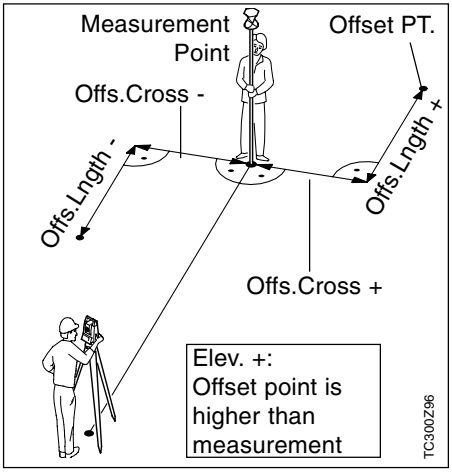
Laser Pointer

Switches on or off the visible laser beam for illuminating the target point. The new setting is displayed for approx. one second and then set.

Target Offset

If it is not possible to set up the reflector directly, or it is not possible to aim the target point directly, the offset values (length, cross and/or height offset) can be entered. The values for the angle and distances are calculated directly for the target point.





Procedure:

1. Enter the point ID and the reflector height
2. Enter the offset values (length, cross and/or height) as per the sketch
3. Define the period for which the offset is to apply.
4. <SET> calculates the corrected values and jumps to the application from which the offset function was started. The corrected angle and distances are displayed as soon as a valid distance measurement has been triggered or exists.

<EXIT> Leaves the function and returns to the application from which the function was started.

SHIFT Changes to 2D target offset (without entry of the height offset).

The period of applicability can be set as follows:

Reset after REC	The offset values are reset to 0 after the point is saved.
Permanent	The offset values are applied to all further measurements.

The function can only be started in the applications "Measuring" and "Surveying". The offset values are always reset to 0 when the application is quit.

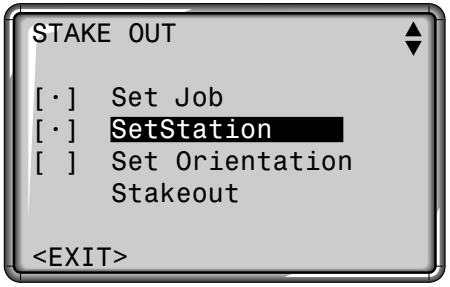
This function deletes the last recorded data block. This can be either a measurement block or a code block.

Deleting the last record **is not reversible** !

Only records can be deleted which were recorded in "Surveying" or in "Measuring".

Start-up programs are a set of sidekick functions for the successful stations setup and data management. The user can select start programs individually.

PROG Calling the program menu and executing an application with .



A "•" indicates that a job is set and that in the job set the last station/ orientation in the memory correspond to the actual station/orientation.

Select or skip a start-up program. The selection is marked by the black bar.

Execute the marked start-up program.

<EXIT> Terminate the start-up programs and back into the program menu or selection of a new application.

Find further information about individual start-up programs on the subsequent pages !

Error messages:

"SET A JOB FIRST"
"NO JOB IN SYSTEM"
- No valid job set.

> Carry out "SET JOB" and select a valid job or generate a new one.

"SET A STATION FIRST"
"NO STATION IN SYSTEM"
- No valid station defined in the job.

> Carry out "SET STATION" and define a valid station. Note that a job was already set.

"SET ORIENTATION FIRST"
"NO ORIENTATION IN SYSTEM"
- No orientation set in the job.

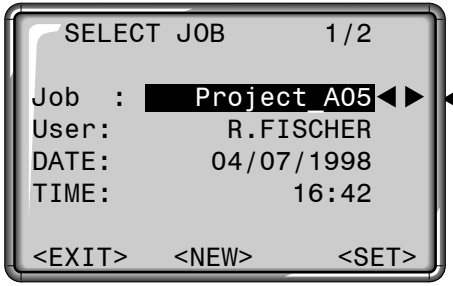
> Carry out "SET ORIENTATION" and make sure that JOB and STATION are valid.

All data is saved in JOBS, like directories. Jobs contain measurement data of different types (e.g. measurements, codes, fixed points, stations,...) and are individually manageable and can be readout, edited or deleted separately.

If a job was not yet defined and ALL or REC is activated in "MEASURE" the system automatically generates a job with name "DEFAULT".
Using the SurveyOffice program package TPS300 Tools "TPS setup" the number of available jobs can be either set to 4 (mixed data management: measurements and fixed points) or to 8 (only measurements or only fixed points).

Remarks

1/2 Job no 1 of a total of two available jobs.



Selection
Using the arrow keys you can scroll within the available jobs. Select the desired job.

Re-enter Job

<NEW> Defining a new job. Activates a display for input of a new job name and user.

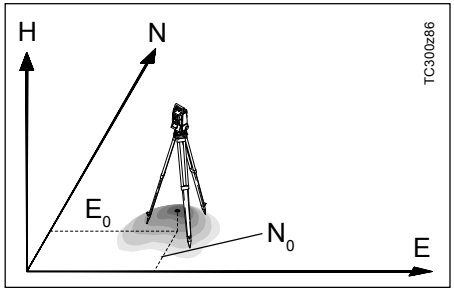
<SET> Setting the job and continue to "SET STATION".

<EXIT> Back to start-up programs.

All subsequent recorded data is stored in this job/directory.

Date and time are automatically placed by the system and cannot be changed.

Each coordinate computation relates to the currently set station. Therefore, at least station point plan coordinates (E, N) are required. The station height can be entered optionally. The coordinates can be entered either manually or read from the internal memory.



Known point

```
SET STATION              ▼
Stn  :              200
hi   :            1.600  m

E0   :         1000.000  m
N0   :         1000.000  m
H0   :         1000.000  m
<EXIT>                <SET>
```

1. Enter a point number available in the memory or point search with Wildcard (*).
2. <SET>
   Sets and records station coordinates. Return to start program overview.
3. Wildcard-Search enables the global search for points in the complete memory (all jobs).

SHIFT : Extends the display.

Set manually

If an entered point number cannot be found in the internal memory then the manual input is activated automatically.

1. Enter Point ID.
2. Enter coordinates and height.
3. <OK> : Sets and records station coordinates. Return to "SET STATION".

Method 1: Set orientation

This program enables an orientation angle to be entered manually, or for the orientation to be determined by measurement to points with known coordinates.

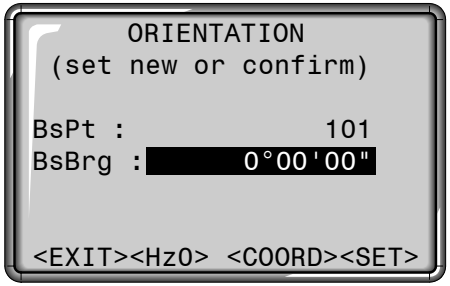
Orientation coordinates can be either obtained from the internal memory or entered manually. Using button <Hz0> the orientation can be set to 0.000 quickly and easily.

The system offers the following possibilities:

- Setting any Hz-value with manual input.
- With <Hz0> set Hz=0.000.
- Orientation to target points with known coordinates.

Set any Hz-orientation

By entering the Hz-angle the user can set any Hz-orientation.



Move cursor to input field "BsBrg".

Enter new angle.

Erase field or set to 0°00'00".

Set Hz0

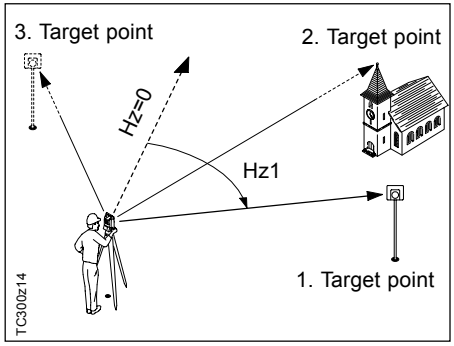
Using button <Hz0> the orientation can be set to 0.000 quickly and easily.

<Hz0> Hz-orientation is set to 0°00'00".

<SET> Orientation is confirmed if no input was made, or the new orientation is set and registered if a new point number was entered or a new Hz-angle set.

Optionally, an alphanumeric point number and a description can be added to the orientation block.

For determining the orientation a maximum of 5 target points with known coordinates can be used.



Orientation coordinates can be either obtained from the internal memory or entered manually.

If an orientation point number cannot be found in the internal memory then the instrument automatically activates the manual entry of the coordinates.

<COORD> Activates input/edit mode for entry of a known orientation point.

```
ORIENTATION  1/I II
BsPt :           201
hr   :         1.300  m
BsBrg:     236°56'14"
dHz  :      51°12'23"
dHD  :         0.569  m

          <MEAS>    <SET>
```

MEAS: An angle and a distance measurement is triggered. If no distance can be measured only an angle measurement is made.

SHIFT Dialog for orientation to several target points.

1/I Status indication; shows that first point was measured in telescope position I.

1/I II First point measured in telescope pos. I and II.

dHz: After the first measurement the finding of other target points (or the same point when changing the telescope position) is easier by setting the indicated angle difference near to 0°00'00" by turning the instrument.

dHD: Difference between horizontal distance to target point computed from coordinates and the measured distance.

Display of computed orientation

<SET> Display of orientation results if several target points are measured.

```
ORIENTATION RESULT

NoPts.:              2
Stn   :            200
HzCor :    123°00'23"
StDev :    ± 0°00'08"

<EXIT>   <RESI>    <OK>
```

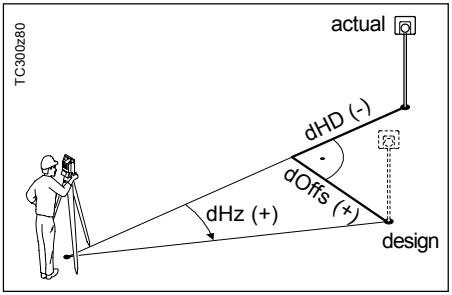
<OK> Set computed Hz-orientation.

If more than one target point is measured then the orientation is computed using the "least squares method".

Displaying residuals

<RESI> Display of residuals.

```
    RESIDUALS  Pt: 1/3
BsPt :            ABC1
dHz  :      -0°00'23"
dHD  :         -0.045 m
dOffs:         -0.028 m
dH   :          0.075 m

<EXIT>              <OK>
```



dH: Height correction
dHD: correction of the horizontal distance
dHz: Correction of Hz-angle.

Useful information

- If the orientation is **only** measured in telescope position II the Hz-orientation is based on telesope position II. If measured **only** in telescope position I or mixed the Hz-orientation is based on telescope position I.
- The prism height may **not** be changed during measurements in the first and second telescope position.
- If a target point is measured several times in the same telescope position the **last valid** measurement is used for the computation.

Introduction

Depending on local software versions the contents of the displays (lines) described in this chapter can differ. However, the function of the relevant display remains the same.

Before starting an application, make sure the instrument is perfectly levelled up and the station data is correctly set.

Button functions

DIST: Distance measurement is triggered.

ALL : Values are measured **and** recorded.

With these onboard applications the functionality of the TC(R)303/305/307 instruments are improved considerably.
As a result, the functionality is extended and the daily surveying fieldwork is made easier. By using internally recorded values the user is mainly protected from entering incorrect data. Points with given coordinates as well as measured points can be used within the programs.

The following programs are available in the internal memory:

- Surveying
- Setting Out
- Tie Distance
- Area
- Free Station
- Reference Line

PROG Calling the program menus.

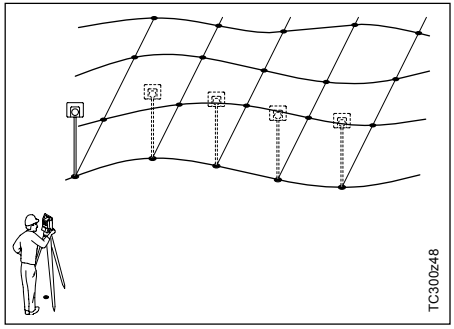
```
      PROGRAM
1 SURVEYING
2 SETTING OUT
3 TIE DISTANCE
4 AREA (PLAN)
5 FREE STATION
6 REFERENCE LINE
<EXIT>
```

Selecting the desired application.

Calling the application and activating the start programs.

When starting an application the dialog with the start-up programs is called automatically *(see chapter "Start programs").*

With the program Surveying the measuring of an unlimited number of points is supported. The program can be compared to simple measuring. Only the guided stationing or orientation *(see chapter "Start programs")* and the additional display for target coordinates are different.



Measured data can either be recorded in the internal memory or output via serial interface RS232 *(see configuration / Interface parameter).*

Procedure:

1. Input of point number.
2. Input of code, if required *(see also "CODING")*
3. Enter new reflector height or change the existing height.
4. Trigger and record measurements with ALL, DIST or USER (if REC is assigned).

Find further information about coding in chapter *"CODING".*

With SHIFT ▲ / ▼ you can switch quickly and easily between different displays.

Measuring display 1

```
    SURVEYING                ▼
PtID :              AB-12
hr   :           1.600 m
Code :              Baum
Hz   :        123°12'34"
V    :         79°56'45"
SD   :         412.883 m
<EXIT>
```

Measuring display 2

```
Hz   :        123°12'34"
HD   :         406.542 m
dH   :          72.081 m
<EXIT>
```

Measuring display 3

```
E    :       1739.420 m
N    :        932.711 m
H    :        456.123 m
<EXIT>
```

The application computes setting-out elements for the **polar, cartesian** or **orthogonal** setting out of points using either coordinates or manually entered angle, horizontal distance and height. Setting out differences can be displayed continuously.
In the Setting out program three different displays are available showing setting out values corresponding to the relevant method.

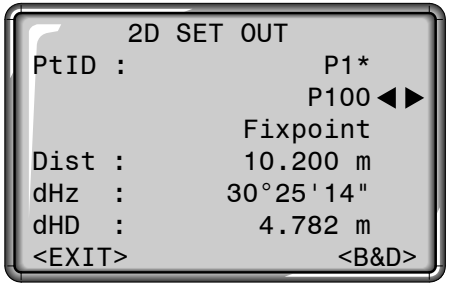
SHIFT Switching display and method.

With the input of a Wildcard search criteria (*) all relevant points can be found quickly and easily by simply scrolling through with ▶ / ◀ .

Additionally, the type of the point found (fixpoint or measured point) is displayed.

Setting out coordinates from memory

1. Input of a point number.
   If the desired point number could not be found the system opens the manual coordinate entry automatically.

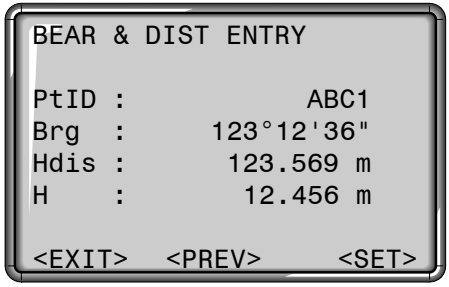


<B&D> Instrument is switched to "Manual input of setting out values".

SHIFT Changing to 3D set out.

Manual input of setting out values

1. Enter direction (Brg), horizontal distance (Hdis) and height (H) of setout point.

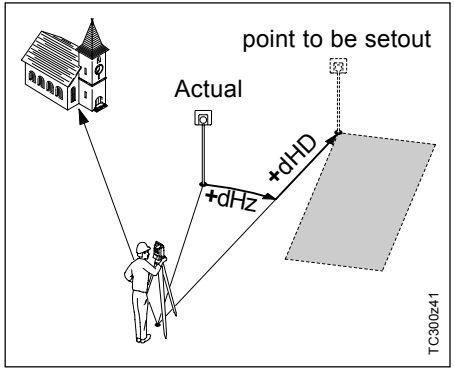


2. <SET> : The entered data is set. Calling the setting out dialog.
3. Trigger measurement with ALL or DIST .
4. The setout offsets are displayed in the same way as with the polar setout.

<PREV> Changing to 2D/3D setting out (ref. to section "Setting out coordinates from memory").

Polar setout

Normal indication of polar setout offsets dHz, dHD, dH.



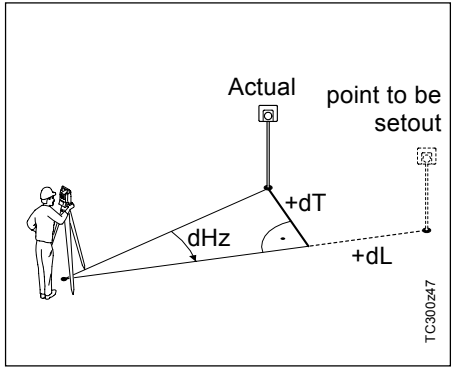
dHz: Angle offset: positive if point to be setout is to the right of the actual direction.

dHD: Longitudinal offset: positive if point to be setout is further away.

dH: Height offset: positive if point to be setout is higher than measured point.

Orthogonal setout

The position offset between measured point and setout point is indicated in a longitudinal and transversal element.

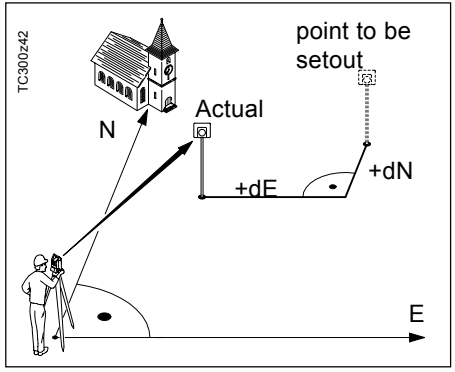


dL: Longitudinal offset: positive if nominal point further away.

dT: Transversal offset, perpendicular to line-of-sight: positive if nominal point is to the right of measured point.

Cartesian setout

Setting out is based on a coordinate system and the offset is divided into a north and east element.

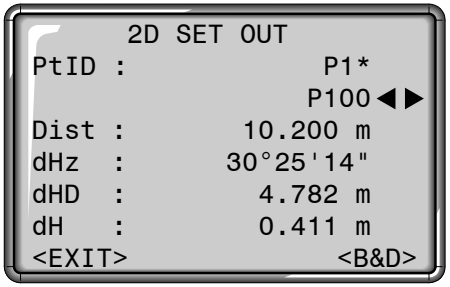


dE Easting offset between setout and actual point.

dN Northing offset between setout and actual point.

Example

By entering a Wildcard criterion (*) a group of points can be found easily and set out one after the other.

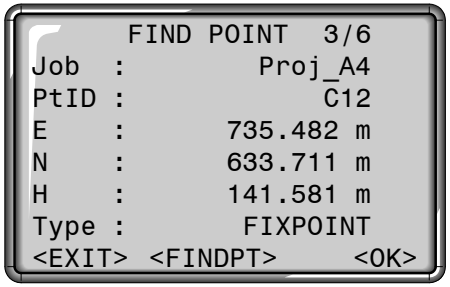


Input: C1*
Finds: C10
C11
C12
...

Using ◀ ▶ you can page quickly through the points found.

Buttons

With ◀ in the "PtID" field point data are displayed and scrolled.



<EXIT> Quit application "Setting out". Return to "Measure".
<FINDPT> Re-enter the search criteria.

Errors

No or invalid PtId or coords:
- The point number entered is not available.

> Re-enter point number/ coordinates.

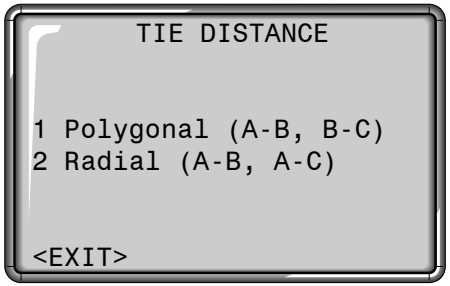
Invalid entries of data:
- Manually entered setting out data is incomplete (e.g. setting out distance missing).

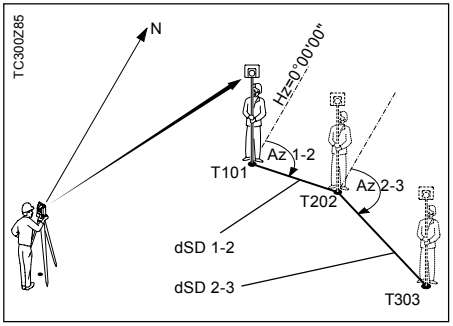
> Check setout parameter and re-enter.

The application **Tie Distance** computes slope distance, horizontal distance, height difference and azimuth of two target points measured **online**, selected from the **Memory** or entered using the **Keypad**.

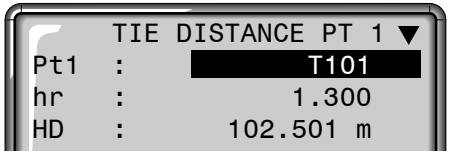
Distances and directions between two successive points are determined and can be saved in the internal memory (e.g 3 to 4).

The user can choose between two different methods:





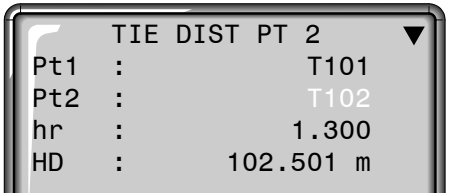
1. Enter desired point number and reflector height for the first target point.



2. Aim on target point and measure.
(ALL, DIST / REC, <MEAS>)

2.1 Variant on 2: instead of measuring the target point, it can also be selected from the memory or entered using the keypad. (<COORD>)

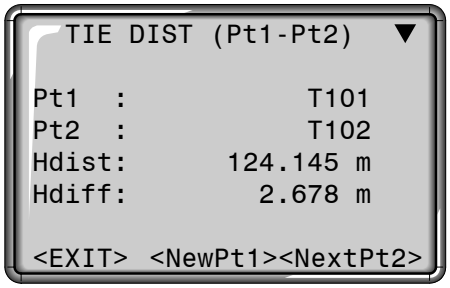
3. Enter desired point number and reflector height for the second target point. The previously measured point number is displayed.



4. Aim on target point and measure.
(ALL, DIST / REC, <MEAS>)

Results

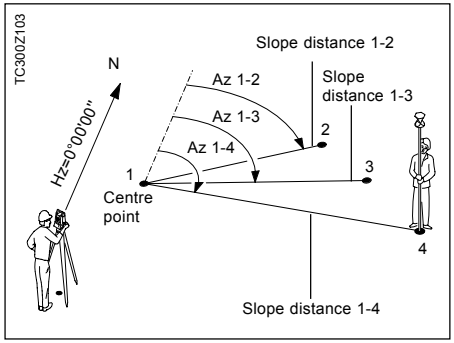
Finally, the results are displayed.



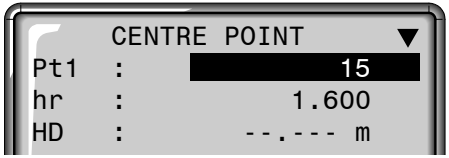
Hdist	Horizontal distance between point1 and point2.
Hdiff	Height difference between point1 and point2.
Sdist	Slope distance between point1 and point2.
Brg	Azimuth between point1 and point2.

<NewPt1> An additional missing line is computed. Program starts again (at point 1).

<NextPt2> Point 2 is set as starting point of a new missing line. New point (Pt 2) must be measured.



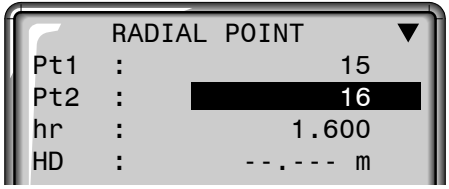
1. Enter desired point number and reflector height for the first target point.



2. Aim on target point and measure. (ALL, DIST / REC, <MEAS>)

2.1 Variant on 2: instead of measuring the target point, it can also be selected from the memory or entered using the keypad. (<COORD>)

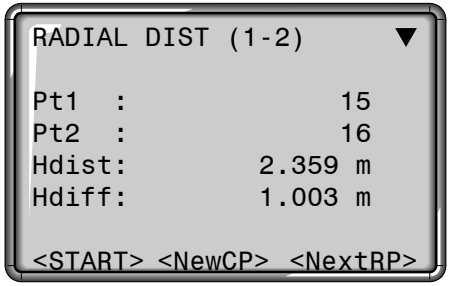
3. Enter desired point number and reflector height for the second target point. The previously measured point number is displayed.



4. Aim on target point and measure. (ALL, DIST / REC, <MEAS>)

Results

Finally, the results are displayed.

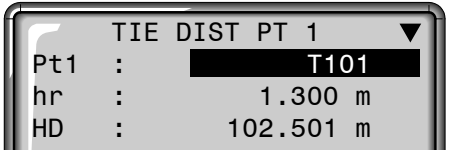


<NewCP> Measure new centre point. Program starts again (at point 1).

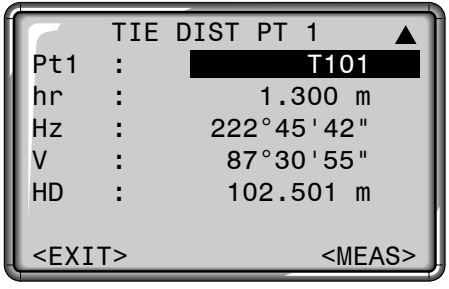
<NextRP> Measure new radial point (centre point Pt. 1 is retained)

Extended Display

On the measurement of the target points and when displaying results, additional angle and distance information can be displayed.



SHIFT ▼ Changes between displays shown above and below.



Error

Error message
"No Distance measured"

- Distance measurement has not been carried out or not saved.

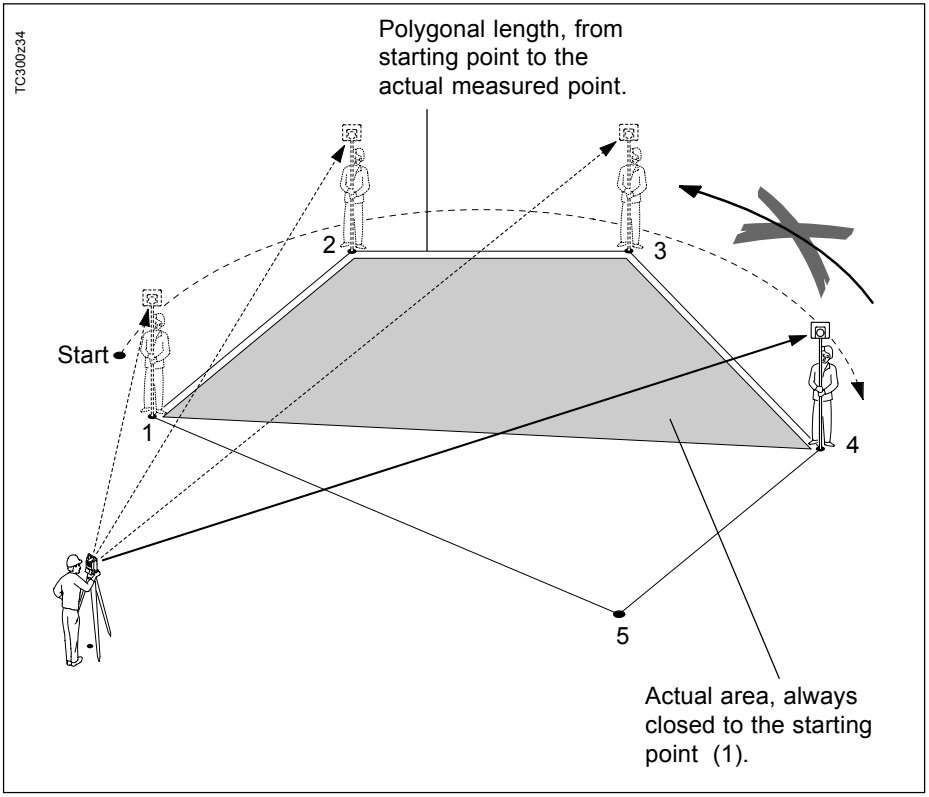
> Make the measurement again.

Area computation

The application areas (plane) computes online areas from an unlimited number of points connected by straights.

From three measured points the actual area is computed and displayed on-line. By activating <RESULT> the number of points used, the computed area and the closed polygonal length (e.g. line 1-2-3-4-1) are displayed.

The points can be measured optionally in the first or second telescope position/face. Between the individual points the telescope position/face can be changed. One distance must always be measured.



1. Input of point number.

2. Triggering a distance measurement with the following possibilities:

<MEAS> Triggering and recording a measurement. Point counter and point number are incremented.

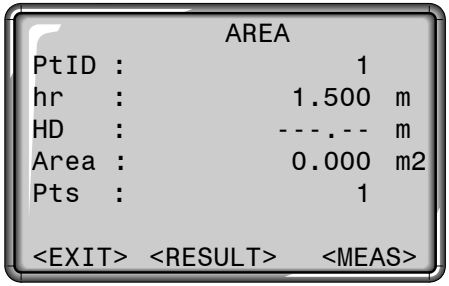
ALL Same function as <MEAS>.

DIST/ Triggering and displaying a distance measurement.

REC Saving with REC if key USER is assigned accordingly.

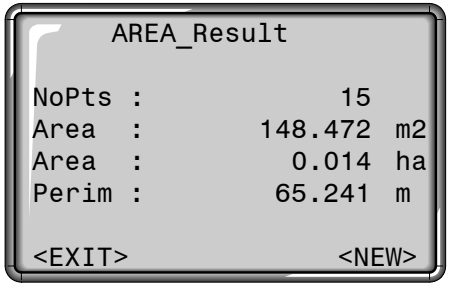
<RESULT> Recording of areas, circumference and point counter.

Measuring display



The area is always displayed according the onboard unit setting (m², hectare).

Results

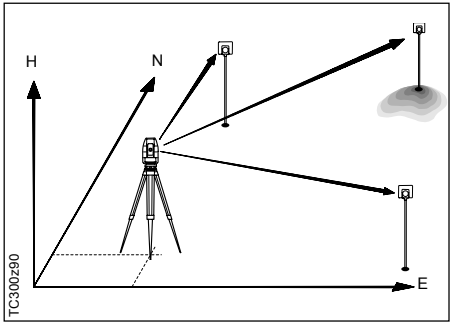


Displayed are:
- area
- number of measured points
- circumference of closed area/ length of closed polygon.

<NEW> Starting a new area computation. The counter is set to "0" again.

<EXIT> Quit program area computation.

The application "Free Station" is used to determine the instrument position from measurements to a minimum of two known points and a maximum of five known points.
It supports measurements to points using either distances and Hz- and V-angles (typical 2 point resection) or angles only (typical 3 point resection) or a combination of angles and distances to different points.



The following measurements sequences to target points are possible:
1. Hz- and V-angles only
2. Distance and Hz- and V-angle
3. Hz- and V-angles to some point(s) and Hz- and V-angle plus distance to other point(s).

The final computed results are Easting, Northing and Height of the present instrument station, including the instruments Hz-circle orientation. Standard deviations and residuals for accuracy assessments are provided additionally.

The station coordinates and orientation can be finally set active to the system.

Measurements and results (position, standard deviations and residuals) are always recorded to the internal memory, provided the internal memory is set as the Data Storage media.

All shown displays are examples. It is possible that local software versions are different to the basic version.

Single face **I** or **II** or dual face **I + II** measurements are always possible. No specific point sequence or specific face sequences are required. Any point can be measured with any face at any time prior of starting the computation process, e.g. measure the last point first - then the first point - and then the second point - etc…

Gross errors checks are made for dual face measurements to ensure the same point(s) are sighted with the other face.

If a target point is measured several times in the same telescope position the **last valid measurement** is used for computation.

Measurement restrictions:

- **2 face measurements**
  For measurements in 2 faces, the reflector height and the refraction coefficient must be kept the same for both faces for the same target point, although it is permissible to change them between different target points. An error message will be generated if the reflector height changes between face I and face II while measuring to the same target point.

- **Target points with 0.000 height**
  Target points with 0.000 height are discarded for height processing. If target points have a valid height of 0.000 m, use 0.001 m to enable it for height processing.

The computation process automatically determines the processing method, e.g. 2 point resection, 3 point resection with angles only, etc…)
If more than the minimum required measurements are performed, the processing routine uses a least squares adjustment to determine the plan position and averages orientation and heights.

1. The original averaged face I and face II measurements enter the computation process. In case of multiple measurements to the same target point, only the last measurement for each face enter the computation process.

2. All measurements are treated with the same accuracy, whether these are measured in single or dual face.

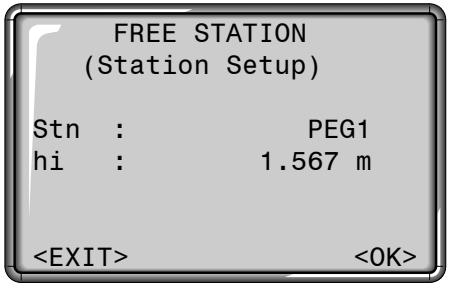
3. The final plan position (E, H) is computed from a least squares adjustment, including standard deviations and residuals for Hz-angle and horizontal distances.

4. The final height (H) is computed from averaged height differences based on the original measurements.

5. The Hz-circle orientation is computed with the original averaged face I and face II measurements and the final computed plan position.

Set the occupied station name and instrument.

Procedure:
1. Enter the station name (Stn)
2. Enter the instrument height (hi)



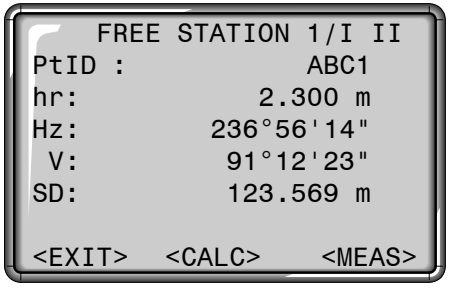
<OK> Proceeds to the measurement screen.
<EXIT> Terminate and return to the start-up program.

Free Station methods:

- **2 point resection**
  => **always** use the ALL-key or the Button <MEAS>
- **3 point resection with angles only**
  => Always use the REC-command under the FNC-menu or the USER-key if REC is assigned to it.
- **Mix of distances and angles**
  => Use either ALL-key or the Button <MEAS> for distances and angles or REC-command for angles only.

Procedure:

1. Enter the target point number (PtID).
   If the desired point is not found within the internal memory, the system automatically opens the manual coordinate entry.
2. Enter the reflector height (hr).



<MEAS> Button initiates measurements.

a) If the target is a prism the Hz- and V-angles and distance is automatically measured and recorded
b) If the target is not a prism or the reflectorless EDM cannot measure a distance, only Hz- and V-angles are measured and recorded

ALL The ALL-key measures and records the Hz- and V-angles and the distance.

REC The REC-command (refer to FNC) measures and records only Hz- and V-angles

<CALC> Proceeds with the result screen and computes the instrument position if at least 2 points in single face with at least one distance are measured

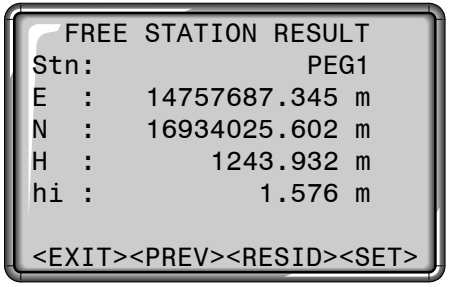
<EXIT> Terminate and return to the start-up program.

1/I Status indication; shows that first point was measured in telescope position I.

1/I II Shows that first point was measured in telescope position I and II.

This dialog shows the final computed station coordinates and instrument height.

1. Page (viewing the station coordinates and instrument height)

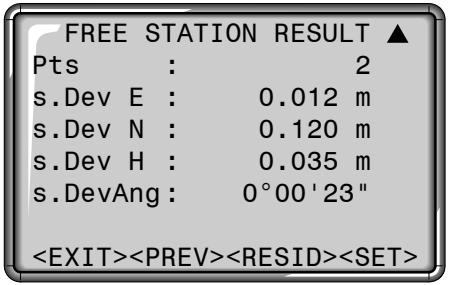


Stn = Name of occupied station
E = Computed station Easting
N = Computed station Northing
H = Computed station Height
hi = Instrument height

<SET> Sets the displayed coordinates and instrument height as the final station to the system.
<RESID> Moves to the residual screen.
<PREV> Returns to the measuring screen for more points to measure.
<EXIT> Terminates the application "FREE STATION" without setting the new station data to the system.

If the instrument height was set to 0.000 in the setup screen, then the station height refers to height of trunnion axis.

2. Page (viewing standard deviations)



Pts = Number of measured points
s.Dev E = Standard deviation Station Easting
s.Dev N = Standard deviation Station Northing
s.Dev H = Standard deviation Station Height
s.DevAng = Standard deviation circle orientation

<SET> Sets the displayed coordinates and instrument height as the final station to the system
<RESID> Moves to the residual screen
<PREV> Returns to the measuring screen for more points to measure.
<EXIT> Terminates the application FREE STATION without setting the new station data to the system.

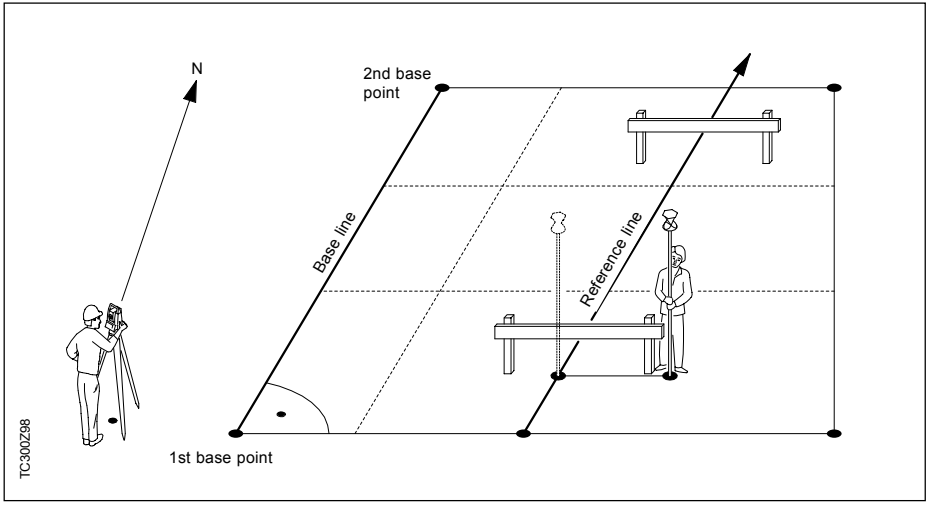
This dialog shows the computed residuals.
The residuals always show computed value (given data) minus measured value.

<PREV> Returns to the result screen
<EXIT> Terminates the application FREE STATION without setting the new station data to the system.

Use the cursor keys to toggle the display of residuals for the various measured points.

Important messages	Meaning
Selected point has no valid data	This message occurs if the selected target point has no easting or northing coordinate
Max 5 points supported	If already 5 points are measured and a further point is selected . The system supports maximum 5 points
Bad data - no position computed	The measurements may not allow to compute final station coordinates (Easting, Northing)
Bad data - no height computed	Either the target height are invalid or insufficient measurements are available to compute a final station height.
Insufficient space in job	The present selected job is full and does not allow further storage. This error could occur either with measurements or when the system stores result data, such as station results. standard deviations or residuals.
Hz (I - II) > 0.9 deg, measure point again	This error occurs if a point was measured in one face and the measurement in the other face differs by more than 180° ±0.9° for the horizontal angle circle
V (I - II) > 0.9 deg, measure point again	This error occurs if a point was measured in one face and the measurement in the other face differs by more than 180° ±0.9° for the vertical angle reading
More points or distance required	There are insufficient data measured to be able to compute a position. Either there are not enough points used or not enough distances measured.

This program facilitates the easy setting out or checking of lines for buildings, straight sections of road, simple excavations, etc. A reference line can be defined with reference to a known base line, which, e.g. has been defined based on an existing site boundary. The reference line can be offset either longitudinally or in parallel to the base line, or be rotated around the first base point as required.



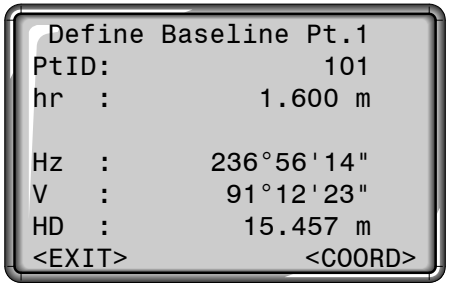
The base line is given by two base points. The base points can be defined in three ways:

- Measure point
- Enter co-ordinates using keypad
- Select point from memory.

Definition of the base points:

a) Measuring base points:
Input a point number and independent measurement of the base points using ALL or DIST/ REC.

b) Base points with co-ordinates:
Input a point number. The search for associated points in the memory can be initiated using <COORD>. If the required point is not in memory or there are no valid co-ordinates in the memory, the program prompts for manual entry of the co-ordinates.

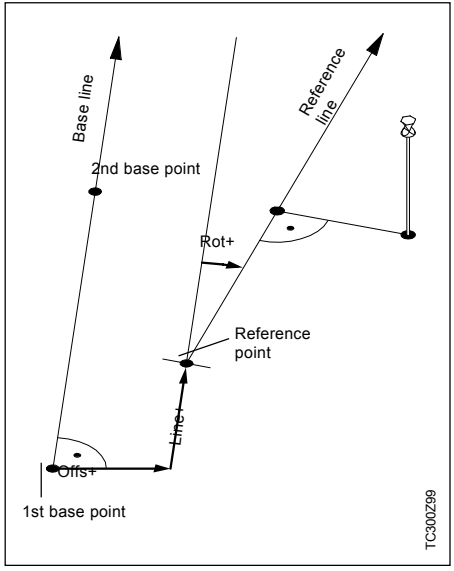


Analogous procedure for the second base point.

<EXIT>	Return to the start-up programs.
<COORD>	Input co-ordinates or search for fixed points and measurements.
<FINDPT>	Activates selective point search (see "Point Search" section)
<OK>	Confirms the entry and continues the program.
<NewL>	Renewed input of the first base point.

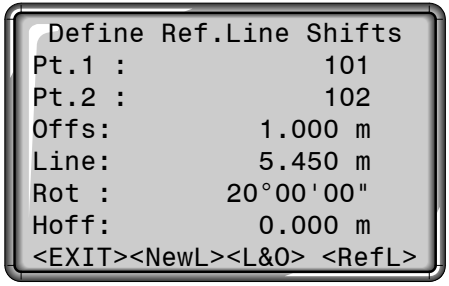
DIST	Triggers a distance measurement.
ALL	Triggers a distance measurement and register the measured data.

The base line can be offset longitudinally and in parallel, as well as rotated. This new line is called the reference line. All measured data refers to the reference line.



Input of the parameters:

Using the navigation keys ▲ / ▼, the focus can be moved to the offset and rotation parameters for the reference line.



The following entries are possible:

Offs+: Parallel offset of the reference line to the right, referred to the direction of the base line (1-2).

Line+: Longitudinal offset of the start point (=reference point) of the reference line in the direction of base point 2.

Rot+: Rotation of the reference line clockwise around the reference point.

Hoff+: Height offset; the reference line is higher than the first base point.

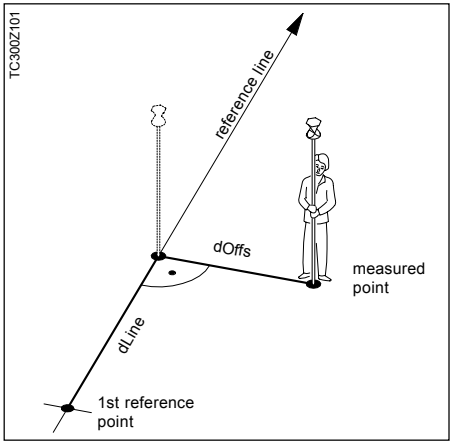
The calculation of the reference line is performed in stages as per the diagram shown on the left.

<EXIT> Return to the start-up programs

<NewL> Return to the definition of a new base line

<L&O> Opens the "Orthogonal Set-out" application

<RefL> Opens the "Reference Line" application



The <RefL> function calculates longitudinal, transverse and height differences relative to the reference line. After the first distance measurement, the measurement dialog displays the calculated values (dLine, dOffs, dHt) continually if tracking mode is activated.

```
Reference Line Result
PtID:              103
hr  :          1.550 m

dOffs:        -0.054 m
dLine:         0.020 m
dHt  :         0.120 m
<EXIT>             <RefL>
```

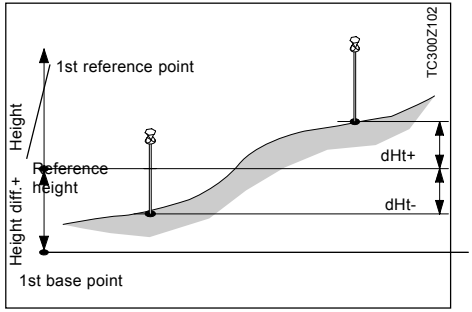
DIST Triggers a distance measurement.

ALL Measures and registers measured data.

<EXIT> Return to the start-up programs

<RefL> Redefine reference line.

The height of the first reference point is always used as the reference height for the calculation of height differences (dHt).



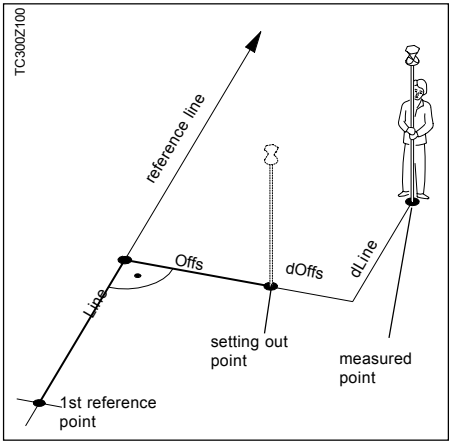
If tracking mode is activated (see "EDM Settings section"), correction values for the position of the reflector are displayed continuously.

Relative to the reference line you can enter longitudinal, transverse and height offsets for the target points to be set-out. The program then calculates the differences between the measured point and the calculated point. The program displays either the orthogonal (dL, dT, dH) or the polar differences (dHz, dHD, DH). By "making" these differences as small as possible, you can position the prism on the point to be set-out.

Using SHIFT ▲ / ▼ , you can switch between polar and orthogonal setting out differences.

If tracking mode is activated (see "EDM Settings" section), correction values for the position of the reflector are displayed continuously.

Example "orthogonal methods"



Offset input:

```
 Input Line & Offset
PtId:              103
hr  :          1.550 m

Offs:          3.750 m
Line:         10.500 m
Ht  :          1.500 m
<EXIT> <SHIFTS>   <CALC>
```

Display in measure mode:

```
 Measure Line & Offset ▼
PtId:              103
hr  :          1.550 m

dHz :        -0°15'20"
dHD :          1.220 m
dH  :          0.350 m
<EXIT> <SHIFTS>    <L&O>
```

```
dOffs:         3.750 m
dLine:        10.500 m
dHt  :         0.350 m
```

<EXIT> Return to the start-up programs.
<SHIFTS> Redefine reference line.
<CALC> Set-out points.
<L&O> Input new setting out elements.
DIST Triggers a distance measurement.
ALL Triggers a distance measurement and register the measured data.

The signs for the distance and angle differences are exactly the same as for the "Setout" application. These are correction values (required minus actual).

+dHz	Turn telescope clockwise to the setting out point.
+dHD	The setting out point is further away than the point measured.
+dHt	The setting out point is higher than the measured point.

Warnings/messages

Important messages	Meaning
Save via RS232	Data output (system setting menu) via RS232 interface is activated. To be able to successfully start reference line, the "IntMem" setting must be enabled.
Base line too short	Base line is shorter than 1 cm. Choose base points such that the horizontal separation of both points is at least 1 cm.
Distance not measured	No distance measured or invalid. Repeat distance measurement until a valid distance is displayed.
Co-ordinates invalid	No co-ordinates or invalid co-ordinates for a point. Ensure that a point used has at least one Easting and one Northing co-ordinate.

Codes contain information about recorded points. With the help of coding, points can be assigned to a particular group simplifying later processing.

Basically, it is differentiated between GSI- coding (TPS100 instruments) and OSW-coding (TPS300 instruments). For further information regarding "Coding", please refer to *chapter "Data Manager".*

OSW-coding

Unlike the GSI-coding OSW-coding enables the division into attribute names and values.

Code:	Code name
Desc.:	Additional remark
Attrib.:	User-defined attribute name; defined when creating the codelist.
Value:	Attribute value;can be entered or edited when calling the code.

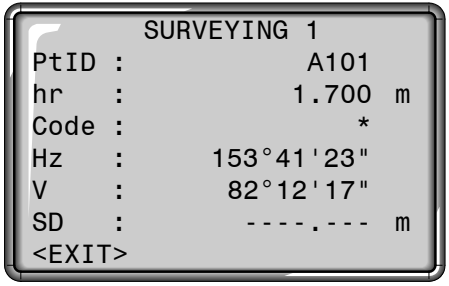
GSI-coding

GSI codelists created with TCTools or in T100 instruments can be used.

Code:	Code name
Desc.:	Additional remark
Info1:	more, freely editable
...	information
Info8:	lines

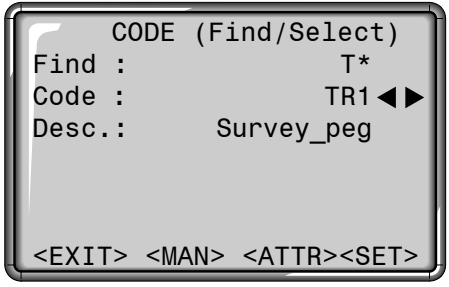
Searching code blocks

How I can find an already entered code again ?
Starting from "SURVEYING" the code function can be easily called.



1. Move cursor to field "Code".
2. Enter a Wildcard criterion (e.g. T*) or exact code designation and confirm with . Code function is activated.

All codes corresponding to the entered search criteria are found.



<ATTR> Display of remaining attributes.

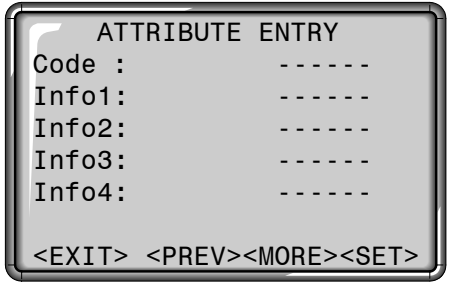
<MAN> Starts manual code input.

◀ ▶ Using the arrow keys, you can page through the codes found with entered search criteria.

Manual code input

Individual code blocks can be entered directly via keypad.

<MAN> The manual code input is started and an empty code block is called.



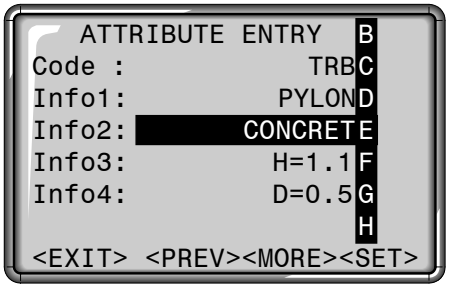
Navigation and numeric/ alphanumeric input possible via cursor keys.

Attributes 5 to 8 can be displayed with <MORE> or SHIFT .

Extending/editing code

1. Call available code from code list.

2. Attributes can be overwritten freely.



Call edit mode and edit attribute.

Exceptions:

With the codelist editor of SurveyOffice a status can be assigned to the attributes.

- Attributes with "fixed status" (see SurveyOffice) are write-protected. They cannot be overwritten or edited.
- For attributes with status "Mandatory" an input of a confirmation is required.
- Attributes with status "Normal" can be edited freely.

Recording code block

After quitting the code function with <SET> the code block in the system is temporarily set. Recording only with measurement (ALL- or REC-fix keys) and always with reference to the actual point number.

Leica SurveyOffice
With the help of the TPS-Setup ("External Tools") the instrument can be configured, so that the codes are recorded either before or after the measurement.

Warnings / Messages

ATTRIB. CANNOT BE CHANGED
> Attribute with fixed status cannot be changed.

NO CODELIST AVAILABLE
> No codelist in memory. Manual input for code and attributes are called automatically.

ENTRY REQUIRED
<OK>
> Code missing. Extend input.

Individually (<MAN>) entered code blocks will not be copied to the codelist.

Leica SurveyOffice
Codelists can be easily created and uploaded to the instrument using the supplied "Leica SurveyOffice" Software.

Possible buttons

<EXIT> Quits code function. Returns to previous application or function.

<MAN> Activates the manual code entry.

<MORE> Displays more code attributes.

<SET> Accepts the code entry or selection and sets the code block in the system temporarely

Quick Settings

SHIFT PROG Calling up menu functions.

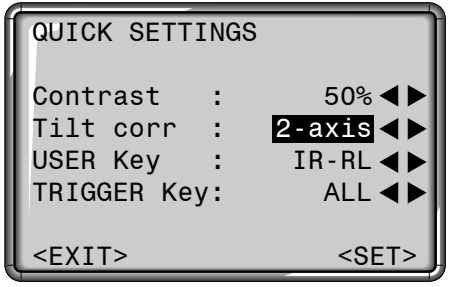
<EXIT> Leave the menu. Back to "Measure".

"Quick Settings" are settings frequently used integrated into a common display. All of these settings can also be changed in the configuration.
The parameter or selection fields are controlled via the navigation keys.
The current active parameter is indicated by the black bar.

SHIFT PROG Calling the menu functions.

QUICK SETTINGS

Execute.



Contrast:
Setting the display contrast in 10% steps.

Tilt Correction:
Switching on/off the compensator.

USER key:
Allocation of function from FNC menu.

Trigger key:
Configuration of trigger key located at the side of the instrument. Can be either assigned with ALL or DIST or deactivated.

This menu enables extensive user-specific settings in order to adapt the instrument to their own requirements.

SHIFT PROG Calling menu functions.

SHIFT ALL SETTINGS

Execute.

```
   SETTINGS
SYSTEM SETTINGS
ANGLE SETTINGS
UNITS
EDM SETTINGS
COMMUNICATION
TIME & DATE
<EXIT>
```

<EXIT> Quit "Settings". Back to "Measure".

System Settings

All parameter selection fields are available to the user.

```
SYSTEM SETTINGS

Beep        :       OFF◀▶
Sector Beep:        OFF◀▶
DataOutput  :     RS232◀▶
AutoOFF     :   Disable◀▶

<EXIT>              <SET>
```

SHIFT ▼ Display additional parameter.

◀ ▶ Selection of setting.

<EXIT> Back to "Settings" without setting the changed settings.

<SET> Setting the changed settings and back to "Settings".

Beep
The beep is an acoustic signal after each key stroke.

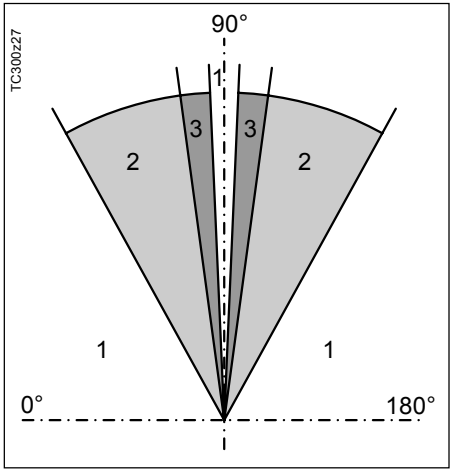
OFF	Beep switched off
ON	Beep switched on
LOUD	Increased volume

Sector Beep

OFF:	Sector beep switched off.
ON:	Sector beep sounds at right angles (0°, 90°, 180°, 270° or 0, 100, 200, 300 gon).

Example Sector Beep:

From 95.0 to 99.5 gon (or from 105.0 to 100.5 gon) a "Fast beep" sounds whilest from 99.5 to 99.995 gon (or from 100.5 to 100.995 gon) a "Permanent beep" sounds.



1 No beep
2 Fast beep (interrupted)
3 Permanent beep

Data Output

RS232 Data is recorded via the serial interface. For this purpose, a data storage device must be connected.

Int All data is recorded in the internal memory.

AUTO-OFF

ENABLE The instrument is switched off after 20 minutes without any acticn (= no key pressed; V and Hz angle deviation ≤ ±3' / ±600cc).

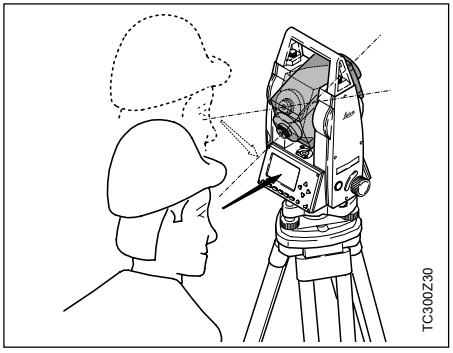
DISABLE Function is deactivated and the instrument is permanently operating. The battery will not last for as long.

SLEEP Economy mode. Instrument is recovered by any key stroke.

DISPLAY CONTRAST

10% Setting the display contrast in 10% steps; adapting the readability depending on the light conditions.

The readability of LCDs is influenced by external conditions (temperature, lighting) and by the reading angle *(see figure)*. The display contrast can be adapted step by step until the optimum readability is achieved.



USER key

Allocation of a function from FNC menu (SHIFT USER) to the User key (USER).

REC	Record a measurement block.
IR<->RL	Change the EDM type between IR and RL.
REM	Indirect height determination *(see also chapter FNC).*
DEL. L.REC	Delete the last data block recorded in the internal memory.

Trigger key

Configuration of the trigger key on side cover.

OFF	Trigger key deactivated
ALL	Trigger key with same function as the ALL-key.
DIST	Trigger key with same function as the DIST-key.

FACE_I Definition

Possibility to define the telescope position I in relation to the position of the V-drive.

V-left	Telescope position I if V-drive is left hand located.
V-right	Telescope position I if V-drive is right hand located.

GSI Format

Select GSI output format.

GSI8:	81..00+12345678
GSI16:	81..00+1234567890123456

GSI Mask

Select GSI output mask.

Mask 1:	PtID, Hz, V, SD, ppm+mm, hr, hi
Mask 2:	PtID, Hz, V, SD, E, N, H, hr

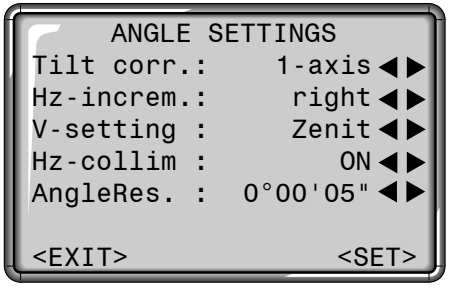
DISPLAY HEATER

ON	Is automatically activated when the display illumination is on and the instrument temperature is ≤5°C .

RETICLE

The reticle illumination is only switched on if the display illumination is on.

Low	reticle illumination dimmed
Medium	average brightness
High	strong illumination



Tilt corr

OFF	Tilting compensation switched off
1-axis	V-angles relate to the plumb line.
2-axis	V-angles relate to plumb line and the Hz-angles are corrected for the tilt of the standing axis.

If the instrument is used on an unstable base (e.g. shaking platform, ship, etc.) **the compensator should be switched off.**
This avoids the compensator drifting out of it's measuring range and interupting the measuring process by indicating an error.

The compensator setting remains active even after the instrument is switched off.

Hz-Incr.

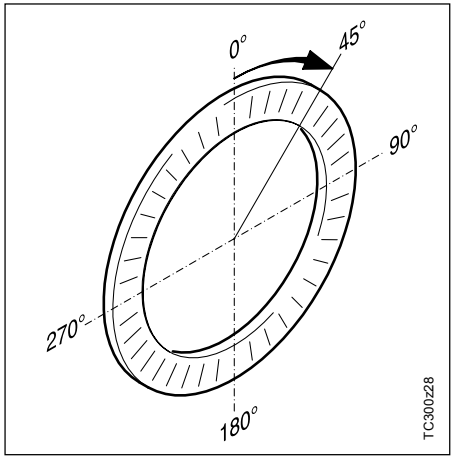
Hz angle incrementation

right	Set Hz to "Right angle measurement" (= clockwise).
left	Set Hz to "Left angle measurement" (= counterclockwise). "Left angle measurements" are only shown in the display. Within the memory they are recorded as "Right angle measurements".

V-angle

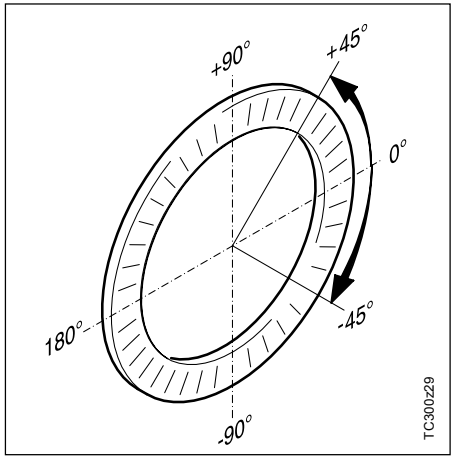
The "0"- orientation of the vertical circle can be either selected for the zenith, the horizontal plane or in %.

Zenith



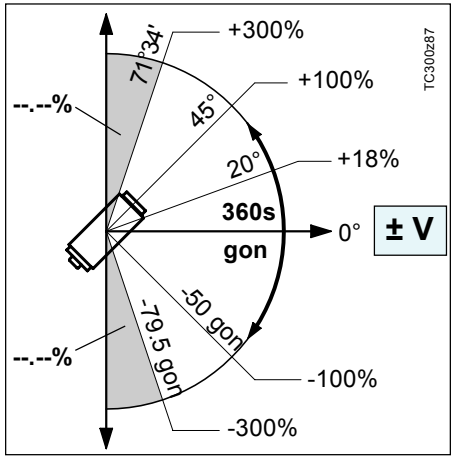
The V-angle increases from 0° - 360° (0 - 400 gon).

Horizontal plane



V-angles above the horizontal plane are indicated as positive values and below the horizontal plane as negative values.

V%



100% correspond to an angle of 45° (50 gon, 1600 mil).

The % value increases rapidly. "--.--%" appears on the display above 300%.

Hz-collimation

ON Hz-collimation is switched ON.

OFF Hz-collimation is switched OFF.

If option "Hz-collimation ON" is active, each measured Hz-angle is corrected (depending on V-angle).

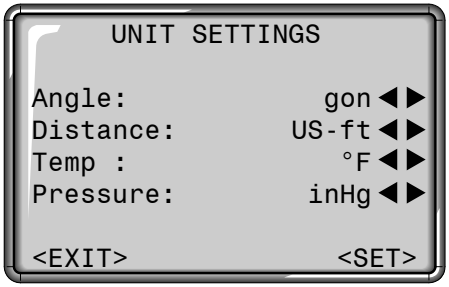
For normal operation the Hz-collimation remains switched on.

Find more information about the Hz-collimation *in chapter "Determining instrument errors".*

Resolution

The displayed angle format can be selected in three steps.

- **For 360°'"**:
  0° 00' 01" / 0° 00' 05" / 0° 00' 10"
  Always " are indicated.
- **For 360°**:
  0.0005° / 0.001° / 0.005°
- **For gon**:
  0.0005 gon / 0.001 gon / 0.005 gon
- **For mil**:
  0.01 mil / 0.05 mil / 0.10 mil
  Always two decimals are indicated.



Angle

° ' "	(degree sexagesimal) possible angle values: 0° to 359°59'59"
DD	(degree decimal) possible angle values: 0° to 359.999°
gon	possible angle values: 0 gon to 399.999 gon
mil	possible angle values: 0 to 6399.99mil

The setting of the angle units can be changed at any time.
The actual displayed values are converted according to the selected unit.

Distance

m	Meter
ft/in1/8	US feet -inch - 1/8 inch
US-ft	US feet
Intl.ft	International feet

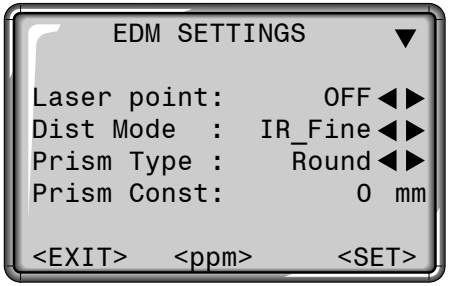
Temperature

°C	Degree Celsius
°F	Degree Fahrenheit

Pressure

mbar	Millibar
hPa	Hecto Pascal
mmHg	Millimeter mercury column
inHg	Inch mercury column

The EDM settings contain a detailled menu with choice fields for required settings.



Call second display with SHIFT.

Laser Point

OFF: Visible laser beam is switched off.

ON: Visible laser beam for visualising the target point is switched on.

Dist Mode

With TCR instruments different settings for measurements with visible (RL) and invisible (IR) EDM type are available.

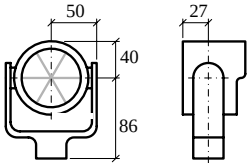
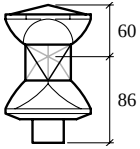
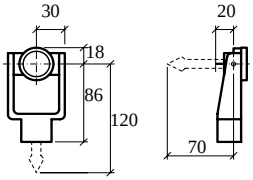
Depending on selected measuring mode the selection prism types are different.

RL_SHORT	Short range. For distance measurements without prisms with a target distance up to 80 m (3mm + 2 ppm)
RL_TRACK	Continuous distance measurement without prisms (5mm + 2 ppm)
RL_Prism	Long range. For distance measurements with prisms (5mm + 2 ppm)

With the RL-EDM each object in the beam is measured (possibly also branches, cars, etc.).

IR_FINE	Fine measuring mode for high precision measurements with prisms (2mm + 2 ppm)
IR_FAST	Quick measuring mode with higher measuring speed and reduced accuracy (5mm + 2 ppm)
IR_TRACK	Continuous distance measuring (5mm + 2 ppm)
IR_TAPE	Distance measurement using Retro targets (5mm + 2 ppm)

Prism type
Calling the function in the EDM settings.

Leica Prisms	Constants [mm]	
Standard prism GPH1 + GPR1	0.0	
360° prism GRZ4	+23.1	
Miniprism GMP101/102	+17.5	
Reflective targets	+34.4	
USER	--	is set at "Prismconst" (-mm + 34.4; e.g.: mm = 14 -> input = -14 + 34.4 = 20.4)
RL	+34.4	Reflectorless

Prism constant
Calling the function in the EDM settings.

Entry of a user specific prism constant. Input can only be made in [mm].

Limit value: -999 mm to +999 mm

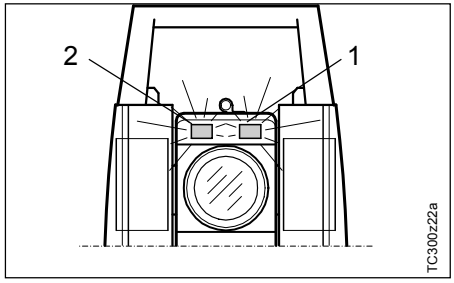
Guide Light EGL

The optionally available Guide Light EGL consists of two coloured flashing lights in the telescope of the total station. All TC(R)303/305/307-instruments can be equipped with this Guide Light. The person at the prism can be guided by the flashing lights directly to the line of sight. The light points are visible up to a distance of 150 meters. This is useful when setting out points.

OFF: The automatic Guide Light EGL is switched off.

ON: The automatic Guide Light EGL is switched on.

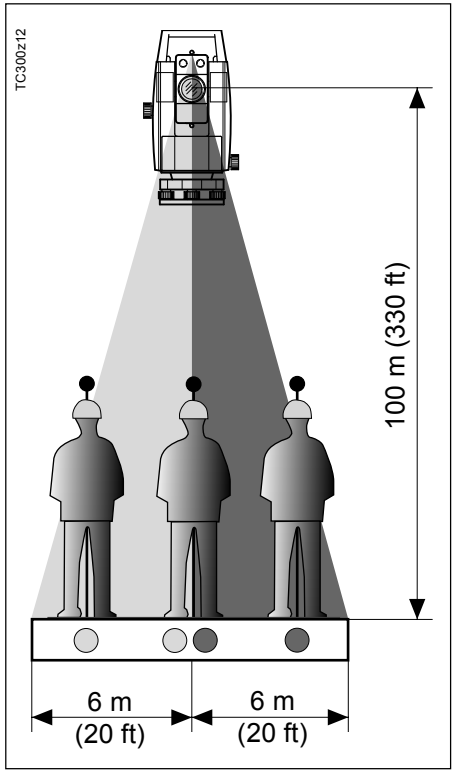
Menu options are only active when an EGL is installed.



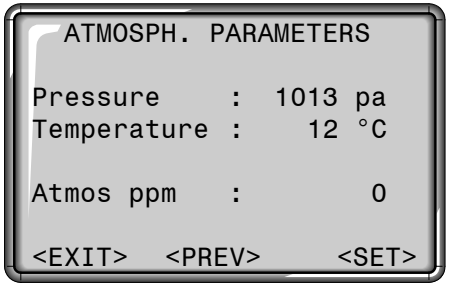
1 Flashing red diode

2 Flashing yellow diode

Operating range:
5 - 150 m (15 -500 ft)
Divergence:
12 m (40ft) at 100m (330 ft)



Atmospheric Parameters (ppm)
Distance measurement is influenced directly by the atmospheric conditions of the air in which distance measurement are taken.

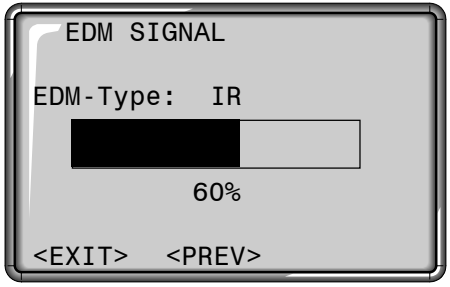


The atmosperic distance corrections are derived from the air temperature, from the air pressure or the height at mean sea level and the relative air humidity or the humidity temperature.

In order to take into consideration these influences distance measurements are corrected using atmospheric correction parameters.

- Pressure
  Air pressure at instrument location.
- Ht. a. MSL
  Height above sea level at instrument location.
- ,
  Air temperature at instrument location.
- Rel. Humid.
  Relative humidity of air in % (normally 60%)
- Refr.Coeff
  Input of refraction coefficient for consideration of the atmospheric refraction.
  When calculating the height difference and the horizontal distance the Refraction Correction is taken into consideration.
- Atmos_PPM
  Calculated and indicated atmospheric PPM.

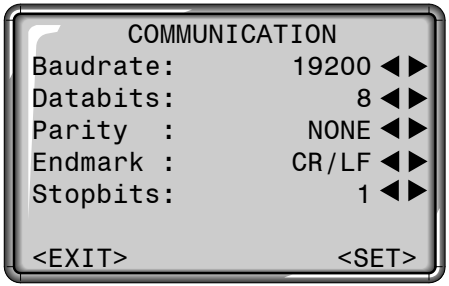
<SIGNAL> button



EDM Type:
Indication of current EDM selection (infrared or reflectorless).

 :
Indication of EDM signal strength (reflection strength) in 10% steps. Enables optimum distance measurement to poorly visible targets.

<PREV> Back to EDM settings.



For data transfer between PC and instrument the communication parameters of the serial interface RS232 must be set.

Leica Standard setting:
19200 Baud, 8 Databit, No Parity, 1 Stopbit, CR/LF

Baudrate
Data transfer speed 2400, 4800, 9600, 19200 [bits/second]

Databits
7 Data transfer is realized with 7 databits. Is set automatically if parity is "Even" or "Odd".
8 Data transfer is realized with 8 databits. Is set automatically if parity is "None".

Parity

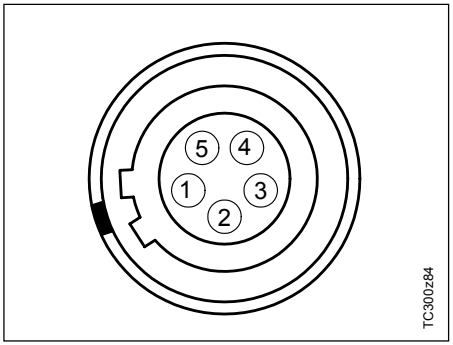
Even	Even parity
Odd	Odd parity
None	No parity (if data bit is set to 8)

Endmark

CRLF	Carriage return; line feed
CR	Carriage return

Stopbits
Depending on settings for databit and parity the setting could be 0, 1 or 2.

Interface plug connections:



1	External battery
2	Not connected / inactive
3	GND
4	Data reception (TH_RXD)
5	Data transfer (TH_TXD)

TH ... Theodolite

For displaying and setting of date and time.

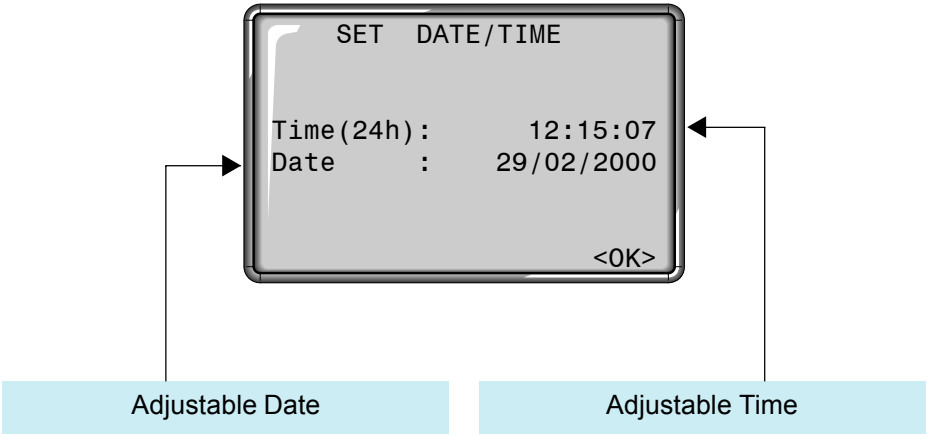
Time:
Form: hh:mm:ss
(hours, minutes, seconds)

Date:
Form: dd/mm/yyyy
(day, month, year)

 / Selection of an input field.

 /  Activate edit mode.

After inputing the time/date is immediately set for the complete system.



Useful information which can be called via menu. These are only indications of actual setting and cannot be changed here. All changes to settings must be carried out in menu "SETTINGS".

Calling the menu functions.


SYSTEM INFOS


Execute.

Scrolling the display.

<SW> Software versions overview.

Free Jobs
Number of free jobs is displayed. If no jobs are in the memory under "Measure and Record" the system creates a "Default" job automatically All data is stored into this Default job which can be freely renamed.

Tilt corr
Display of current compensator setting:

OFF: Compensator switched off.
1-axis: Compensator activated in longitudinal axis (into direction target line).
2-axis: Compensator activated in longitudinal and transverse axis

USER key
Current assignment of the USER key. The following functions from the FNC menu are available:

REC: Record a measurement block
IR<->RL: Switch between IR and RL.
REM: Calling function "Measuring remote points" within the measuring program.
DEL L.REC: Delete the last internaly recorded measuring block.

Trigger Key
OFF: function deactivated.
ALL: ALL function activated.
DIST: DIST function activated.

Battery
Remaining battery power (e.g. 40%).

Instr.Temp.
Measured instrument temperature.

DSP Heater (ON/OFF)
Activates the display heating. With setting ON the heating is switched on as soon as the instrument temperature falls below 5°C and the illumination is switched off. When the temperature increases again, the heating is automatically switched off.

Hz collim (ON/OFF)
The correction of measured Hz-angles with the Hz collimation can be switched ON/OFF.

Calibration values
Indication of last determined and stored calibration values (Hz-collimation, V-index and tilting axis error).

Software versions
The software of the instrument is composed of different software packages. Depending on this packages different versions are possible.

Op-System:	Operating System
App.-SW:	Applications, functions and menu
Layout:	User displays

The Data Manager contains all functions for entering, editing and for checking data in the field.

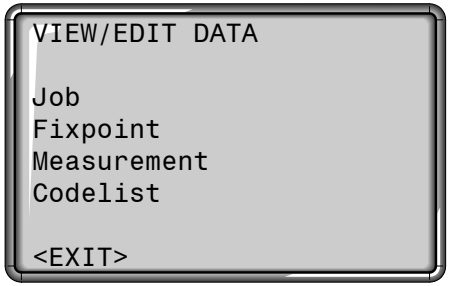
Move focus bar to Data Manager.

Call Data Manager.

- **EDIT/VIEW/DELETE**
  Editing, creating, viewing and deleting jobs, measurements, fixpoints and codelists.
- **INITIALIZE MEMORY**
  Deleting complete memory, individual jobs or complete data areas (e.g. fixed points, measurements).
- **DATA DOWNLOAD**
  Selected data sets are transfered to the interface without protocol and test procedures.
- **STATISTICS**
  Statistical information about job and memory allocation.

VIEW/EDIT DATA

Call Data Manager.



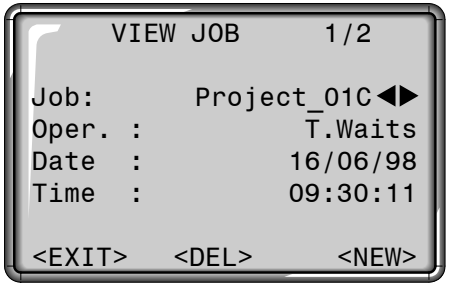
<EXIT> Back to Data Manager.

Selection of data type using arrow keys.

Call Data Manager.

Job

Jobs are a summary of data of different types, e.g. fixed points, measurements, codes, results, etc.



The job definition consists of the input of job name and user. Additionally, the system generates time and date at the time or creation.

Job search:

◀ ▶ Using the arrow keys the job list can be paged through in both directions.

Deleting job:

◀ ▶ Select relevant job.

<DEL> All data within a job is deleted.

Input of a Job:

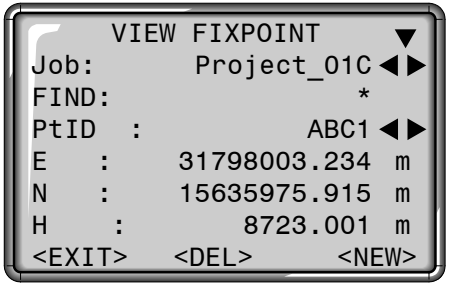
<NEW> Define a new job and entering job data (e.g. job, user).

<SAVE> New job is created and registered.

<VIEW> Back to job search without saving.

Fixpoints

Fixpoints may be entered with point number, coordinates (E, N) and height.



Valid fixed points contain min. one point number and either the coordinates (E, N) or the height (H).

Displaying the complete data of a fixed point with SHIFT.

Enter fixed points:

<NEW> Starts the point and edit input for fixed points or editing of existing fixed points by calling the relevant point number.

Within the job selection field the directory for the fixed point is selected.

<PREV> Back to fixed point search or display of coordinates.

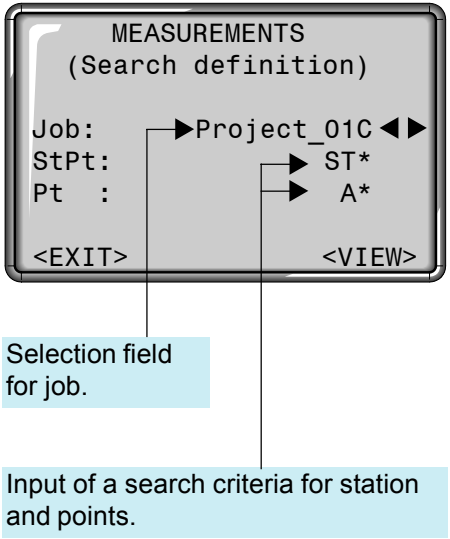
<DEL> Selected fixed point is erased.

Fixed point search:

Here the same conditions are valid as with the point search. You can enter the exact point number or limiting the data range by entering a Wildcard criterion (e.g. A*).

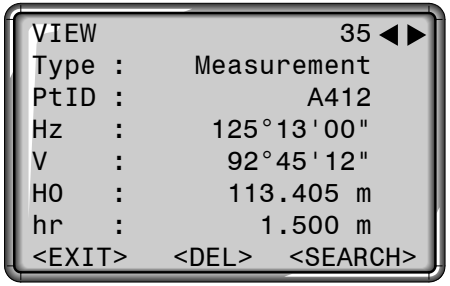
Measurements

Measurement data available in the internal memory can be searched and displayed or erased.



Points can be searched for by three methods:

- Job selection:
  (e.g. "Project_01C")
- Station selection:
  Searches for points as part of stations meeting the search criteria (e.g. "ST*").
- Point selection:
  Finds all points meeting the conditions mentioned above and also the search critera for the point search. (e.g. "A*")



All data as part of stations with the criteria "St100" and with point numbers starting with "A" are found.

If a station is exactly entered (e.g. "St100") then all data with the relevant point numbers are found belonging to this station/these stations (it is possible that station "St100" has been used several times).

SHIFT Extended display with coordinates and time information.

<DEL> Deletes the selected data set from the internal memory.

<SEARCH> Back to point search.

Regardless of used programs, additional data blocks can be recorded in the measuring range:

Corrections:
EDM-Type, EDM-Mode, Prism typ, Prism constant, Atmospheric PPM, Scale PPM, Height PPM, Pressure, Ht. Above Sea Level, Temperature, Rel. humid., Refraction Coefficient, CM East offset

Stations:
PtID, E, N, H, hi, Desc., Date, Time

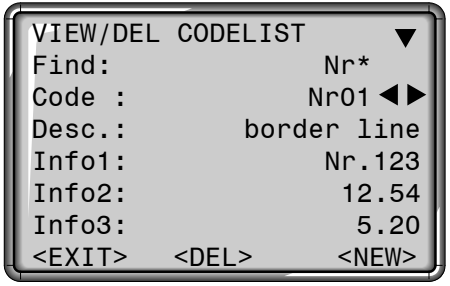
Results:
No pts, StDev. Hz, Date, Time, Area, Tie Distance, setout differences, etc.

Measurements:
Pt, Hz, V, SD, Hd, dH, hr, E, N, H, Rem., Date, Time

Codes:
Code, Rem., Attr.1-8

Codelist

To each code a description and max. 8 attributes with up to 16 characters can be assigned.

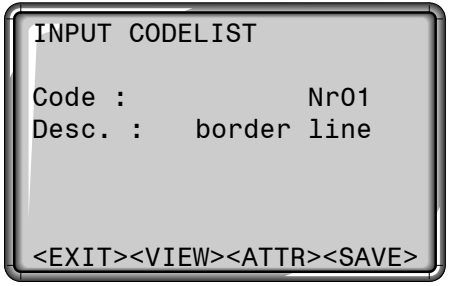


Searching for code:

Using arrow keys the codelist can be toggled through in both directions.

<NEW> : Enter new codelist:

Input of a new code and a descriptive text.



<ATTR> Input of attributes (alphanumeric).

<SAVE> Records inputs; back to code search.

<VIEW> Back to code search; without saving.

Deleting code:

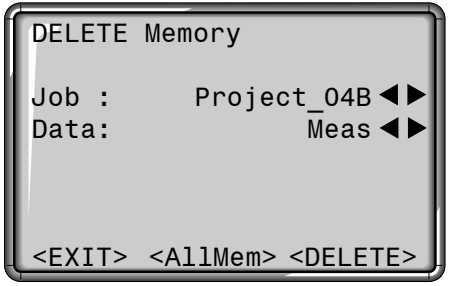
Select relevant code.

<DEL> Deletes code block.

SHIFT Extended display for viewing and checking attributes.

Either code can be searched directly with code name or Wildcard (*).

Individual jobs or complete data areas of a job are deleted. Deleting all data in memory.
Two choice fields enable the selection of a particular area.



Selection of job and data area to be deleted.

Possible data areas:
- measurements
- fixed points

<DEL> Starts deleting process within the selected area.

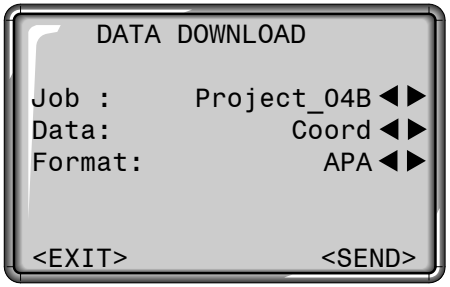
<AllMem> Deletes all data in memory. All data will be lost !

<NO> Back to selection of area to be deleted. Data is kept.

<YES> Deletes the selected data area within the selected job.

Deleting the memory cannot be undone. After confirming the message all data is deleted permanently.

With this special function measured data can be transfered via the serial interface to a receiver (e.g. a Laptop). Using this type of transfer the success of the transfer is not checked.



Selection of individual parameters.

<SEND> Data is sent via interface.

Job: Selection of job from which data should be transfered.

Data: Fixpoints or measurements can be sent separately and independently from each other. Selection of data type.

Format: Selection of output format. Only previously loaded format can be selected for download. New formats can be uploaded using Leica SurveyOffice (Data Exchange Manager). Leica formats GSI8/16 are supported.

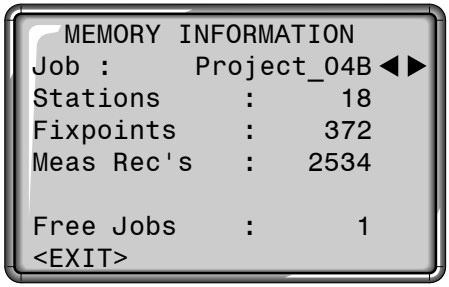
Example: "GSI" format

Within the "data" setting "MEASUREMENTS" a data set could be shown as follows:

```
11....+00000D19  21.022+16641826
22.022+09635023  31..00+00006649
58..16+00000344  81..00+00003342
82..00-00005736  83..00+00000091
87..10+00001700  522.16-00000000
```

If the receiver is to slow in processing data the data could be lost. With this type of data transfer the instrument is not informed about the performance of the receiver (no protocol).

It is possible for the user to call-up important information about the status of internal memory. Additionally, the user can obtain information about the composition of the data in the individual jobs.



<EXIT> Back to Data Manager.

Stations:
Number of stations used within the selected jobs.

Fixpoints:
Number of stored fixpoints within the selected jobs.

Meas Rec's:
Number of recorded data blocks (measured points, codes, etc.) within the selected jobs.

Free Jobs:
Number of free or not defined jobs.

Messages

Data SAVED
- Data has been recorded in the internal memory.

> Display disappears after <1 seconds. Back to last active display.

Data DELETED
- Data has been deleted in the internal memory.

> Display disappears after <1 seconds. Back to last active display.

JOB DELETED
- The content of a complete job has been deleted permanently.

> Display disappears after <1 seconds. Back to last active display.

Warnings

No data found in memory!
- No relevant data blocks could be found in the memory.

> Search for other data or enter relevant data in the Data Manager. Confirm with <OK>. Back to last active display.

Error messages

All memory blocks occupied!!
- Available memory full.

> Delete a job or data area in the internal memory. Confirm message with <OK>.

Job already exists in database!!
- Job or job name already exists in memory.

> Change job name. Make sure that the job name is not already available. Confirm message with <OK>.

Invalid Job-Name!!
- Job name is empty or contains a "-".

> Change job name. Confirm message with <OK>.

The calibration contains the determination of the following instrument errors:

- Hz-collimation
- V-index (simultaneously electronic level)

The calibration can be found in menu "Calibration" *(see also menu structure)*.

SHIFT PROG Calling the menu functions.

Calibration

Execute.

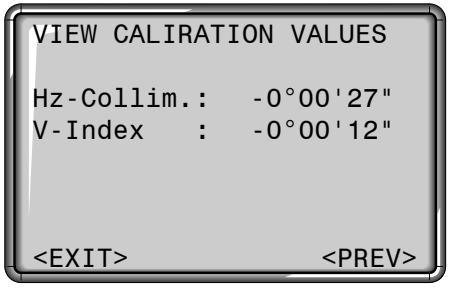
For determining the Hz-collimation or the V-index it is necessary to measure in both telescope positions. The procedure can be started in any telescope position.

The user is guided clearly through the procedure. As a result, a wrong determination of instrument error is eliminated.

HZ-COLLIMATION

or ...

With button <VIEW> an overview of the stored values is given.



Buttons:

<VIEW> Display of actual calibration values.

<MEAS> Measurements are triggered exclusively by pressing this button. Buttons ALL or DIST are not active during calibration.

<EXIT> Back to calibration menu without saving.

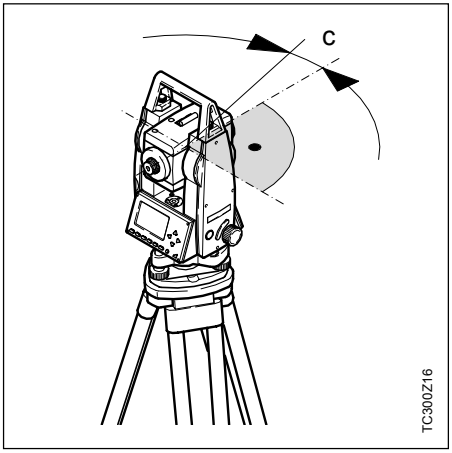
<PREV> Back to last active display.

The instruments are adjusted in the factory prior to shipping.

Instrument errors can change with time and temperature.

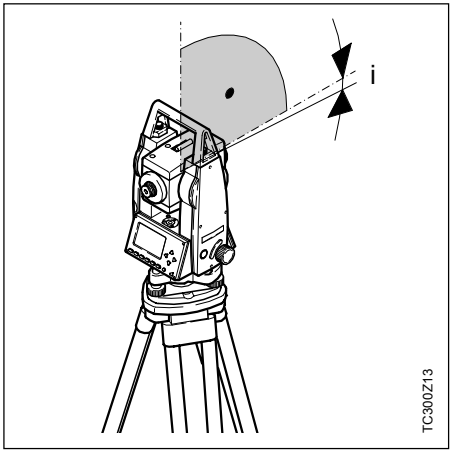
These errors should be determined before the instrument is used for the first time, before precision surveys, after long periods of transport, before and after long periods of work, and if the temperature changes by more than 10°C (18°F).

Before determining the instrument errors, level-up the instrument using the electronic bubble. The instrument should be secure and firm, and should be protected from direct sunlight in order to avoid thermal warming on one side only.



The line-of-sight error or collimation error (C) is the deviation from the perpendicular between the tilting axis and the line of sight.

The effect of the line-of-sight error to the Hz-angle increases with the vertical angle.
For horizontal aimings the error of Hz equals the line-of-sight error.

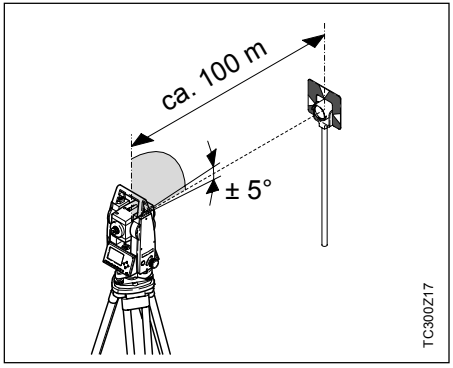


The vertical circle should read exactly 90° (100 gon) when the line of sight is horizontal. Any deviation from this figure is termed vertical index error (i).

By determining the vertical index error the electronic level is adjusted automatically.

1. Level up instrument exactly using the electronic level.

2. Aim at a point approximately 100m from the instrument wich is less than 5° from the horizontal.

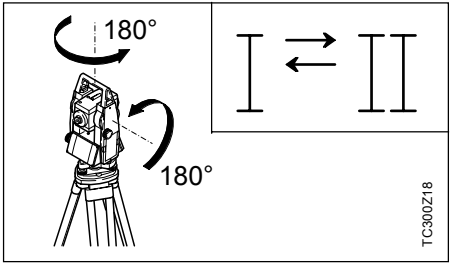


For checking the horiontal aiming Hz and V are displayed.

```
HZ-COLLIMATION (1)

Hz :        123°43'07"
V  :        272°11'31"

Sight target horizontal

<EXIT>   <MEAS>
```

3. Trigger measurement.

4. Change telescope position and aim on point again.



5. Using the trigger key trigger measurement again.

```
HZ-COLLIMATION (2)

Hz :        303°43'17"
V  :         87°48'19"
dHz:         -0°00'10"
dV :          0°00'28"

<EXIT>   <MEAS>
```

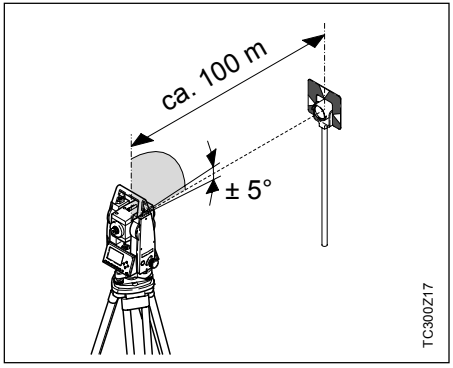
6. Indication of previous and recomputed line-of-sight-error.

```
HZ-COLLIMATION (c)

c(old):      -0°00'27"
c(new):      -0°00'27"
```

The new value can be either accepted with <SET> or rejected with <EXIT>.

1. Level up instrument exactly using the electronic level.

2. Aim at a point approximtely 100m from the instrument which is less than 5° from the horizontal.



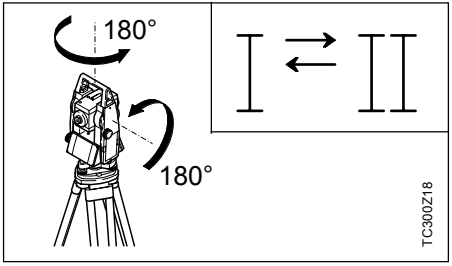
By determining the vertical index error the electronic level is adjusted automatically.

For checking the horiontal aiming Hz and V are displayed.

```
     V-INDEX   (1)

Hz :        123°43'07"
V  :        272°11'31"

Sight target horizontal

<EXIT>   <MEAS>
```

3. Trigger measurement.

4. Change telescope position and aim on point again.



5. Using the trigger key trigger measurement again.

```
     V-INDEX   (2)

Hz :        303°43'17"
V  :         87°48'19"
dHz:         -0°00'10"
dV :          0°00'28"

<EXIT>   <MEAS>
```

6. Indication of previous and recomputed V-index.

```
     V-INDEX (i)

i(old):      -0°00'27"
i(new):      -0°00'27"
```

The new value can be either accepted with <SET> or rejected with <EXIT>.

Important messages	Meaning	Measures
V-Angle not suitable for calibration (Check V-angle or face)	Aiming tolerance not met or telescope position/face not changed.	Aim on the target point with an accuracy of min. 5 gon. The target point must be approximately in the horizontal plane. Confirmation of the message required.
Calibration result out of tolerance. Previous values retained	Computed values out of tolerance. Previous values retained.	Repeat measurements. Confirmation of the message required.
Hz-Angle out of limit	Hz-angle in second face/telescope pos. deviates more than 5 gon from the target point.	Aim on the target point with an accuracy of min. 5 gon. Confirmation of the message required.
Measurement Error. Try again.	Measurement error appeared (e.g. instable set up or period between measuring in telescope position I and II too long).	Repeat the process. Confirmation of the message required.

Intended use of instrument

The following directions should enable the person responsible for the TC(R)303/305/307, and the person who actually uses the instrument, to anticipate and avoid operational hazards.

The person responsible for the instrument must ensure that all users understand these directions and adhere to them.

Permitted uses

The electronic total stations are intended to the following applications:

- Measuring horizontal and vertical angles
- Measuring distances
- Recording measurements
- Computing by means of application software
- Visualising the standing axis (with laser plummet)

Adverse uses

- Use of the total station without previous instruction
- Use outside of the intended limits
- Disabling safety systems and removal of hazard notices
- Opening the instrument using tools (screwdriver, etc.), unless this is specifically permitted for certain functions
- Modification or conversion of the instrument
- Use after misappropriation
- Use with accessories from other manufacturers without the prior express approval of Leica Geosystems
- Aiming directly into the sun
- Inadequate safeguards at the surveying site (e.g. when measuring on roads, etc.)

- Controlling machines, or controlling moving objects or similar, with the integrated distancer (visible laser)
- Deliberate dazzling of third parties

WARNING:
Adverse use can lead to injury, malfunction, and material damage.
It is the task of the person responsible for the instrument to inform the user about hazards and how to counteract them. The electronic total stations are not to be used until the user has been properly instructed how to use them.

Limits of use

Environment:
Suitable for use in an atmosphere appropriate for permanent human habitation: not suitable for use in aggressive or explosive environments. Use in rain is permissible for limited periods.

Refer to section "Technical Data".

DANGER:
Local safety authorities and safety experts must be contacted before working in hazardous explosive areas or in extreme environment conditions by the person in charge of the instrument. This includes the use of a lockable battery holder to prevent accidental opening of the compartment.

Responsibilities

Area of responsibility for the manufacturer of the original equipment Leica Geosystems AG, CH-9435 Heerbrugg (hereinafter referred to as Leica Geosystems):
Leica Geosystems is responsible for supplying the product, including the User Manual and original accessories, in a completely safe condition.

Responsibilities of the manufacturers of non-Leica Geosystems accessories:
The manufacturers of non-Leica Geosystems accessories for the TC(R)303/305/307 electronic total stations are responsible for developing, implementing and communicating safety concepts for their products, and are also responsible for the effectiveness of those safety concepts in combination with the Leica Geosystems product.

Responsibilities of the person in charge of the instrument:

WARNING:
The person responsible for the instrument must ensure that it is used in accordance with the instructions. This person is also accountable for the training and deployment of personnel who use the instrument and for the safety of the equipment when in use.

The person in charge of the instrument has the following duties:

- To understand the safety instructions on the product and the instructions in the User Manual.
- To be familiar with local regulations relating to accident prevention.
- To inform Leica Geosystems immediately if the equipment becomes unsafe.

WARNING:
The absence of instruction, or the inadequate imparting of instruction, can lead to incorrect or adverse use, and can give rise to accidents with far-reaching human, material, financial and environmental consequences.
Precautions:
All users must follow the safety directions given by the manufacturer and the directions of the person responsible for the instrument.

WARNING:
The battery charger is not designed for use under wet and severe conditions. If instrument becomes wet it may cause you to receive an electric shock.
Precautions:
Use charger only in dry rooms and protect instrument from humidity. Do not use instruments becoming wet.

WARNING:
If you open the charger, either of the following actions may cause you to receive an electric shock:
- Touching live components
- Using the charger after incorrect attempts to carry out repairs

Precautions:
Do not open the charger. Only a Leica Geosystems-approved service technician is entitled to repair it.

DANGER:
Because of the risk of electrocution, it is very dangerous to use reflector poles and extensions in the vicinity of electrical installations such as power cables or electrical railways.

Precautions:
Keep at a safe distance from electrical installations. If it is essential to work in this environment, first contact the safety authorities responsible for the electrical installations and follow their instructions.

WARNING:
By surveying during a thunderstorm you are at risk from lightening.

Precautions:
Do not carry out field surveys during thunderstorms.

CAUTION:
Be careful not to point the instrument directly towards the sun, because the telescope functions as a magnifying lens and can injure your eyes or damage the distance measuring device and the Guide Light EGL.

Precautions:
Do not point the telescope directly at the sun.

WARNING:
During target recognition or stakeout procedures there is a danger of accidents occurring if the user does not pay attention to the environmental conditions (e.g. obstacles, excavations or traffic).
Precautions:
The person responsible for the instrument must make all users fully aware of the existing dangers.

WARNING:
Inadequate securing of the surveying site can lead to dangerous situations, for example in traffic, on building sites and at industrial installations.
Precautions:
Always ensure that the surveying site is adequately secured. Adhere to the local regulations governing accident prevention and road traffic.

CAUTION:
If a target lamp accessory is used with the instrument the lamp's surface temperature may be extreme after a long working period. It may cause pain if touched. Replacing the halogen bulb before the lamp has been allowed to cool down may cause burning to the skin or fingers.
Precautions:
Use appropriate heat protection such as gloves or woollen cloth before touching the lamp, or allow the lamp to cool down first.

WARNING:
If computers intended for use indoors are used in the field there is a danger of electric shock.

Precautions:

Adhere to the instructions given by the computer manufacturer with regard to field use in conjunction with Leica Geosystems instruments.

CAUTION:
During the transport or disposal of charged batteries it is possible for inappropriate mechanical influences to constitute a fire hazard.
Precautions:
Before transporting or disposing of equipment, discharge the battery (e.g. by running the instrument in tracking mode until the batteries are exhausted).

WARNING:
If the equipment is improperly disposed of, the following can happen:

- If polymer parts are burnt, poisonous gases are produced which may impair health.
- If batteries are damaged or are heated strongly, they can explode and cause poisoning, burning, corrosion or environmental contamination.
- By disposing of the equipment irresponsibly you may enable unauthorized persons to use it in contravention of the regulations, exposing themselves and third parties to the risk of severe injury and rendering the environment liable to contamination.
- Leakage of silicone oil from the compensator can damage the optical and electronic subassemblies.

Precautions:
Dispose of the equipment appropriately in accordance with the regulations in force in your country. Always prevent access to the equipment by unauthorized personnel.

CAUTION:
If the accessories used with the instrument are not properly secured, and the equipment is subjected to mechanical shock (e.g. blows, falling etc.), the equipment may be damaged, safety devices may be ineffective or people may sustain injury.
Precautions:
When setting-up the instrument, make sure that the accessories (e.g. tripod, tribrach, etc.) are correctly adapted, fitted, secured and locked in position.
Avoid subjecting the equipment to mechanical shock.
Never position the instrument on the tripod baseplate without securely tightening the central fixing screw. If the screw is loosened always remove the instrument immediately from the tripod.

CAUTION:
Watch out for erroneous measurements if the instrument is defective or if it has been dropped or has been misused or modified.
Precautions:
Periodically carry out test measurements and perform the field adjustments indicated in the User Manual particularly after the instrument has been subjected to abnormal use and before and after important measurements.

CAUTION:
Allow only authorized Leica Geosystems service workshops to service the instrument.

The EDM module built into the total stations produces an invisible infra-red laser beam which emerges from the telescope objective.

The product is a Class 1 laser product in accordance with:

- IIEC 60825-1: 1993 "Radiation safety of laser products".
- EN 60825-1 : 1994 "Radiation safety of laser products".

The product is a Class I laser product in accordance with:

- FDA 21CFR Ch.I §1040: 1988 (US Department of Health and Human Service, Code of Federal Regulations)

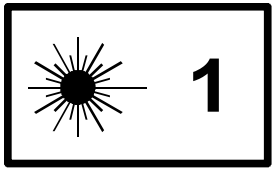
Class 1/I laser products are safe under reasonably foreseeable conditions of operation and are not harmful to the eyes provided that the products are used and maintained in accordance with the instructions.

WARNING:

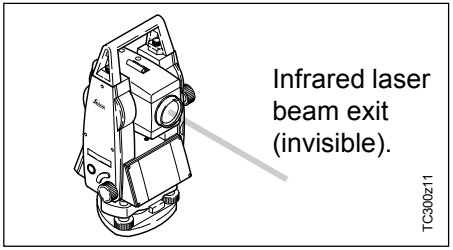
It can be dangerous to look into the beam with optical equipment (e.g. binoculars, telescopes)

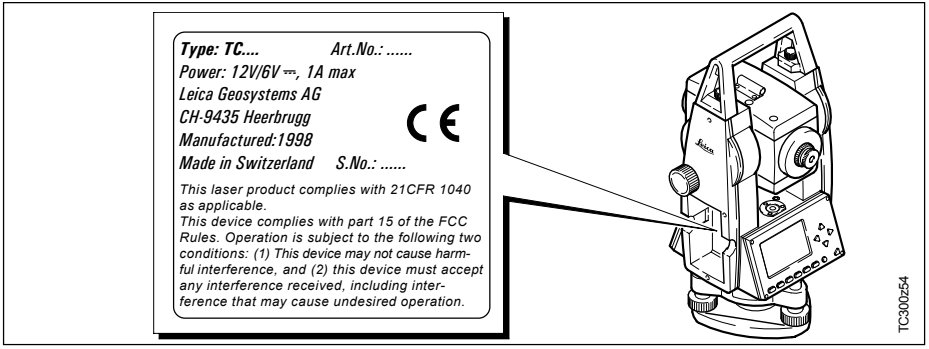
Precautions:

Do not look directly into the beam with optical equipment.



Beam divergence:	1.8 mrad
Pulse duration:	800 ps
Maximum radiant power:	0.33 mW
Maximum radiant power per pulse:	4.12 mW
Measurement uncertainty:	± 5%





As an alternative to the infrared beam, the EDM incorporated into the total station produces a visible red laser beam which emerges from the telescope objective.
The product is a Class 2 laser product in accordance with:

- IEC 60825-1: 1993 "Radiation safety of laser products".
- EN 60825-1: 1994 "Radiation safety of laser products".

The product is a Class II laser product in accordance with:

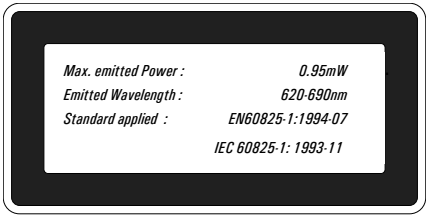
- FDA 21CFR Ch.I §1040: 1988 (US Department of Health and Human Service, Code of Federal Regulations)

Class 2/II laser products:
Do not stare into the beam or direct it unnecessarily at other persons. Eye protection is normally afforded by aversion responses including the blink reflex.

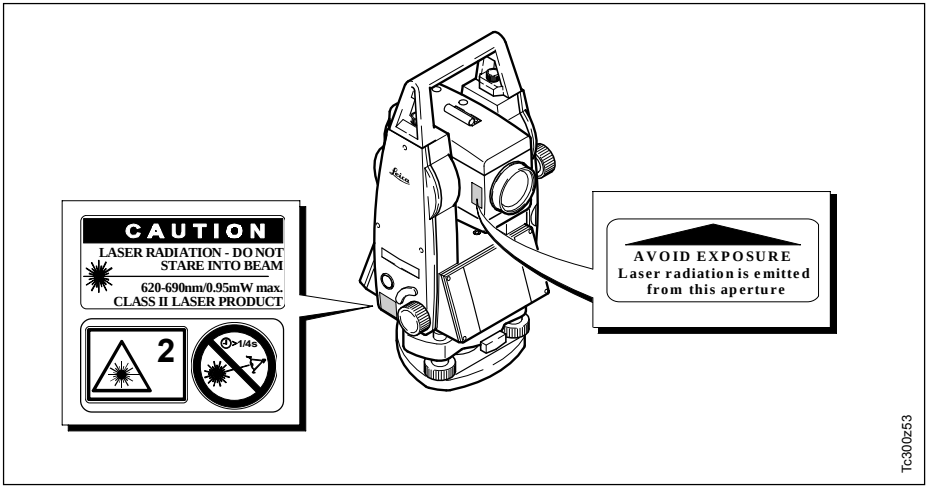
WARNING:
It can be dangerous to look into the beam with optical equipment (e.g. binoculars, telescopes)

Precautions:

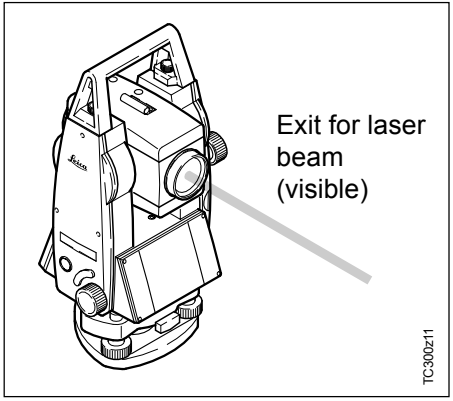
Do not look directly into the beam with optical equipment.



Labelling



Beam divergence:	0.15 x 0.35 mrad
Pulse duration:	800 ps
Maximum radiant power:	0.95 mW
Maximum radiant power per pulse:	12 mW
Measurement uncertainty:	± 5%



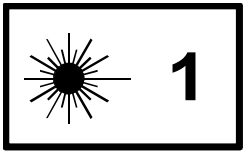
The integrated Guide Light produces a visible LED beam from the upper front side of the telescope.
The product is a Class 1 LED product *) in accordance with:

- IEC 60825-1: 1993 "Radiation safety of laser products"
- EN 60825-1: 1994 "Radiation safety of laser products"

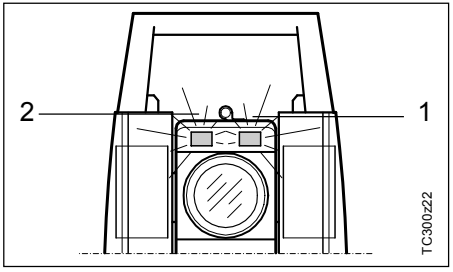
*) Within the specified working range of > 5 m (> 16 ft).

Class 1 LED products are safe under reasonably foreseeable conditions of operation and are not harmful to the eyes provided that the products are used and maintained in accordance with the instructions.

CAUTION:
Use the Guide Light only within the specified working range of > 5 m (> 16 ft) from the telescope.



Flashing LED	yellow	red
Beam divergence:	2.4 °	2.4 °
Pulse duration:	2 x 105 ms	1 x 105 ms
Maximum radiant power:	0.28 mW	0.47 mW
Maximum radiant power per pulse:	0.75 mW	2.5 mW
Measurement uncertainty:	± 5 %	± 5 %



1 Exit for flashing red LED
2 Exit for flashing yellow LED

The integrated laser plummet produces a visible laser beam which emerges from the base of the instrument.

The product is a Class 2 laser product in accordance with:

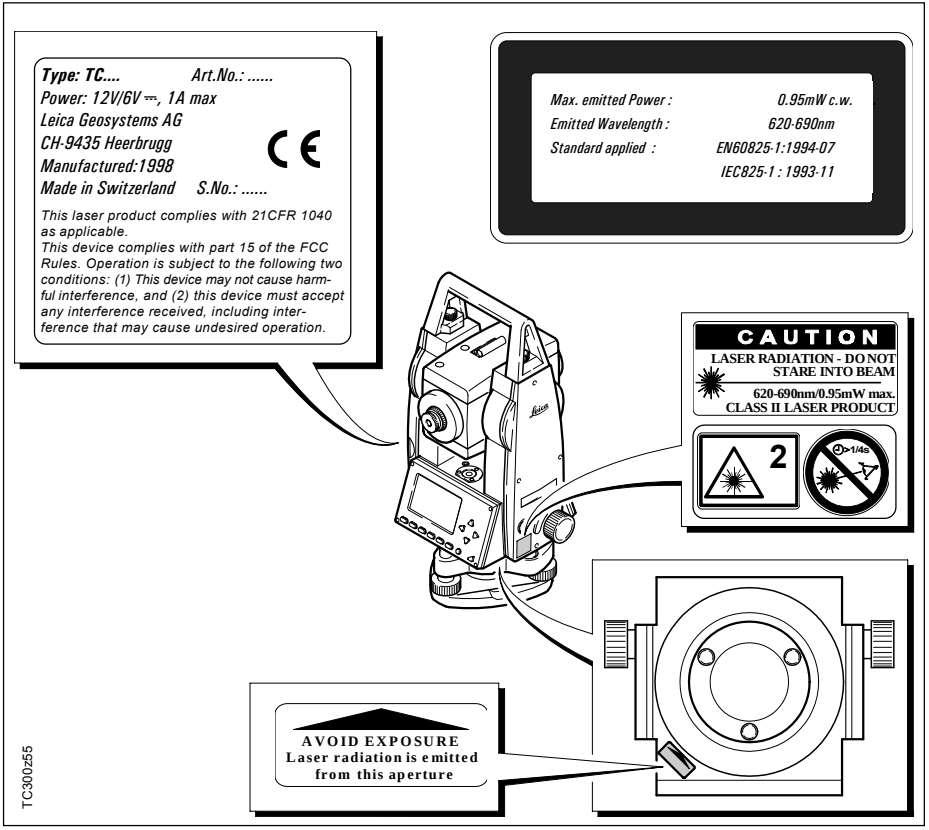
- IEC 60825-1: 1993 "Radiation safety of laser products".
- EN 60825-1 : 1994 "Radiation safety of laser products".

The product is a Class II laser product in accordance with:

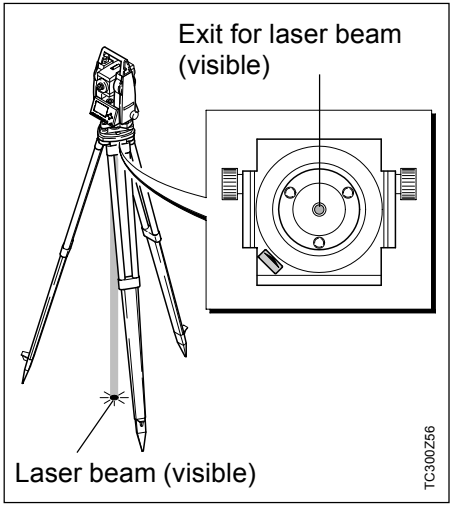
- FDA 21CFR Ch.I §1040: 1988 (US Department of Health and Human Service, Code of Federal Regulations)

Class 2/II laser products:
Do not stare into the beam or direct it unnecessarily at other persons. Eye protection is normally afforded by aversion responses including the blink reflex.

Labelling



Beam divergence:	0.16 x 0.6 mrad
Pulse duration:	c.w.
Maximum radiant power:	0.95 mW
Maximum radiant power per pulse:	n/a
Measurement uncertainty:	± 5%



Electromagnetic acceptability

The term "electromagnetic acceptability" is taken to mean the capability of the instrument to function correctly in an environment where electromagnetic radiation and electrostatic discharges are present, and without causing electromagnetic disturbances in other equipment.

WARNING:
Electromagnetic radiation can cause disturbances in other equipment.

Although electronic total stations meet the strict regulations and standards which are in force in this respect, Leica Geosystems cannot completely exclude the possibility that other equipment may be disturbed.

CAUTION:
There is a risk that disturbances may be caused in other equipment if the total station is used in conjunction with accessories from other manufacturers, e.g. field computers, personal computers, walkie-talkies, non-standard cables, external batteries.

Precautions:
Use only the equipment and accessories recommended by Leica Geosystems. When combined with total stations, they meet the strict requirements stipulated by the guidelines and standards. When using computers and walkie-talkies, pay attention to the information about electromagnetic acceptability provided by the manufacturer.

CAUTION:
Disturbances caused by electromagnetic radiation can result in the tolerance limits for measurements being exceeded.

Although the total stations meet the strict regulations and standards which are in force in this connection, Leica Geosystems cannot completely exclude the possibility that the total station may be disturbed by very intense electromagnetic radiation, e.g. near radio transmitters, walkie-talkies, diesel generators, power cables.
Check the plausibility of results obtained under these conditions.

WARNING:
If the total station is operated with connecting cables attached at only one of their two ends (e.g. external supply cables, interface cables), the permitted level of electromagnetic radiation may be exceeded and the correct functioning of other instruments may be impaired.

Precautions:
While the total station is in use, connecting cables (e.g. instrument to external battery, instrument to computer) must be connected at both ends.

WARNING:

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules.
These limits are designed to provide reasonable protection against harmful interference in a residential installation.
This equipment generates, uses and can radiate frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications.
However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

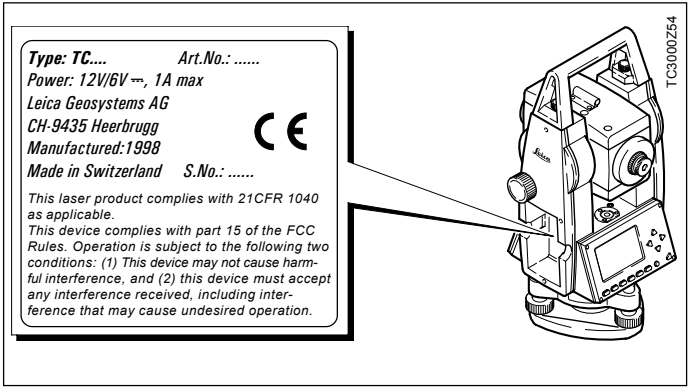
- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

WARNING:

Changes or modifications not expressly approved by Leica Geosystems for compliance could void the user's authority to operate the equipment.

Product labelling:

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

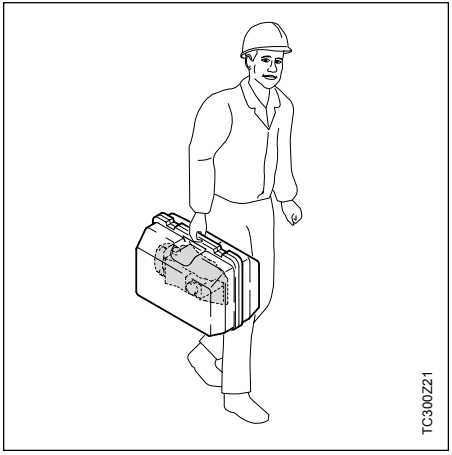


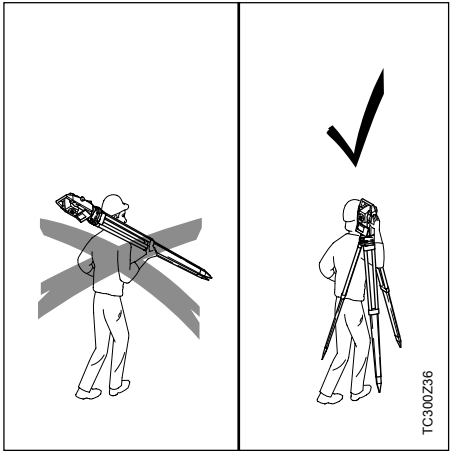
Transport

When transporting or shipping the equipment always use the original Leica Geosystems packaging (transport case and shipping cardboard).

After a longer period of storage or transport of your instrument always check the field ajustment parameters indicated in this manual before using the instrument.

In the field

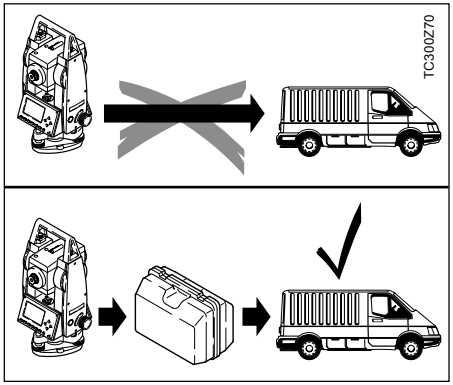




When transporting the equipment **in the field**, always make sure to

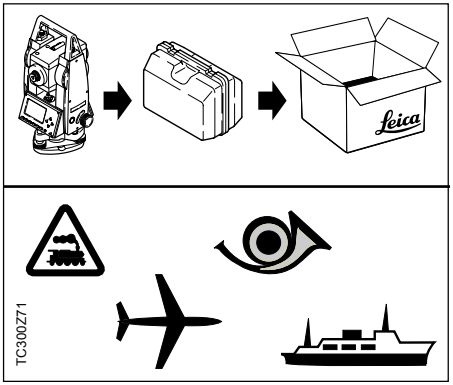
- either carry the instrument in its original transport case or,
- carry the tripod with its legs splayed across your shoulder, keeping the attached instrument upright.

Inside vehicle



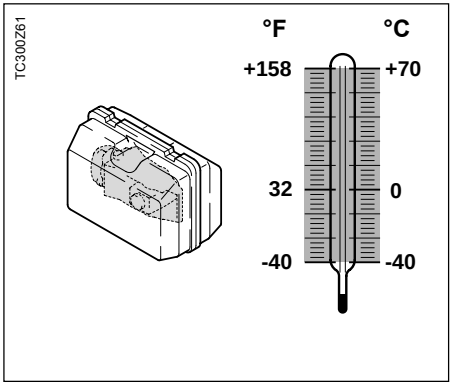
Never transport the instrument loose **inside the vehicle**.
The instrument can be damaged by blows and vibrations. It must always be transported in its case and be properly secured.

Shipping



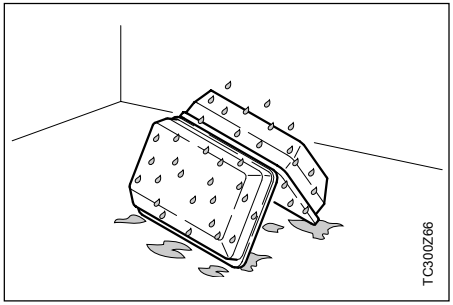
For shipping the instrument by **rail, aircraft** or **ship** use the Leica Geosystems original packaging (transport case or shipping cardboard) or another suitable packaging securing the instrument against blows and vibrations.

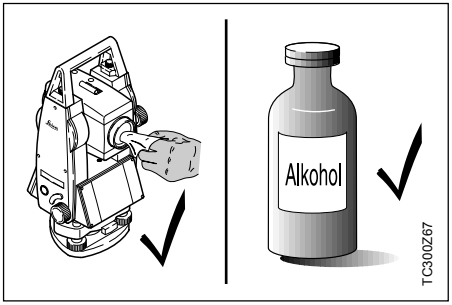
Storage

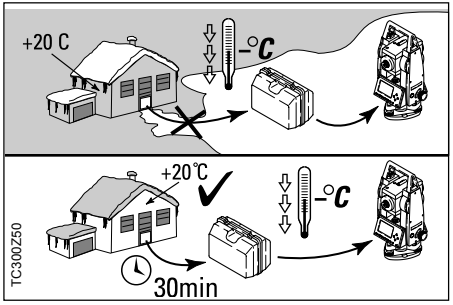


When storing the equipment, particularly in summer and inside a vehicle, take the **temperature limits** into account.

When storing the intrument inside a building also use the transport case (if possible, in a safe place).







If the instrument becomes wet, leave it unpacked.

Wipe down, clean, and dry the instrument (at not more than 40 °C/ 108°F), transport case, foam inserts, and accessories. Pack up the equipment only when it is perfectly dry.

When using the instrument in the field always close the transport case.

Objective, eyepiece and prisms:

- Blow dust off lenses and prisms.
- Never touch the glass with fingers.
- Use only a clean, soft and lint-free cloth for cleaning. If necessary, moisten the cloth with pure alcohol.

Use no other liquids; these may attack polymer components.

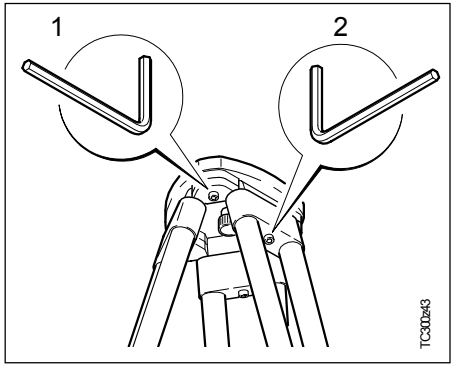
Fogging of prisms:

Reflector prisms that are cooler than the ambient temperature tend to fog. It is not enough simply to wipe them. Keep them for some time inside your jacket or in the vehicle to allow them to adjust to the ambient temperature.

Cables and plugs

Keep plugs clean and dry. Blow away any dirt lodged in the plugs of the connecting cables.

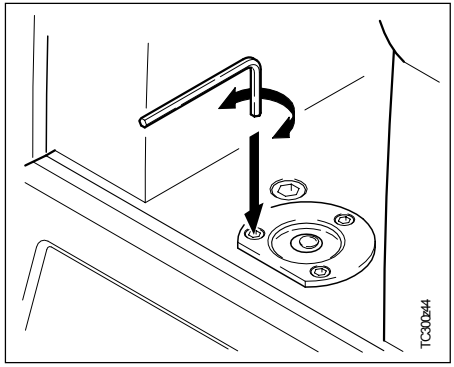
Tripod



The connections between metal and timber components must always be firm and tight.

- Tighten the Allen screws (2) moderately.
- Tighten the articulated joints on the tripod head (1) just enough to keep the tripod legs open when you lift it off the ground.

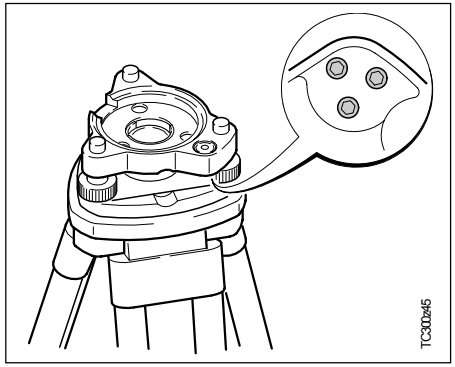
Circular level



Level-up the instrument in advance with the electronic level. The bubble must be centered. If it extends beyond the circle, use the Allen key supplied to center it by turning the adjustment screws.

After adjustment no screw must be loose.

Circular level on the tribrach



Level the instrument and then remove it from the tribrach. If the bubble is not centred, adjust it using the adjusting pin.
Turning the adjustment screws:

- to the left: the bubble approaches the screw
- to the right: the bubble goes away from the screw.

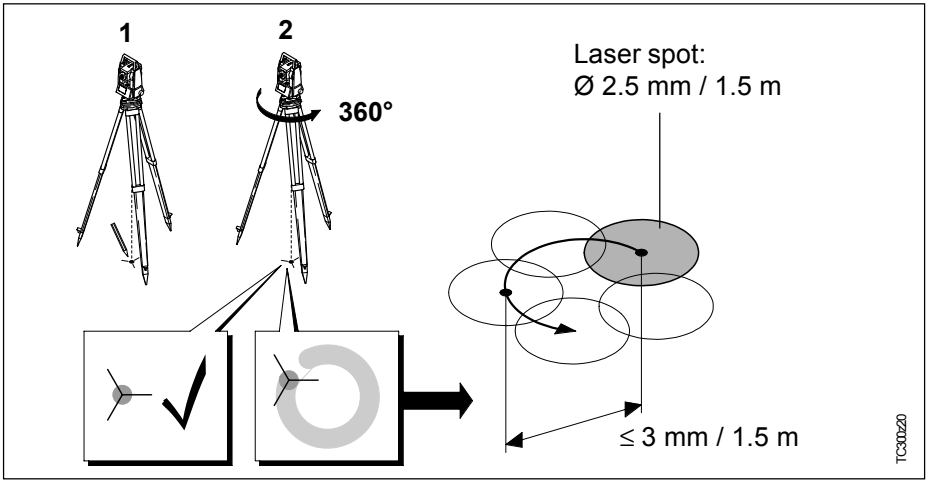
After adjustment no screw must be loose.

The laser plummet is integrated into the vertical axis of the instrument. Under normal circumstances setting of the laser plummet is not necessary. If an adjustment is necessary due to external influences the instrument has to be returned to any Leica service department.

Checking by turning the instrument by 360°:

1. Install the instrument on the tripod approx. 1.5 m above ground and level up.
2. Switch on laser plummet and mark the centre of the red spot.
3. Turn instrument slowly by 360° and observe the red laser spot.

Inspecting the laser plummet should be carried out on a bright, smooth and horizonal surface (e.g. a sheet of paper).



If the centre of the laser spot makes a clearly circular movement or if the centre of the point is moving away more than 3 mm from the first marked point an adjustment is possibly necessary. Call your nearest Leica service department.

Depending on brightness and surface the size of the laser spot can vary. At a distance of 1.5 m an average value of 2.5 mm diameter must be estimated.

The maximum diameter of the circular movement described by the centre of the laser point should not exceed 3 mm at a distance of 1.5m.

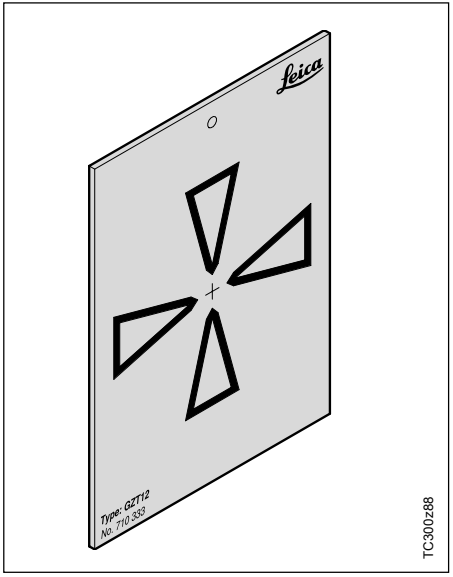
The red laser beam used for measuring without reflector is arranged coaxially with the line of sight of the telescope, and emerges from the objective port. If the instrument is well adjusted, the red measuring beam will coincide with the visual line of sight. External influences such as shock or large temperature fluctuations can displace the red measuring beam relative to the line of sight.

The direction of the beam should be inspected before precise measurement of distances is attempted, because an excessive deviation of the laser beam from the line of sight can result in imprecise distance measurements.

Inspection

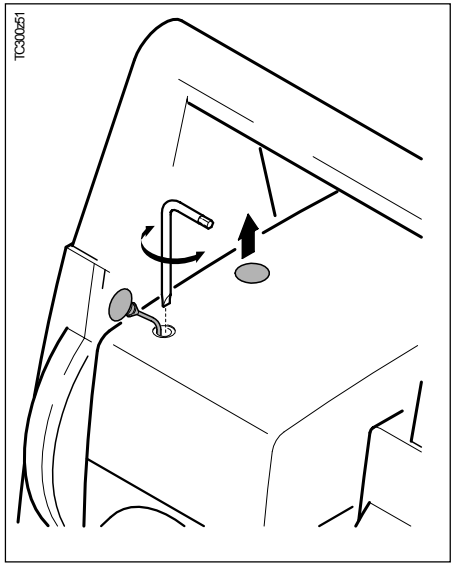
A target plate is provided. Set it up between five and 20 metres away with the grey reflective side facing the instrument. Move the telescope to face II. Switch on the red laser beam by activating the laser-point function. Use the telescope crosshair to align the instrument with the centre of the target plate, and then inspect the position of the red laser spot on the target plate. Generally speaking the red spot cannot be seen through the telescope, so look at the target plate from just above the telescope or from just to the side of it.
If the spot illuminates the cross, the achievable adjustment precision has been reached; if it lies outside the limits of the cross, the direction of the beam needs to be adjusted.

If the spot on the more reflective side of the plate is too bright (dazzling), use the white side instead to carry out the inspection.



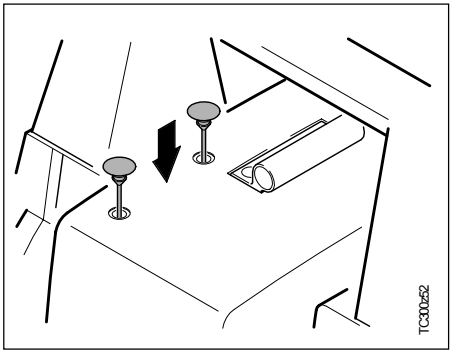
Adjusting the direction of the beam

Pull the two plugs out from the adjustment ports on the top side of the telescope housing.
To correct the height of the beam, insert the screwdriver into the rear adjustment port and turn it clockwise (spot on target plate moves obliquely upwards) or anticlockwise (spot moves obliquely downwards).
To correct the beam laterally, insert the screwdriver into the front adjustment port and turn it clockwise (spot moves to the right) or anticlockwise (spot moves to the left).

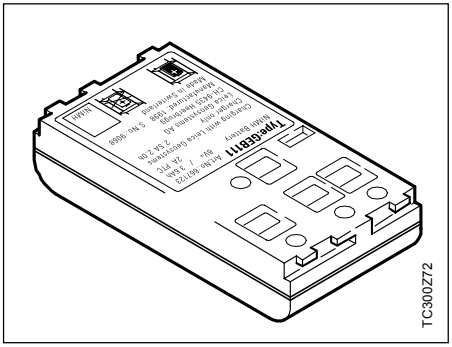


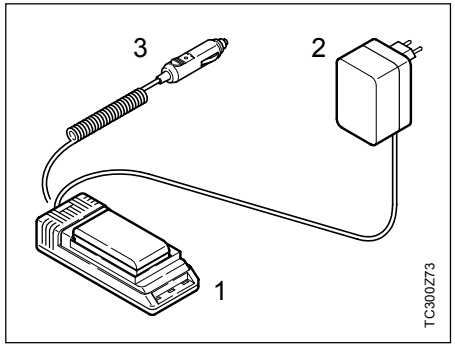
Throughout the adjustment procedure, keep the telescope pointing to the target plate.

After each field adjustment, replace the plugs in the adjustment ports to keep out damp and dirt.



WARNING:
Use a battery charger in a dry room only, never outdoors. Charge batteries only at an ambient temperature between +10°C and +30°C (50°F to 86°F). We recommend a temperature of 0°C to +20°C (32°F to 68°F) for storing the batteries.





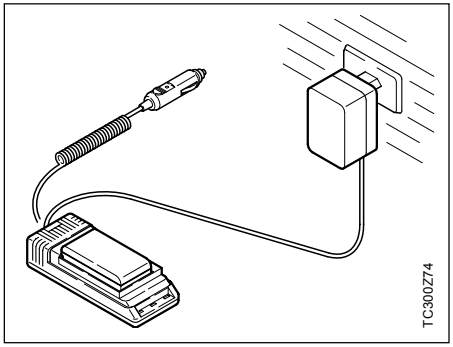
Only use batteries, charging sets and accessories recommended by Leica Geosystems .

In order to fully extend battery capacity it is absolutely necessary, with the new GEB111 batteries, to carry out 3 to 5 complete charging/discharging cycles.

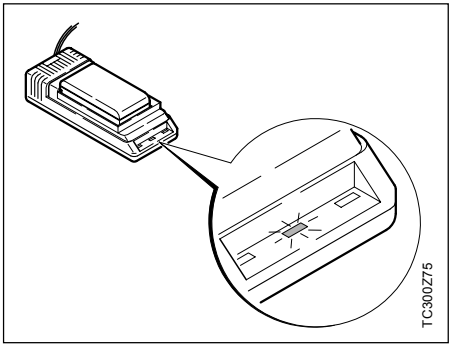
Your Leica Geosystems instrument is operated with rechargable plug-in batteries. For the TC(R)303/305/307 instruments use the NiMH battery GEB111.

1 Battery charger GKL111
2 Mains connection cable
3 Vehicle connection cable

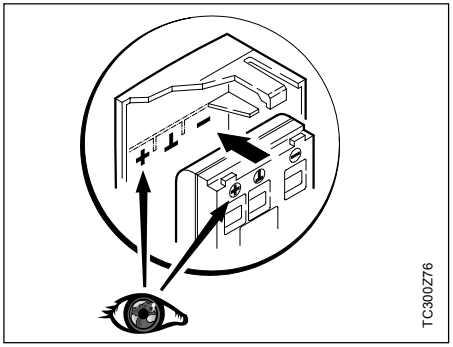
Using the Basic battery charger GLK111 one Basic / Pro battery can be charged. Charging can be carried out via a mains socket using the power supply unit or via the vehicle connection cable inside vehicles (12V or 24V).



Connect battery charger GKL111 to mains or inside the vehicle.
Insert battery GEB111 into the charger so that the metal contacts of the charger and of the battery connect and the battery is locked in place.
The continuously lit green lamp indicates the charging process.



As soon as the green lamp is flashing the battery is charged (takes 1 to 2 hours) and can be removed from the charger.
Insert charged battery into the battery holder of your instrument. Pay attention to the correct polarity (corresponding with indication in the battery cover).



Pull battery holder with inserted battery into the instrument. Now the instrument is ready for measuring and can be switched on.

Find more information in chapter "Inserting / charging battery" or in the information leaflet of your battery charger GKL111.

Telescope
- Transit fully
- Magnification: 30x
- Image: upright
- Free Objective aperture: 40 mm
- Shortest focussing distance: 1.7 m (5.6 ft)
- Focusing: fine
- Field of view: 1°30' (1.7gon)
- Telescope field of view at 100m 2.6 m

Angle measurement
- absolute, continuous,
- Updates each 0.3 seconds
- Units selectable
  360° sexagesimal, 400gon,
  360° decimal, 6400 mil, V%, ±V
- Standard deviation
  (acc. to DIN 18723 / ISO 12857)

TC(R)303	3" (1 mgon)
TC(R)305	5" (1.5 mgon)
TC(R)307	7" (2 mgon)

- Display resolution

gon	0.0005
360d	0.0005
360s	1"
mil	0.01

Level sensitivity
- Circular level: 6'/2 mm
- Electronic bubble: 20"/2mm

Laser plummet:
- Location: in vertical axis of instrument
- Accuracy: Deviation from plumbline 1.5 mm (2 sigma) at 1.5 m instrument height
- Diameter of laser point 2.5 mm / 1.5 m

Compensator:
- 2-axis-oil compensator
- Setting range ±4' (0.07 gon)
- Setting accuracy

TC(R)307	2" (0.7 mgon)
TC(R)305	1.5" (0.5 mgon)
TC(R)303	1" (0.3 mgon)

Keyboard:
- Tilt angle: 70°
- Base area: 110x75 mm
- No. of buttons: 12 plus ON and trigger key (on side cover)
- optional 2nd keyboard

Display:
- Backlit
- Heatable (Temp. < -5°C)
- LCD: 144x64 Pixel
- 8 lines with 24 characters each

Type of tribrach:
- Tribrach removable GDF111
  Thread diam.: 5/8"
  (DIN 18720 / BS 84)

Dimensions:
- Instrument:
  Height (including tribrach and carrying handle):
  - with tribrach GDF111
    360 mm ± 5 mm
  Width: 150 mm
  Length: 145 mm

- Case: 468x254x355mm (LxBxH)

Weight
(including battery and tribrach)
- with tribrach GDF111 5,2 kg

Tilting axis height:
- without tribrach 196 mm
- with tribrach GDF111
  240 mm ± 5 mm

Power supply:
- Battery: Ni+Mh (0% Cadmium)
- Voltage: 6V, 1800 mAh
- External supply (via serial interface)
  If an external cable is used, then the voltage range must lie between 11.5V and 14V.

Number of measurements:
- Angle: >4 h
- Distance: >1000

Temperature range:
- Storage: -40°C to +70°C
  -40°F to +158°F
- Operating: -20°C to +50°C
  -4°F to +122°F

Automatic corrections
- Line-of-sight error Yes
- Vertical-index error Yes
- Earth curvature Yes
- Refraction Yes
- Tilt correction Yes

Recording
- RS232 interface Yes
- Internal memory: Yes
  Total capacity 256 KB
  ≈ 4000 data blocks or
  ≈ 7000 fixpoints

Distance measurement (IR: infrared)

- Type: infrared
- Carrier wavelength: 0.780 µm
- Measuring system: special frequency system basis 100 MHz ≙ 1.5 m
- EDM type: coaxial
- Display (least count): 1 mm

EDM measuring program	Accuracy * (Standard deviation)	Time per measurement
Standard measurement	2 mm + 2 ppm	<1 sec.
Fast measurement	5 mm + 2 ppm	<0.5 sec.
Tracking	5 mm + 2 ppm	<0.3 sec.
IR Tape	5 mm + 2 ppm	<0.5 sec.

* Beam interruptions, severe heat shimmer and moving objects within the beam path can result in deviations of the specefied accuracy.

	Range: (normal and rapid measurement)				
	Standard prism	3 prisms (GPH3)	360° reflector	Tape 60mm x 60mm	Mini-prism
1	1800 m (6000 ft)	2300 m (7500 ft)	800 m (2600 ft)	150 m (500 ft)	800 m (2600 ft)
2	3000 m (10000 ft)	4500 m (14700 ft)	1500 m (5000 ft)	250 m (800 ft)	1200 m (4000 ft)
3	3500 m (12000 ft)	5400 m (17700 ft)	2000 m (7000 ft)	250 m (800 ft)	2000 m (7000 ft)

1) Strong haze, visibility 5km; or strong sunlight, severe heat shimmer
2) Light haze, visibility about 20km; or moderate sunlight, slight heat shimmer
3) Overcast, no haze, visibility about 40km; no heat shimmer

Distance measurement (RL: visible)

- Type: visible red laser
- Carrier wavelength: 0.670 µm
- Measuring system: special frequency system basis 100 MHz ≙ 1.5 m
- EDM type: coaxial
- Display (least count): 1 mm
- Laser spot size: approx. 7x 14 mm / 20 m
  approx. 10 x 20 mm / 50 m

Distance measurement (reflectorless)

- Range of measurement: 1.5 m to 80 m (to target plate 710 333)
- Display unambiguous: to 760 m
- Prism constant (additive constant): + 34.4 mm

	Range (without reflector)	
Atmospheric conditions	No reflector (white target)*	No reflector (grey, albedo 0.25)
4	60 m (200 ft)	30 m (100 ft)
5	80 m (260 ft)	50 m (160 ft)
6	80 m (260 ft)	50 m (160 ft)

* Kodak Grey Card used with exposure meter for reflected light

4) Object in strong sunlight, severe heat shimmer
5) Object in shade, or sky overcast
6) Day, night and twilight

EDM measuring program	Accuracy ** (Standard deviation)	Time per measurement
Short	3 mm + 2 ppm	3.0 sec. +1.0 sec./10m > 30m
Prism	5 mm + 2 ppm	2.5 sec.
Tracking	5 mm + 2 ppm	1.0 sec. +0.3 sec./10m > 30m

** Beam interruptions, severe heat shimmer and moving objects within the beam path can result in deviations of the specefied accuracy.

Distance measurement (with reflector)

- Range of measurement: from 1000m up
- Display unambiguous: to 12 km

	Range (with reflector)	
Atmospheric conditions	Standard prism (GPR1)	Three prisms (GPH3)
1	1500 m (5000 ft)	2000 m (7000 ft)
2	5000 m (16000 ft)	7000 m (23000 ft)
3	> 5000 m (16000 ft)	> 9000 m (30000 ft)

1) Strong haze, visibility 5km; or strong sunlight, severe heat shimmer
2) Light haze, visibility about 20km; or moderate sunlight, slight heat shimmer
3) Overcast, no haze, visibility about 40km; no heat shimmer

The distance displayed is correct only if the scale correction in ppm (mm/km) which has been entered corresponds to the atmospheric conditions prevailing at the time of the measurement.

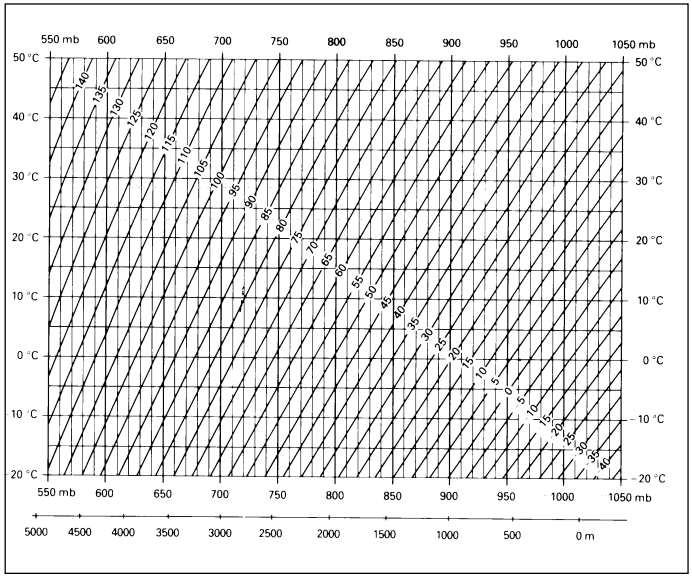
The atmospheric correction includes adjustments for air pressure, air temperature and relative humidity.

If, for highest-precision distance measurements, the atmospheric correction should be determined with an accuracy of 1 ppm, the following parameters must be redetermined: Air temperature to 1°C; air pressure to 3 millibars; relative humidity to 20%.

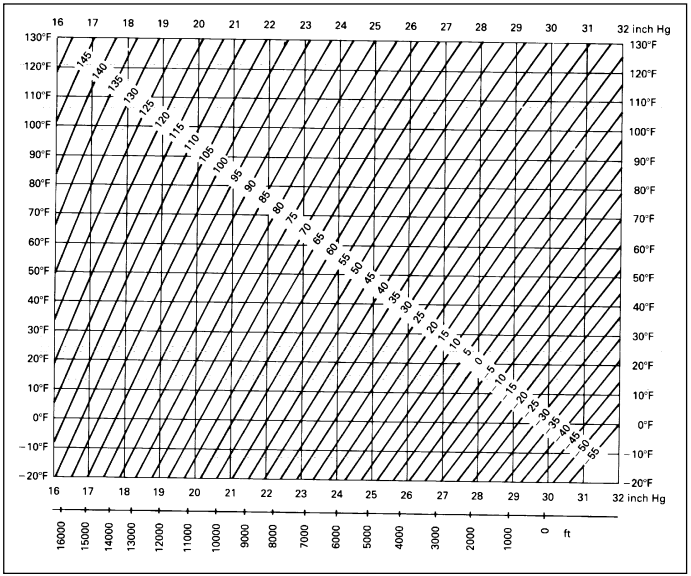
The air humidity influences the distance measurement if the climate is extremely hot and damp.

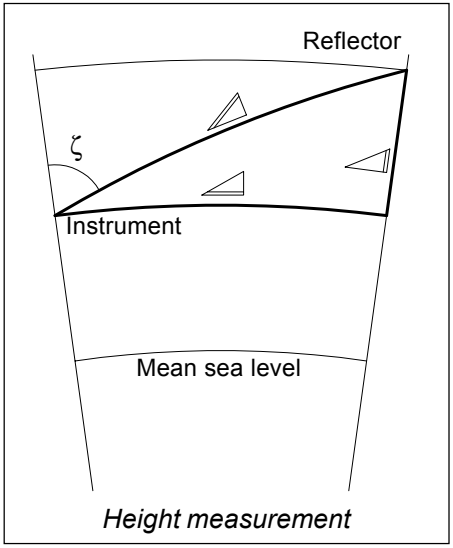
For high-precision measurements, the relative humidity must be measured and entered along with the air pressure and the temperature.

Atmospheric correction in ppm with °C, mb, H (metres) at 60% relative humidity



Atmospheric correction in ppm with °F, inch Hg, H (feet) at 60% relative humidity





Height measurement

The instrument calculates slope distance, horizontal distance and height difference in accordance with the following formula. Earth curvature and mean refraction coefficient (k = 0.13) are taken into account automatically. The calculated horizontal distance relates to the station height, not to the reflector height.

$$\text{slope} = D_0 \cdot (1 + ppm \cdot 10^{-6}) + mm$$

slope = displayed slope distance [m]
D0 = uncorrected distance [m]
ppm = scale correction [mm/km]
mm = prism constant [mm]

$$\text{slope} = Y - A \cdot X \cdot Y$$

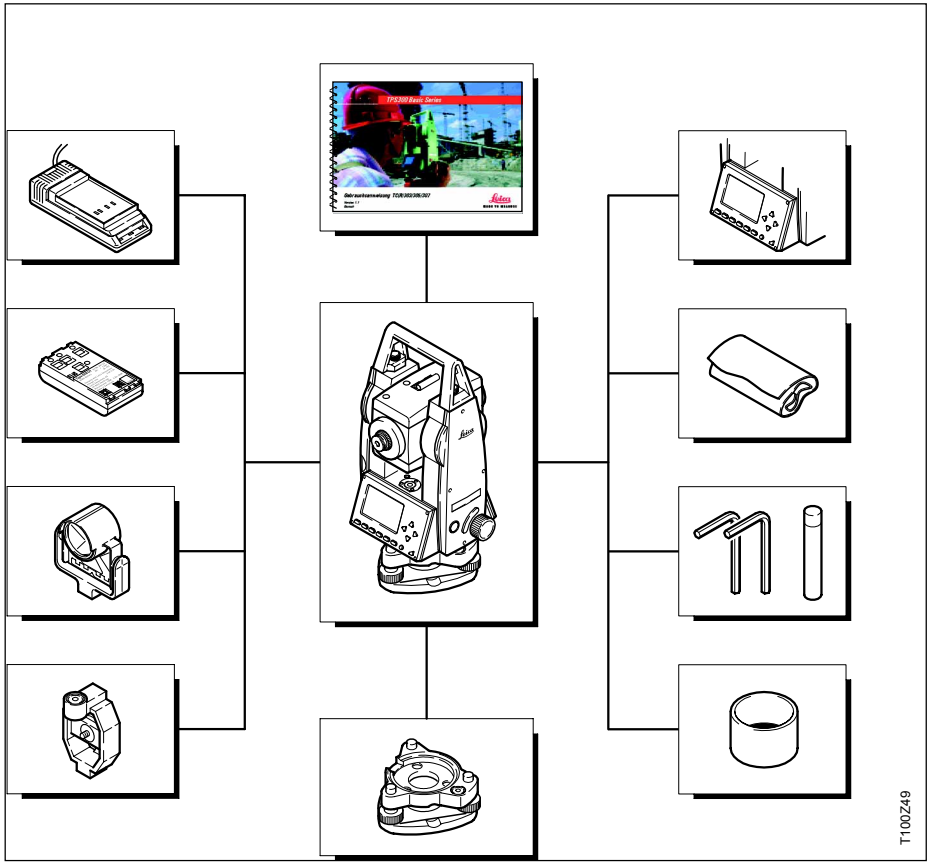
$$\text{slope} = X + B \cdot Y_2$$

slope = horizontal distance [m]
slope = height difference [m]
$Y = \text{slope} \cdot |\sin \zeta|$
$X = \text{slope} \cdot \cos \zeta$
ζ = vertical-circle reading

$$A = \frac{1 - k/2}{R} = 1.47 \cdot 10^{-7}\ [m^{-1}]$$

$$B = \frac{1 - k}{2R} = 6.83 \cdot 10^{-8}\ [m^{-1}]$$

k = 0.13
$R = 6.37 \cdot 10^6$ m



Battery charger (EU, US, UK, AU, JP)
6 Volt, 1800 mAh
-20°C-50°C

Battery GEB111
6 Volt, 1800 mAh
-20°C-50°C
Art.No. 667318

Leica Standard prism

Leica Miniprism

Removable tribrach GDF111
Art.No. 667305

Lens hood for objective

Tool Set

Protective cover

Additional keypad
Optionally an additional keypad is available for the TC(R)305/307.

User Manual

Leica Geosystems AG, Heerbrugg, Switzerland, has been certified as being equipped with a quality system which meets the International Standards of Quality Management and Quality Systems (ISO standard 9001) and Environmental Management Systems (ISO standard 14001).

Total Quality Management-
Our commitment to total customer satisfaction

Ask your local Leica agent for more information about our TQM program

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