Trimble 3300

Topo Software User Guide

Part no.: 571 703 051

Contents

5 Applications

6 Data Management

1 Introduction

Dear Customer

By purchasing an Trimble 3300 Routine Total Station from Trimble you have opted for a leading-edge product in the field of surveying instruments. We congratulate you on your choice and would like to thank you for the trust placed in our company.

For quite some time, surveying has no longer been limited to the measurement of bearings and distances. Complex measurement systems have been in demand that do not only satisfy ever increasing needs for automatization, but also those involving digital data processing as well as the effectiveness of daily measuring practice. New standards have thus been set regarding technology and operating convenience.

The Trimble 3300 Routine Total Station is part of a complete range of surveying instruments from Trimble. Data interchange between all the instruments is ensured by a common data format.

The operating convenience offered by the Trimble 3300 hardware is very high within this group of total stations. The clear graphic display and only 7 keys give the user a wide variety of information for the processing in the field and provide him with valuable aids for achieving high productivity in solving his surveying tasks.

The software version “Topo[1]” meets high standards with the special programs for this application.

[1] topography

☝ **Attention !**

Please read the safety notes in chapter 2 carefully before starting up the instrument.

The instrument was manufactured by tested methods and using environmentally compatible quality materials.

The mechanical, optical and electronic functions of the instrument were carefully checked prior to delivery. Should any defects attributable to faulty material or workmanship occur within the warranty period, they will be repaired as a warranty service.

This warranty does not cover defects caused by operator errors, inexpert handling or inappropriate application.

Any further liabilities, for example for indirect damages, cannot be accepted.

User manual:	**Edition**
Cat. No.:	571 703 051
Date:	**February 2001**
Software release:	**> V 5.50**

Subject to alterations by the manufacturer for the purposes of further technical development.

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Telefax: +49-6142-2100-220

E-mail:

Support@spectraprecision.de

Homepage:

http://www.trimble.com

☞ **Tip**

The type label and serial number are provided on the left-hand side and under-side of the instrument, respectively. Please note these data and the following information in your user manual. Always indicate this reference in any inquiries addressed to our dealer, agency or service department:

Instrument:

- ☐ Trimble 3303
- ☐ Trimble 3305
- ☐ Trimble 3306

Serial number: Software version:

Serial number	Software version
A	

We would like to wish you every success in completing your work with your Trimble 3300. If you need any help, we will be glad to be of assistance.

Yours

ZSP Geodetic Systems GmbH
Carl-Zeiss-Promenade 10
D-07745 Jena

Phone: (03641) 64-3200
Telefax: (03641) 64-3229
E-Mail: surveying@zspjena.de
http://www.trimble.com

2 Trimble 3300 - The Routine Total Stations

This chapter gives you an overview of the operation and controls of the instrument as well as the programs which are a special feature of the Trimble 3300 Routine Total Stations.

Hardware Overview

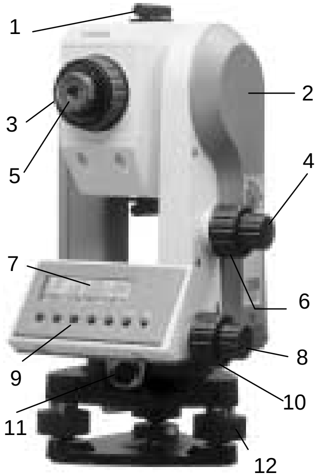


Fig. 1-1: Trimble 3303,
Control side

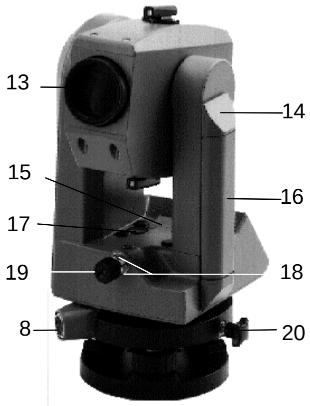
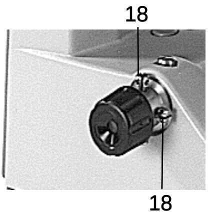


Fig. 1-2: Trimble 3300,
Objective side

1	Sighting collimator
2	Mark for trunnion axis height
3	Telescope focusing control
4	Vertical tangent screw
5	Eyepiece
6	Vertical clamp
7	Display (graphic capabilities 128 x 32 pixels)
8	Horizontal tangent screw
9	Keyboard
10	Horizontal clamp
11	Interface
12	Tribrach screw
13	Telescope objective with integrated sun shield
14	Battery cassette lock
15	Vertical axis level
16	Battery
17	Circular level
18	Adjustment screws for optical plummet
19	Optical plummet
20	Tribrach clamping screw

Fig. 1-3: Trimble 3300,
Optical plummet



The Routine Total Stations Trimble 3303 / 3305 and Trimble 3306

The electronic Routine Total Stations as instruments of mean accuracy are not only appropriate for land-measuring by geodesists, but also users on building sites appreciate their uncomplicated handling as well as rapidity, reliability and clearness in measuring.
Measurements are made easy thanks to menu guidance supported by graphics, instrument software with flexible point identification and universal data record formats.

The principal features:

Distance measurement	by phase comparison method
Measuring range	Trimble 3303 up to 1500 m with 1 prism, Trimble 3305 / 3306 up to 1300 m with 1 prism
Angle measurement	Hz and V electronically all common units and angle reference systems
Error compensation	Automatic compensation of sighting axis and index errors
The advantages in operating	Display screen with graphic capabilities (128 x 32 pixels), user-friendly surface, easy familiarisation, simple handling, reliable control of all measuring and computing processes with clear references, integrated, practical application programs, ergonomic arrangement of controls, light, compact construction
Quick charging, longer times of measuring	Eco-friendly power supply for about 1000 angle and distance measurements, charging time 1 hour
Data management	RS 232 C (V 24) interface as data input and output
	In the internal data memory of Trimble 3303 and Trimble 3305, 1900 data lines can be saved.

This program is available on the delivered instrument.

Overview about software version „Topo“

(version > 5.00)

Coordinate programs

- Unknown Station (5 Backsight point - **new**)
- Known Station
- Heightstationing
- Polar Points (with eccentricity – **new**)
- Setting Out

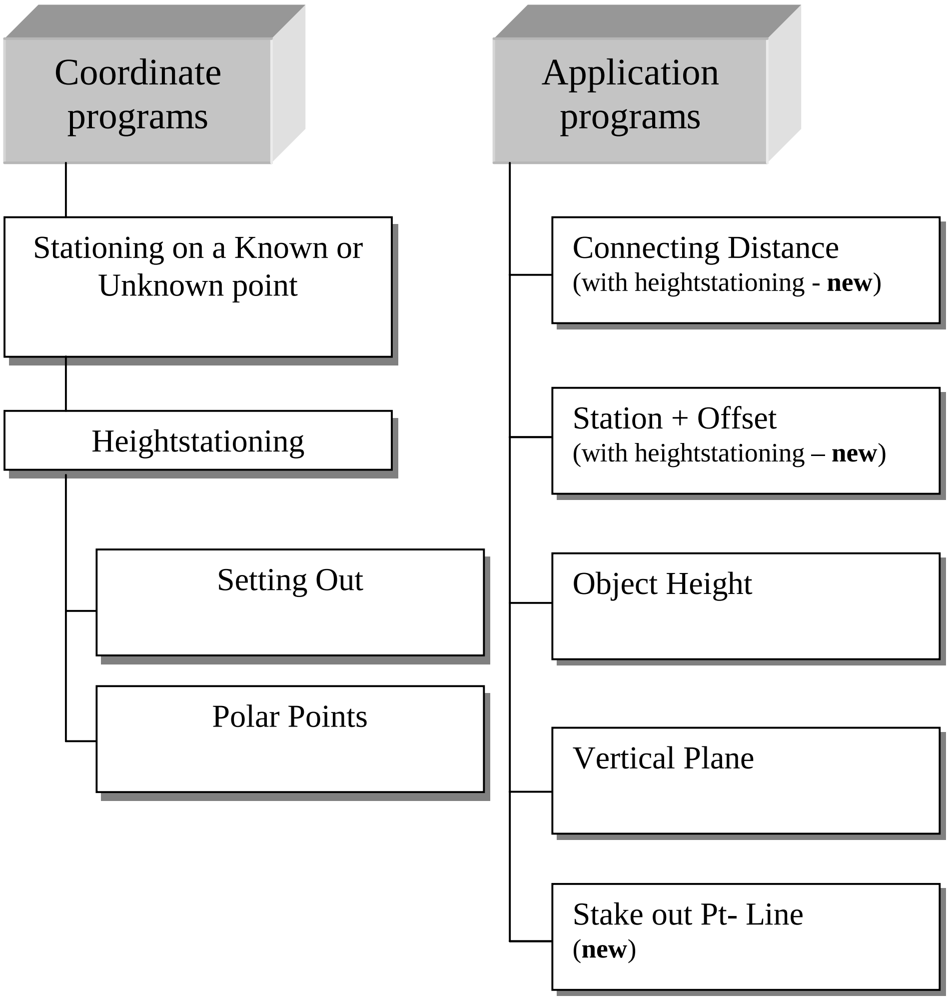
Application programs

- Connecting Distances (with heightstationing **– new**)
- Statio + Offset (with heightstationing – **new**)
- Object Height
- Vertical Plane
- Area Calculation (**new**)

This program version can be selected.

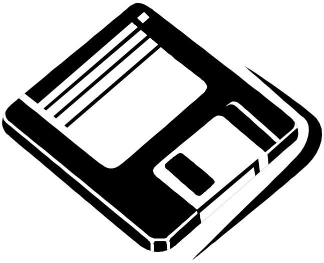
Overwiev about software version „Construction“

(version > 4.00)



Overview about software "Topo"

Menu (ON + MENU)



- Input
  1. Addco (addition constant)
  2. Scale
  3. Temp (temperature)
  4. Pressure
- Applications
  1. Connecting distance
  2. Object height
  3. Station + Offset
  4. Vertical plane
  5. Area Calculation
- Coordinates
  1. Unknown Station
  2. Known Station
  3. Stationing in elevation
  4. Polar points Determination
  5. Setting out
- Instrument setting
  1. Angles (resolution)
  2. Distances (resolution)
  3. V reference
  4. Coo system
  5. Coo display
  6. Temperature
  7. Pressure
  8. Switch off
  9. Acoustic signal
  10. Contrast
  11. EDM T-Out
  12. Angles (Units)
  13. Distances (Units)

Overview about software “Topo”

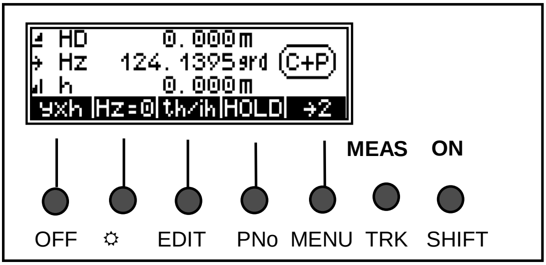
- Interface
  - 0 Record.
  - 1 Format
  - 2 Parity
  - 3 Baud rate
  - 4 Protocol
  - 5 Position C
  - 6 Position P
  - 7 Position I
  - 8 T-O Rec.
  - 9 PC-Demo
- Datentransfer
  - 1 MEM -> Peripherie
  - 2 Peripherie -> MEM
- Update

The Keyboard

Two types of keys:

- Hardkeys
  - direct function ON and MEAS
  - Key in connection with ON (SHIFT)
- Softkey
  function depending on program, significance explained in display line at the bottom

For operating the Trimble 3300, only 7 keys are needed.



Functions (Hardkeys)

ON	Switching the instrument on and changing over to hardkey function
MEAS	Starting a measurement
ON OFF	Switching the instrument off
ON ✳	Illumination ON/OFF
ON EDIT	Calling up the memory
ON PNo	Calling up the input of point number and code
ON MENU	Going to the main menu
ON TRK	Starting the tracking function

Softkeys

Overview softkeys Annex

Function keys defined by the display in dependence on the program.

The Basic Concept of the Menu

The total station is able to realise a great variety of functions.

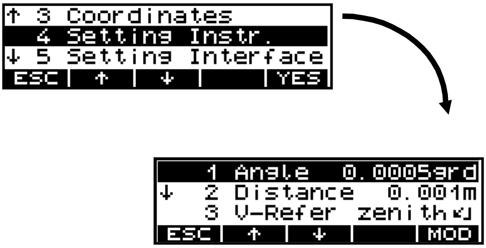
Functions needed directly during the measuring process are accessible through the key functions.

ON MENU

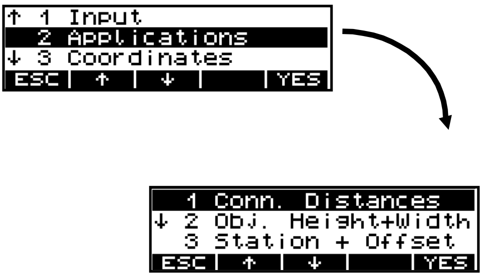
The menu facilitates the access to many other functions.

Having selected the menu, you can go to submenus and you are offered available functions, respectively:

e.g. settings



e.g. measurement programs



Use of this Manual

The manual is divided into 8 main chapters.

The subchapters have not been numbered. Clarity and convenience are provided by a maximum of 3 structural levels, for example:

Chapter

4 Coordinates

Section

2 Coordinates Unknown Station

<u>Subsection</u>

<u>Recording</u>

The pages are divided into two columns:

Principal text including

- Description of measuring processes and methods
  - instrument operation and keys
  -Trimble 3300 display / graphics
  - drawings and large graphics
  - tips, warnings and technical information

☞ **Tip**

for hints, special aspects and tricks

☝ **Attention !**

for risks or potential problems

Technical Information

for technical background information

Functional text for

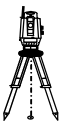
calling up programs:

4 Coordinates

3 Stationing in elevation

Mode Softkeys and their functions

Cross references to other chapters



Small graphics

Measuring tasks are defined as follows:

given: : given values
meas.: : measured values
requ.: : required/computed values

You will find a list of terms in the annex (Geodetic Glossary).

Risks in Use

Instruments and original accessories from Carl Zeiss have to be used only for the intended purpose. Read the manual carefully before the first use and keep it with the instrument so that it will be ready to hand at any time. Be sure to comply with the safety notes.

☝ Attention !

- Don´t make any changes or repairs on the instrument and accessories. This is allowed only to the manufacturer or to specialist staff authorised by the same.
- Only the service team or authorised specialist staff are allowed to open the instrument and accessories.
- Do not point the telescope directly at the sun.
- Do not use the instrument and accessories in rooms with danger of explosion.
- Use the instrument only within the operative ranges and conditions defined in the chapter of technical data.
- Do not operate the battery charger in humid or wet conditions (risk of electrical shock). Make sure the voltage setting is identical on the battery charger and voltage source. Do not use instruments while they are wet.

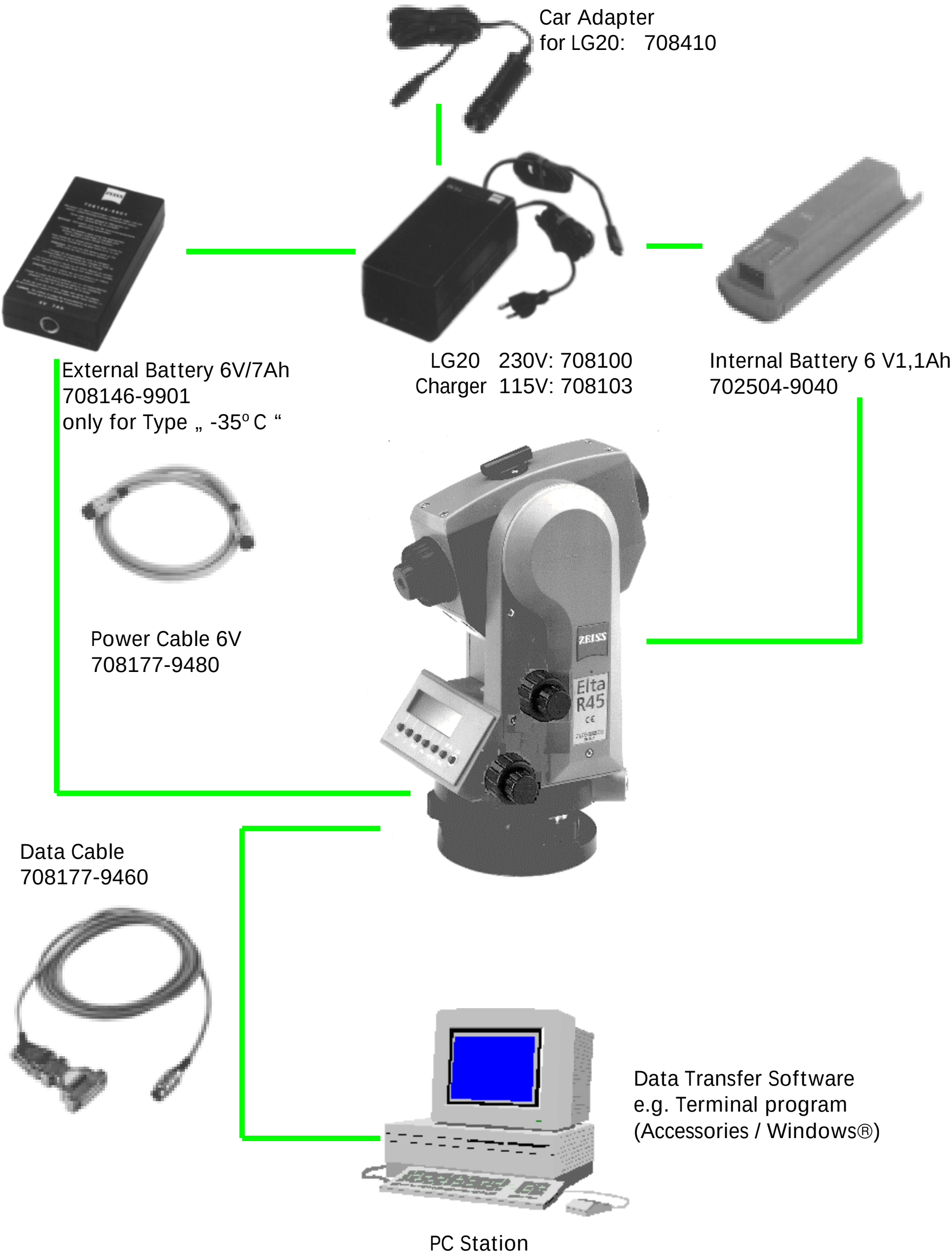
☝ Attention !

- Take the necessary precautions at your measuring site in the field, note the relevant traffic rules.
- Check that the instrument has been correctly set up and the accessories are properly secured.
- Limit the time of working when it is raining, cover the instrument with the protective hood during breaks.
- After taking the instrument out of the case, fix it immediately to the tripod with the retaining screw. Do never leave it unfastened on the tripod plate. After loosening the retaining screw again, put the instrument immediately back into the case.
- Prior to starting operation, allow sufficient time for the instrument to adjust to the ambient temperature.
- Tread the tripod legs sufficiently down in the ground in order to keep the instrument in stable position and to avoid its turning over in case of wind pressure.
- Check your instrument at regular intervals in order to avoid faulty measurements, especially after it has been subjected to shock or heavy punishment.
- Remove the battery in case of being discharged or for a longer stop period of the instrument. Recharge the batteries with the LG 20.
- Properly dispose of the batteries and equipment taking into account the applicable national regulations.

Attention

☝ Attention !

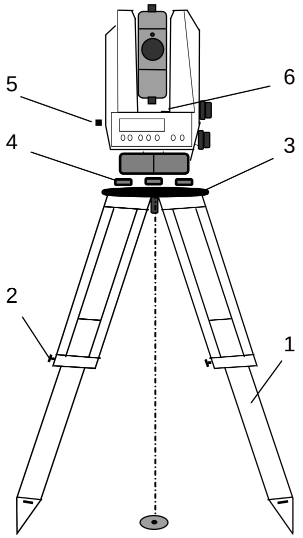
- The mains cable and plugs of accessories have to be in perfect condition.
- When working with the tachymeter rod near to electrical installations (for example electric railways, aerial lines, transmitting stations and others), there is acute danger to life, independent of the rod material. Inform in these cases the relevant and authorised security offices and follow their instructions. Keep sufficient distance to the electrical installations.
- Avoid surveying during thunderstorms because of lightning danger.


Car Adapter
for LG20: 708410
External Battery 6V/7Ah
708146-9901
only for Type „ -35° C “
LG20 230V: 708100
Charger 115V: 708103
Internal Battery 6 V1,1Ah
702504-9040
Power Cable 6V
708177-9480
Elta
R45
Data Cable
708177-9460
Data Transfer Software
e.g. Terminal program
(Accessories / Windows®)
PC Station

3 First Steps

The first steps cover up the set-up of the instrument, including the explanation of basic inputs and the necessary presettings.
After having set the parameters for saving and entered the point information, you can measure in the start-up menu.

Set-Up and Coarse Centring



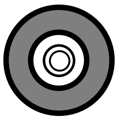
In order to guarantee the stability of measurement we recommend the use of a havy Tripod.

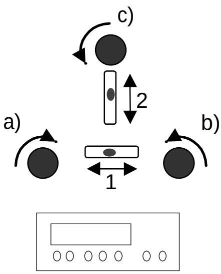
Set-up:
Extend the tripod legs (1) to a comfortable height of observation and fix them using the tripod locking screws (2). Screw the instrument centrally to the tripod head plate (3). The tribrach screws (4) should be in mid-position.

Coarse Centring:
Set up the tripod roughly above the station point (ground mark), the tripod head plate (3) should be approximately horizontal.

Centre the circular mark of the optical plummet (5) above the ground mark using the tribrach screws.
To focus the circle: Turn the eyepiece.
To focus the ground mark: Draw out or push in the eyepiece of the optical plummet.

Levelling and Fine Centring





Coarse Levelling:
Level the circular bubble (6) by adjusting the length of the tripod legs (1).

Precision Levelling:
Align the control unit parallel with the imaginary connecting line between two tribrach screws. Level the instrument by turning the tribrach screws a) and b) in opposite directions. Turn the instrument by 100 grad in Hz and level instrument with tribrach screw c).For checking, turn the instrument round the vertical axis.

After that, check the residual inclination by turning the instrument in both diametral positions of (1) and (2). Take the mean of deviation from center point of level and adjust, if necessary.

Precision Centring:
Shift the tribrach on the tripod head plate until the image of the ground mark is in the centre of the circular mark of the optical plummet; repeat the levelling various times if necessary.

Telescope Focusing

Focusing the Crosslines:
Sight a bright, evenly coloured surface and turn the telescope eyepiece until the line pattern is sharply defined.

> ☝ **Attention !**
>
> Sighting of the sun or strong light sources must by all means be avoided. This may cause irreparable damage to your eyes.

Focusing the target point:
Turn the telescope focusing control until the target point is sharply defined.

> ☞ **Tip**
>
> Check the telescope parallax: If you move your head slightly whilst looking through the eyepiece, there must be no relative movement between the crosslines and the target; otherwise, refocus the crosslines as above.

Switching the Instrument on

ON Press key

Additionally to the company logo, the number of the software version (important for future updates) and the values last set for:
- addition constant
- scale
- temperature
- air pressure

are displayed briefly.

☞ **Tip**

The compensator is automatically activated when the instrument is switched on.

If levelling of the instrument is insufficient, the digits after the decimal point in the displayed angle readings are replaced by dashes.

Switching the instrument off by pressing the keys

ON + OFF

simultaneously.

Principles of Display

The information
- point ***c***ode,
- ***p***oint number and
- measured / computed values

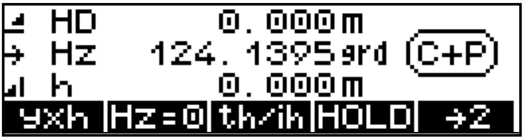
is displayed on two pages.

Toggling between the pages:

➔1	to page 1
➔2	to page 2

Display page 2:

Display page 1:



☞ **Tip**

The fields at the bottom of the display are related to the functions of the keys situated below the display.

They indicate the next possible settings - do not mix it up with the current setting.

Principles of Input

Additionally to the setting of predefinitions - as described further down in this chapter - you will have to enter data continually during the measuring process.

These entries are

- the constantly changing instrument, station and reflector heights and
- coordinates of stations or other known backsight points.

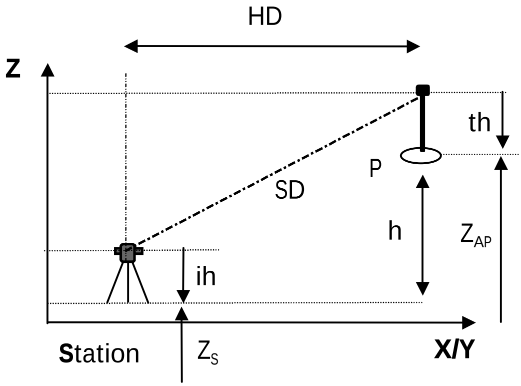
📖 Editor
Data Management

The manual input of coordinates is described in **Chapter *6 Data Management***.

📖 Data Transfer
Data Management

If available, it is useful to transfer the values directly from a PC instead of entering them manually.

Input of Reflector, Trunnion Axis and Station Heights

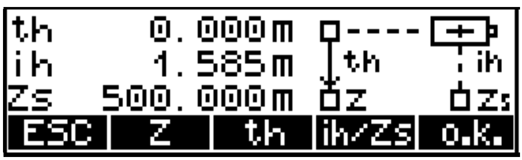


The input of the values of reflector height (th), instrument height (ih) and station height (Zs) (height-stationing) allows you to measure with absolute heights already in the initial menu. If these values have not been entered, only relative height differences will appear in the display (memory). If Zs=0 the height difference “h” is displayed and recorded, otherwise the height “Z”.

on display page 1 only:

th/ih in measuring modes **HD** and **yxh** only

Presettings
First Steps



ESC to quit

Z heightstationing

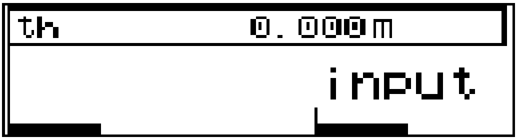
th to enter the reflector height

ih/Zs to enter the instrument and station height

o.k. to confirm

Heightstationing: Input of th and ih/Zs

Input of the reflector height:



th 0.000 m
to confirm the old reflector height (in this case 0)

to enter a value

Presentation of the current position for input in negative type.

← and

→ to go to the desired position in the display

+

- to browse through digits

o.k. to confirm

Input of the instrument height / station height

Editor **Data Management**

to enter values (compare input of th)

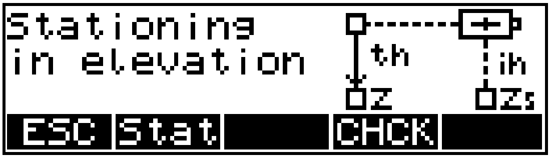
ESC to quit the input routine

Measurement „Stationing in Elevation“

Stat to go to the input menus

CHCK 📖 **Adjusting and checking**

ESC to quit the program



Input one after the other:

Z, ih, th:

└ 📖 Principles **First Steps**

📖 Editor **Data Management**

Measurement to the backsight point

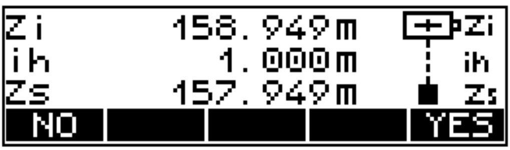
→ sight to the backsight point

ON + *PNo* change of the point number?

MEAS

YES to accept the result, to record data, to left the program

NO to quitt, new start



Result and Recording

Input of Point Number and Code

C+P signalises the possibility to enter point number and code.

ON + PNo

← and

→ to go to the desired digit of point number and code

+ and

- to browse through the existing character set

The entered values will be used in the next measurement.

C 5-digit point code, alphanumeric notation

P 12-digit point number with the special characters #, -, . , .numeric notation

☞ **Tip**

The toggling between point number and code is realised continuously.

For fast browsing, keep the respective key depressed.

After the measurement, the point number is incremented by one unit, the code remains invariable until being modified by the user.

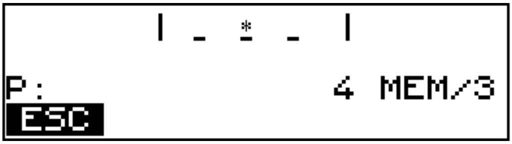
In the application and coordinate programs, the code is provided with non-varying characters (A,B,..). In this case, it is not possible to enter the code.

Principles of Distance Measurements

Single measurement

MEAS

The intensity of the receiving signal can be assessed with the bar graph. The more to the right the stars are presented, the better is the returning signal.



The distance measurement can be cancelled with the softkey ESC.

Presettings
First Steps

The slope distances and derived values are corrected with regard to the influences of earth curvature / refraction. Additionally, a correction of atmospheric influences (temperature and pressure) is applied.

The correction is zero with T = 20°C and P = 944 hPa.

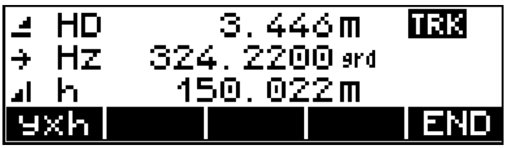
Distance tracking (continuous measurement of the distance)

ON *TRK*

END to finish the measurement

yxh to change the measurement mode

The measuring mode can also be changed during the tracking measurement. For recording data during the tracking measurement use key MEAS.



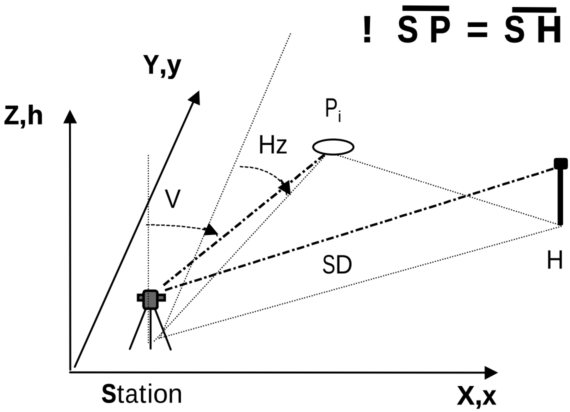
Measurements to inaccessible Points

☞ **Tip**

Please use this function in the start-up menu only.

In the program "Polar Points" it is possible to measure with "Eccentric Measurement".

The prism used for the distance measurement cannot be stationed on the desired point P.



Sight towards the point P and trigger the measurement. Then, sight the prism stationed on the auxiliary point H.
Pay attention to the condition of equidistance S-P = S-H.

If data recording is activated, only a data line indicating the angle to P and the distance to H is saved.
Naturally, the angle and distance to H are displayed after the measurement, being the angle value continuously updated in the Trimble 3300 display.

Introduction

The required presettings are to be subdivided into three groups:

Settings in the Start-up Menu

- Specify measuring units for angle and distance Short-time setting of V angle in percent
- Activating and deactivating the compensator
- Orientation of Hz circle

Frequently used Settings

- Input of pressure and temperature
- Input of scale and addition constant

Rarely used Set Instructions

- Display mode for angle and distance
- Vertical reference system
- System of coordinates
- Display of coordinates
- Measuring units of temperature, pressure
- Switching the instrument automatically off
- Switching the acoustic signal on and off
- Regulation of display contrast and brightness of crossline illumination
- Switching the distance measurement off automatically if sighting line interruption

Settings in the Set-Up Menu

Setting the measuring units of distance

The settings of units for angle and distances are in menu instrument settings. Distances settings can be made in the measurement menu.

Display page 2

F1 F2 F3 F4 F5

to set with

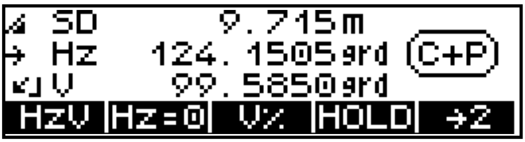
F1 the distance

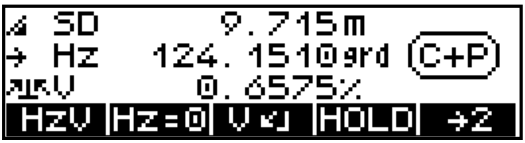
m meters

ft feet

> **Attention !**
>
> If the mode is changed after the measurement, the values will be converted and displayed in the new mode, but saved in this form only after the next measurement.

Display page 1





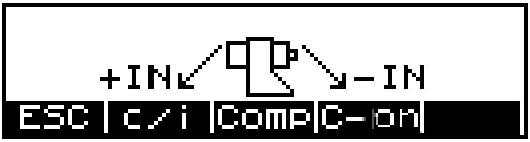
V%

V to toggle quickly between angle in percent / defined measuring unit

Activating and deactivating the compensator

Display page 2:

CHCK to go to the menu



c/i and

Comp 📖 **Adjusting and checking**

C-on to deactivate the compensator function

C-off to activate the compensator function

If recording is activated, an information line will be saved indicating compensator function on or off.

☝ **Attention !**

If the compensator is out of its working range and the function is activated, the digits after the decimal point in the angle readings are replaced by dashes. In this case, the instrument is not sufficiently levelled and a remote release from a PC is not admitted.

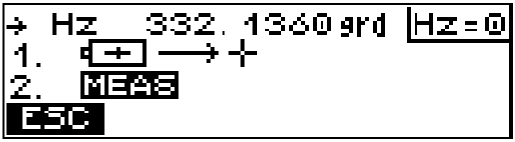
Orientation of Hz circle

Aim: Hz = 0

Hz=0

Sight target

MEAS



Aim: Hz = xxx,xxx

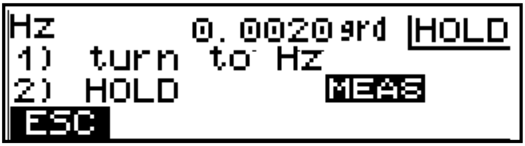
HOLD

Turn the instrument to the desired Hz circle value

MEAS

Sight target

MEAS



Aim: Change counting direction

→Hz	Measurement clockwise
←Hz	Measurement anticlockwise

Display page 2

☝ **Attention !**

The set counting direction is only valid in the start-up menu.

After the connection and in all programs, the Hz counting direction is always set clockwise.

Frequently used Settings

Alteration of pressure, temperature, scale and addition constant

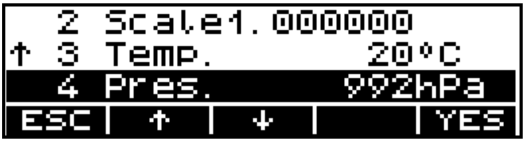
ON MENU

1 Input

↑ and

↓ to go to the desired menu point

o.k. to confirm



+ and

- to alter the addition constant (scale, temperature and pressure) step by step

o.k. to confirm

☞ **Tip**

For the first starting, only temperature and pressure are entered.
If a prism with another prism constant than -35 mm should be used permanently, also this setting should be realised immediately.
(For calculating the constant see annex.)

📖 Formulae and constants
Annex

Range of values

-30 °C	< Temp.	< 70 °C	with Δ 1 °C
-0,127mm	< Addco	< 0,127mm	with Δ 1 mm
0,995000	< Scale	< 1,005000	with Δ 1 ppm
440hPa	< Press.	< 1460 hPa	with Δ 4 hPa

Rarely used Set Instructions

ON MENU

4 Setting the instrument

YES to go to

↑ and

↓ to select the menu point

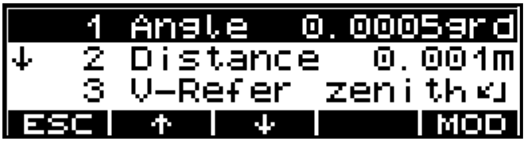
MOD to change setting

ESC to quit menus

↑ and

↓ to quit setting / confirm change

Angle and distance display



Possibilities:

Angle

grad	0,005-0,001-0,0005 (Trimble 3305 / 3306)
grad	0,005-0,001-0,0002 (Trimble 3303)
DMS	10“ - 5“ - 1“
deg	$0{,}005^0$ - $0{,}001^0$ - $0{,}0005^0$
mil	

Distance

m	0,01-0,005-0,001
ft	0,02-0,01-0,001

☝ **Attention !**

The defined presentations of angle and distance are related to the display.
Saving is realised with the highest possible precision.

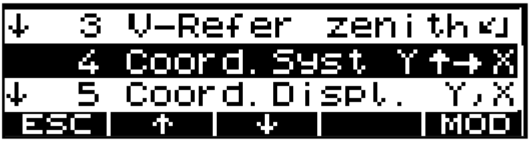
MOD to change setting

ESC to quit menus

↑ and

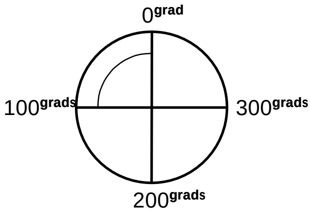
↓ to quit setting / confirm change

Vertical reference system

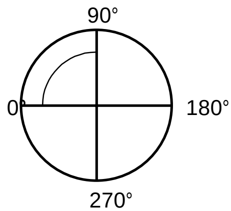


V reference systems:

Zenith angle



Vertical angle

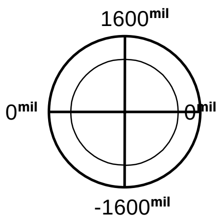


Examples

1: Zenith angle
unit 400 grads

2: Vertical angle
unit 360°

Height angle



Examples

3: Height angle
unit 6400 mil

☞ **Tip**

The setting of the measuring unit % is done in the set-up menu!

System of coordinates / display of coordinates

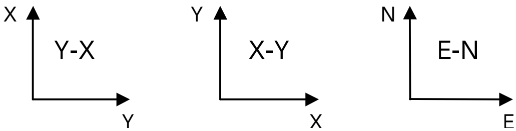
MOD to change setting

ESC to quit menus

↑ and

↓ to quit setting / confirm change

Assignment of coordinates:

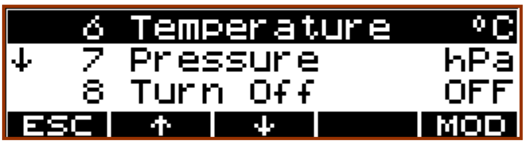


Indication sequence: Y-X / X-Y E-N / N-E

☝ Attention !

When the assignment of coordinates is changed, the question for further use of the internal station coordinates appears in the display, calling the user's attention to a possible source of errors.

Measuring units for pressure / temperature



MOD to change setting

ESC to quit menus

↑ and

↓ to quit setting / confirm change

Possibilities:

Temperature	°C	degrees centigrade
	°F	degrees Fahrenheit
Pressure	hPa	hectopascal (or millibar)
	Torr	
	inHg	

Switching the instrument off / acoustic signal

MOD to change setting

ESC to quit menus

↑ and

↓ to quit setting / confirm change

Possibilities:

Switching off	10 min - 30 min - OFF
Acoustic signal	ON- OFF

☞ **Tip**

Before the instrument will be switched off automatically, a warning appears indicating that the instrument will be switched off within one minute. This process can be interrupted by pressing any key.

Displaycontrast /Reticle illumination

MOD to change settings

ESC to quit the menu

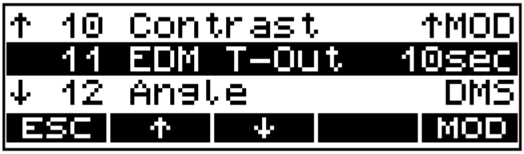
↑ and

↓ to quit settings / to confirm alterations

☞ **Tip**

The adjustment of the contrast is only possible with the display illumination switched off. The adjustment of the Reticle illumination is only possible with the display illumination switched on.

Time out of Distance meter during interrupted EDM



MOD to change settings

ESC to quit the menu

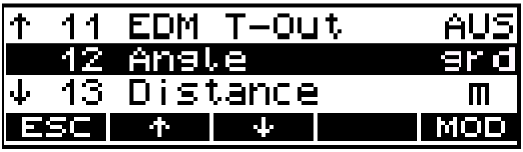
↑ and

↓ to quit settings / to confirm alterations

☞ **Tip**

This setting controls the time out of the distance meter during the EDM interruption.

Settings of units for angles and distances



MOD to change settings

ESC to quit the menu

↑ and

↓ to quit settings / to confirm alterations

Possibilities:

Angles	Grad	400.0000
	DMS	360° 00‘ 00“
	deg	360.0000°
	mil	6400mils
Distances	m	Meters
	ft	Feet

☞ Tip

It is possible to change the units between meters or feet in the start up menu.

Saving the Measured Values

ON + MENU

5 Setting Interface

YES to go to the menu

MOD to toggle between MEM/1, MEM/2, MEM/3
V24/1, V24/2, V24/3
OFF

ESC to return to the higher-order menu

```
↑ 4 Setting Instr.
  5 Setting Interface
↓ 6 Data transfer
ESC | ↑ | ↓ |  | YES
```

```
  0 Recording    MEM/3
↑ 1 Format     REC 500
  2 Parity         odd
ESC | ↑ | ↓ |  | MOD
```

MEM/x - internal saving
(only Trimble 3303 and Trimble 3305)

V24/x - external saving through RS232 interface

Off - no saving

1 - saving of measured values

2 - saving of computed values

3 - 1 and 2

Attention !

These settings are valid in the programs „Coordinates“ and „Applications“.

All values in the Start-up menu are interpreted as measured values (1).

Record data lines
Data Management

Tip

The detailed depiction concerning the question of which values are saved with which type identifiers and with which recording selection you can find in the chapter Data Management.

Presettings
First Steps

☝ **Attention !**

In connection with the selection of saving, the selection of the measuring mode is decisive for:

Which results are to be displayed?
Which values are to be saved?

Selecting the Measuring Mode (presentation of the results at the display)

F1 to set the following measuring modes

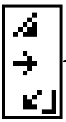
Display page 1:

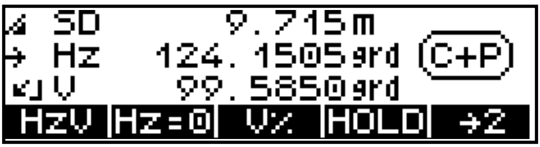
☞ **Tip**

In the display of softkey 1, always the next selectable measuring mode appears.

SD: Display of the real measured values

Status display:





F1 F2 F3 F4 F5

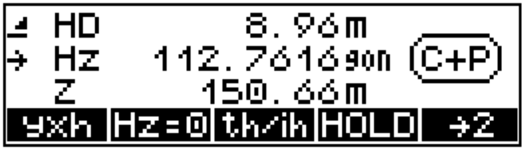
HzV: Display in the theodolite mode

Only for alignments and for setting out right angles, not for distance measurements

HD: Display of the reduced distance and the height difference

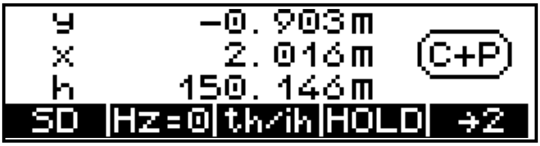
Display of the calculated values
with Z=0

with Z≠0

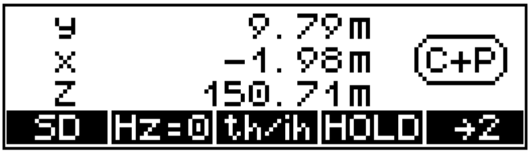


yxh: Display of the local rectangular coordinates

Measurement in the local system with station y=x=0
with Z=0



with Z≠0



☞ **Tip**

The measuring modes can be changed at any time and the results will be displayed immediately in the selected measuring mode, but not, though, another recording. All following measurements are displayed and recorded in the newly selected mode.

In all measuring modes, the angle reading is updated continually.

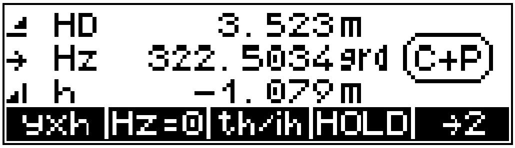
The distance or coordinates are updated only after the next measurement.

Measurement

After entering and defining all parameters required you can carry out the measurement.

MEAS

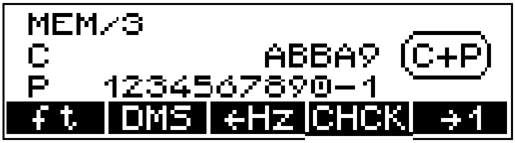
etc. Measurement to further points



ON + PNo

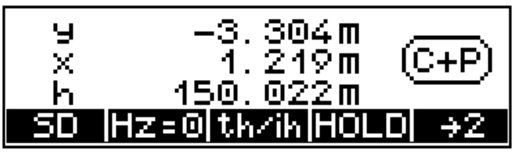
Input point number and code

MEAS



> ☞ Tip
>
> After the measurement, the flush right point number is incremented by one unit within the number of digits displayed up to the special character (no figure) to the left of it. (According to this picture, counting goes only up to 9, then it will begin again with "0".)

Measurements in the modes **HzV** and **SD** are realised without entering and recording local or global heights



Display with absolute heights, with the heights Zs, ih and th entered

4 Coordinates

The basic requirement for a measurement in a system of coordinates is a stationing within this system. That means, that the position and height of the instrument are determined by measuring to known backsight points.
In the case of an unknown station, the scale and the orientation of the Hz circle in azimuth direction are computed additionally to the station coordinates. In the case of a known station, only the scale and the orientation of the Hz circle in azimuth direction are computed.

After the stationing, the actual measurements - that means setting out and polar points - are possible within this system of coordinates.

The guidance through the menu is very easy to understand and based on a unique schema for all programs.

Principle

Coordinates

Unknown station

Each program flow is demonstrated by a graphics.

A and B are backsight points with known coordinates and S is the station the coordinates of which are to be calculated.

CHCK — **Adjusting and Checking**

A — to call point A

> ☞ **Tip**
>
> The function of adjusting and checking is required for measurements to be carried out without/with compensator or for checking the adjustment of the instrument.

Principles
First steps

Editor
Data management

Coordinates are to be entered

B to continue by calling point B

ESC to return to the higher-order menu

A to repeat point A if required

If A has been calculated, measured, defined as station, the symbol for A is filled.

☝ **Attention !**

If errors or confusions should occur whilst measuring to the points, the measurement to single points can be repeated immediately.

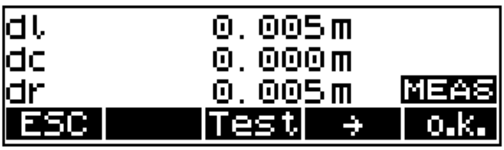
ON + **PNo** to enter point number and code

MEAS to trigger measurement

☞ **Tip**

Prior to each measurement with **MEAS** it is possible to enter a point number and a code for the point to be measured.
In the stationing programs, the codes (A, B, S) have been invariably set. Point numbers can be entered.
The point number is incremented automatically by 1.
The code that has been set is saved with every measurement until being modified by the user.

In the setting-out program, the possibility to measure is indicated additionally by the **MEAS** symbol in the display



Station Point Memory Trimble 3300

In a non-volatile instrument memory, the following data are retained after switching the instrument off and overwritten with every new determination:

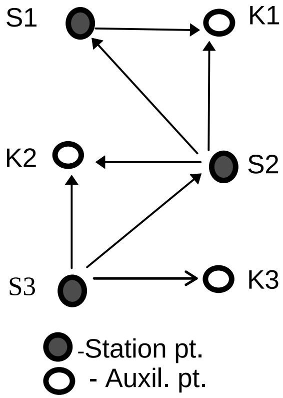
Station coordinates	Y,X,Z
Instrument height	ih
Reflector height	th
Scale	m
Orientation	Om

The coordinates of the station point are calculated or entered by means of the coordination programs.
During the following operations (setting-out / polar points), the user can access this memory at the respective parts of the program and does not have to enter the values again.
After having changed the station, these values have to be calculated or again entered in the course of the program.

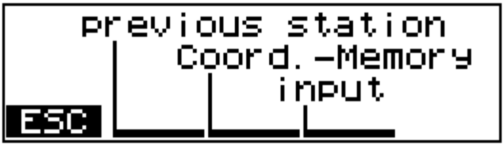
Special Features of Trimble 3306

The Trimble 3306 (the instrument is not fitted out with a data memory) has a memory location for another single point (coor-memory) containing the coordinates of this point (Y;X;Z) in a non-volatile form.
This memory location permits a simple transmission of coordinates (stationing with "unknown station") with the Trimble 3306 and spares the user the trouble to take the coordinates down or to enter them twice.

Trimble 3300
Principle
of transmission of
coordinates
„unknown station"

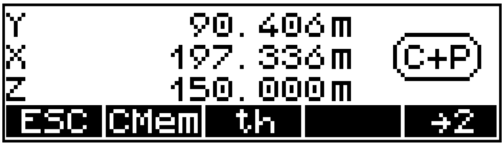


Window of the Trimble 3306 when calling coordinates



Method:

The station coordinates S1 are known or have been calculated by means of a coordinate program. The coordinates of point K1 will be calculated with the program „polar points“ and saved in the „coor-memory“ with CMem.



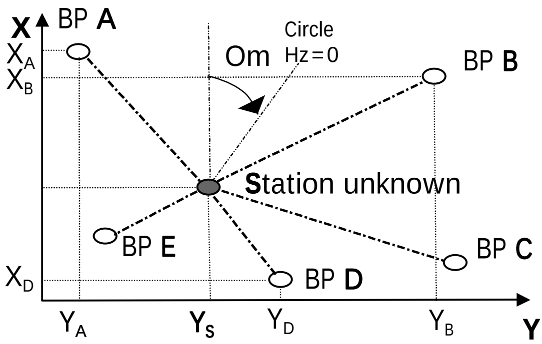
After placing the instrument on S2, the coordinates of the points S1 (last station) and K1 (coor-memory) are called with the stationing program "unknown station" and used for determining the coordinates of S2.

Now, the coordinates of the point K2 can be calculated with the program "polar points" and stored in the "coor-memory". After changing the position of the instrument to S3, the coordinates of this point will be calculated in analogy to station S2.

Coordinates

Unknown Station

If it is <u>not</u> possible to occupy a point with a <u>known position</u> in order to sight the points to be surveyed or set out, a free stationing can be carried out.
If all backsight points have a known height, the Z coordinate can also be determined simultaneously. A maximum of 5 points can be measured!



given: : $(Y,X,Z)_{A....E}$

meas.: : $(SD,Hz,V)_{S-(A-E)}$

requ.: : $(Y,X,Z)_S$, Om , m

By measuring to 2..5 known <u>B</u>acksight <u>P</u>oints (**A**.. **E**), the instrument will calculate the station coordinates X_S,Y_S,Z_S the circle orientation **Om** and the scale **m**.
The description is "with stationing in elevation". The procedure without stationing in elevation is almost identical.

Stationing in Elevation

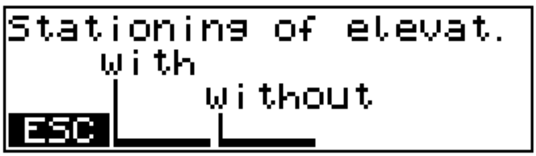
ESC to go to the coordinates menu

with: input of instrument height

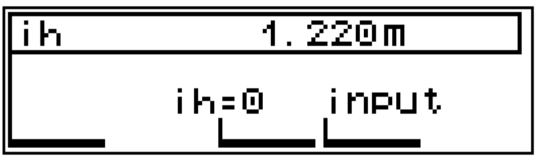
without: no calculation of height

Principles
First steps

Editor
Data management



Input of instrument height



☞ **Note !**

In a free stationing with height determination, all backsight points must have a height coordinate. It is not possible to use individual backsight points separately according to position and height.
The height is calculated by simple averaging.

☞ **Tip !**

If not all backsight points are provided with a height coordinate, the method **without height** is to be applied. Subsequently, the station height can be determined separately by measurement to <u>one</u> point using the stationing in elevation program.

Measurement „Unknown Station“

A to select BP A

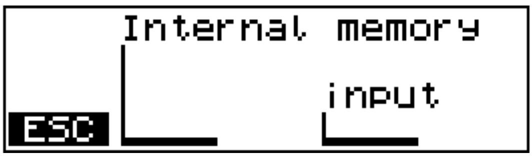
CHCK **Adjusting and checking**

ESC to quit the program

Selecting the coordinates of BP A

Principles
First steps

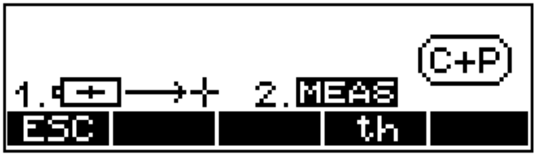
Editor
Data management

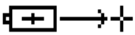


th to enter data for BP A

ON + **PNo** Point number of BP A to be changed?

MEAS to measure to BP A



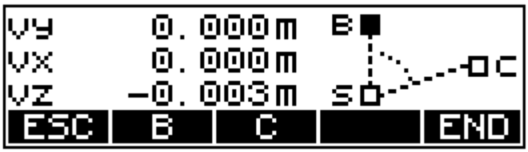
 - Sight reflector

B to select BP B

A Measurement to BP A to be repeated?

The operational steps for BP B....E are now carried out in analogy to BP A.

After at least 2 measurements, approximate coordinates are calculated by software and the deviation to the current measurement is displayed.



ESC to quit the program

B Measurement to BP C to be repeated?

C to measure the next point (E=5.)

END to display the residuals

Explanation:
vy: Residual in Y-direction
vx: Residual in X-direction
vz: Residual in Z-direction

> ☝ **Tip !**
>
> Consequently, residuals can also be used to "stake out" (seek) points, because the measurement of point can be repeated immediately.

More to measure additional point

↑, **↓** to select point

Del to delete point

o.k. to display station coordinates

o.k. to display further parameters

ON + *PNr* to enter the point number of the station

Wdhl to repeat the complete determination

m to edit the scale

o.k. to accept the coordinates, complete the program and go to the coordinates menu; to record

Display of residuals:

```
vy      0.000m
vx      0.000m         A
vz     -0.010m
More  ↑   ↓   Del  o.k.
```

Point to which the residuals belong

After confirming the residuals:

```
Ys     1000.002m
Xs      999.998m
Zs        0.000m
                  o.k.
```

Display of the station coordinates:

```
m       0.996194
Om     399.9960grd  (C+P)
s0        0.000m
Rept       m       o.k.
```

Explanation:

m:	calculated scale
Om:	orientation unknown
s0:	standard deviation of the weighting unit (mean point error)

☞ **Note !**

It is possible to go backwards and re-measure the corresponding points, whereby the intermediary points get lost.
But it is more recommendable to complete the measurement (calling the residuals) after three backsight points, delete and re-measure the corresponding direction. New measurements are added at the end.
Consequently, the assignment of the point codes (A, B, etc.) are shifted.

-	scale
+	to edit
o.k.	to accept scale, to go to the residuals menu

Scale menu

If the scale is outside the permissible range, an error message appears.

☞ **Note !**

After the scale has been confirmed, the station coordinates are re-calculated. Then, the residuals can be evaluated once more.

Recording

Presettings
First steps

If recording is activated, the following lines are saved in dependence on the settings:

Designation of the mode

Point numbers and code

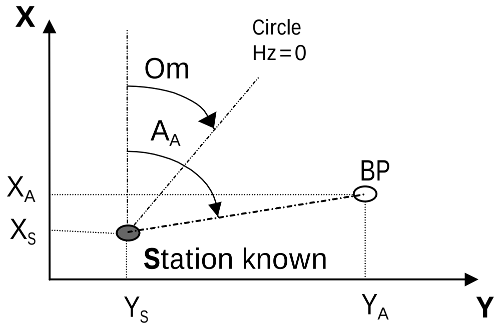
backsight point A, B, C, D, E

Y,X,Z	Coordinates
SD,Hz,V	Readings
vy,vx,vz	backsight point residuals
Y,X,Z	Coordinates of station point S
m,Om	Scale and circle orientation
s0	Standard deviation of the weight unit

Coordinates

Known Station

If it is possible to occupy a point with a known position in order to sight the points to be surveyed or set out, a stationing on a known point can be carried out.



given: : $(Y,X)_{S,A}$

meas.: : $(SD,Hz)_{S-A,}$ or $(Hz,V)_{S-A}$

requ.: : Om , m or Om

By measuring to a known Backsight Point **A**, the instrument will calculate the circle orientation **Om** and the scale **m**.

Measurement „Known Station“

S to call station S

CHCK **Adjusting and checking**

ESC to quit the program

Selecting the coordinates of station S

Principles
First steps

Editor
Data management

After defining S:

There are two ways to calculate the orientation.

Hz see below

XY page 4-11

S to repeat station S

Orientation using a known Azimuth

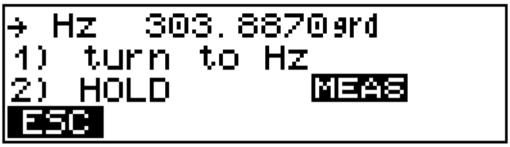
The orientation using a known azimuth will be selected if the bearing angle between the station and the backsight point is known (for example calculated from coordinates) and a distance measurement to the backsight point is impossible.

to set the required direction by turning the instrument

MEAS to clamp the set direction

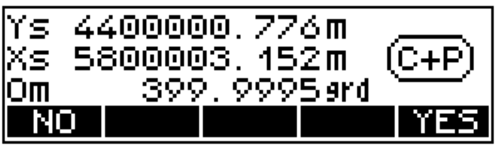
→ to sight the known point

MEAS allocation is completed



YES to confirm, record, quit the program

NO to reject, new start



Display of results and recording

Orientation using known Coordinates

This orientation method will be used if the coordinates of the backsight point are known.

Selecting the coordinates of BP A

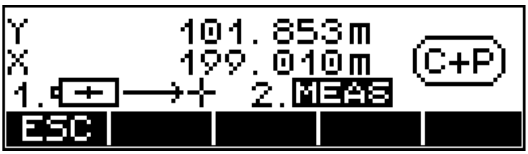
Principles
First steps

Editor
Data management

<u>SD/Hz/V</u>
Distance and bearing measurement
<u>Hz/V</u>
Bearing measurement

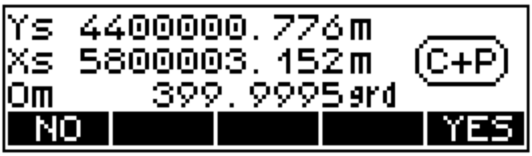
ON + PNo
Point number of BP A to be changed?

MEAS to BP A



YES to confirm the orientation, continuation

NO to reject the orientation, new start



new to accept the new scale

old to transfer the orientation accepting an old scale

Inpt to transfer the orientation entering any scale

Rept to repeat the calculation

Display of results and recording

Recording

Presettings
First steps

If recording is activated, the following lines are saved in dependence on the settings:

Designation of the mode

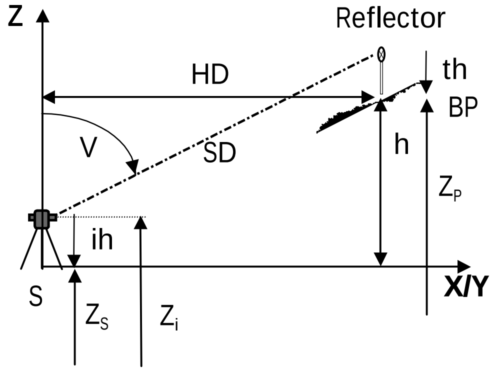
Point numbers and code

Y,X	Coordinates of station point
Y,X	Coordinates of backsight point A
SD,Hz,V	Readings for backsight point A according to selection
m,Om	Scale and circle orientation according to selection

Coordinates

Stationing in elevation

Stationing in elevation permits the determination of the height above **M**ean **S**ea **L**evel independently of planimetric stationing. In programs involving local coordinates, in particular, the absolute height can be included in the measurement.



given.: : Z_P

meas.: : $(SD,V)_{S\text{--}P,}$ ih, th

requ.: : Z_s

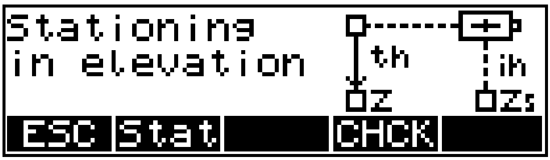
The station height is determined by measurement to a Backsight Point with a known height.

Measurement „Stationing in Elevation“

Stat to go to the input menus

CHCK **Adjusting and checking**

ESC to quit the program



Enter one after another:

Z, ih, th:

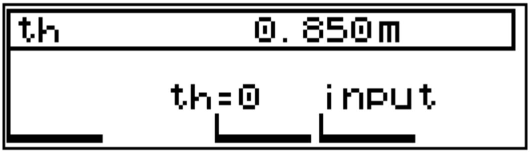
Principles
First steps

Editor
Data management

th 0.850 m
Confirmation of the old value

th=0
Set to zero

Example th:



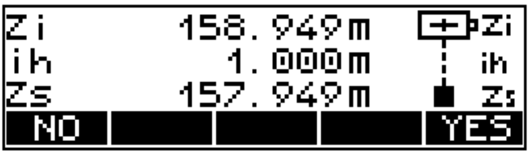
→ Sight backsight point

ON + PNo
Point number to be changed?

MEAS

YES to confirm, record, quit the program

NO to reject, new start



Display of results and recording

Recording

📖 Presettings
First steps

If recording is activated, the following lines are saved in dependence on the settings:

Designation of the mode

Point numbers and code

th	Reflector height at backsight point (only if changed)
ih	Instrument height (only if changed)
Z	Height of backsight point
SD, Hz, V	Readings for backsight point
Zs	New station height

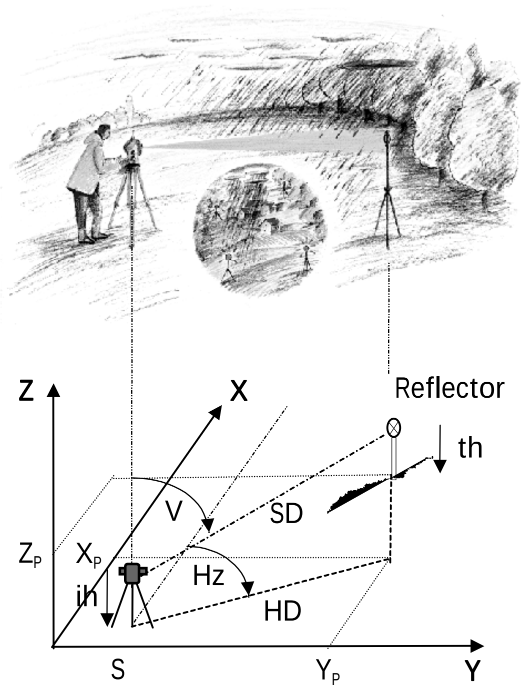
Coordinates

Polar Points

Determination of the coordinates and heights of new points by distance and direction measurements.

The coordinates can be computed in a higher-order system of coordinates.

Local coordinates can be determined in the standard measurement menu.



given.: : $(Y,X,Z)_{,S}$, Om, m

meas.: : $(SD,Hz,V)_{S\text{-}P}$

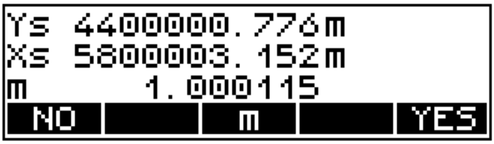
requ.: : $(Y,X,Z)_P$

Confirmation of Stationing

YES to confirm the station coordinates and to continue in the program

NO to reject, new start - stationing

m to change the scale



Scale:

+, **-** to change m

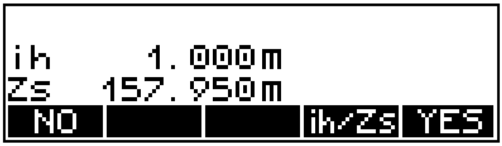
o.k. to confirm

Reference direction:

YES to confirm and continue in the program

NO to reject, new start - stationing

Instrument and station heights:



YES to confirm and continue in the program

NO to reject, new start - height stationing

ih/Zs to enter instrument and reflector heights

☝ **Attention !**

If neither a stationing in elevation has been realised beforehand nor Zs is entered now, all heights Z will be related to the station height Zs=0.
If ih is not entered either, all heights Z will be related to the trunnion axis height Zi=0.

Measurement „Polar Points“

→1, **→2** to change pages over

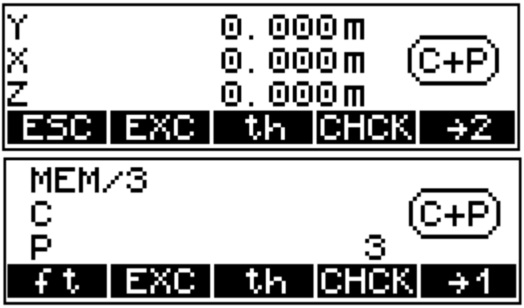
th to enter the reflector height of the new point

ON + ***PNo*** to enter point number and code of the new point

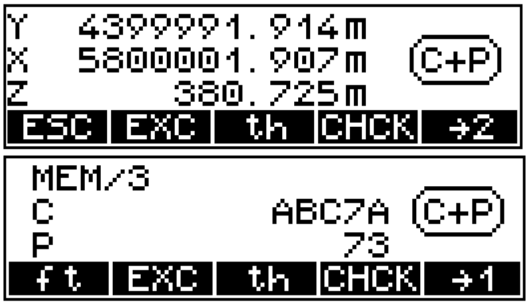
EXC eccentric measurement

CHCK 📖 **Adjusting and checking**

MEAS to start the measurement



Display of results and saving



☞ **Tip**

The measurement can be triggered both on display pages 1 and 2.
After the measurement, the program returns to the page where the measurement has been triggered.

Eccentric Measurement

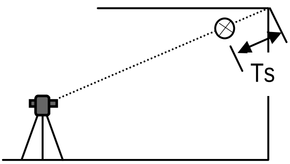
If points cannot be measured directly, the eccentric measurement option can provide the solution. Spatial eccentric target measurements are very helpful especially for indoor surveys.

Inp to enter the length

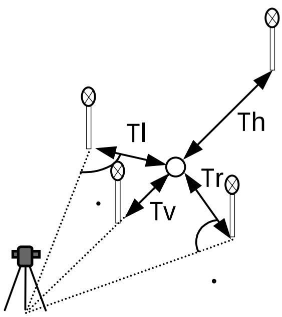
MOD to change the mode

o.k. to accept

ESC to quit the menu



spatial eccentricity



position eccentricities

The graphics does not change !

Type of target eccentricity (softkey **MOD**):

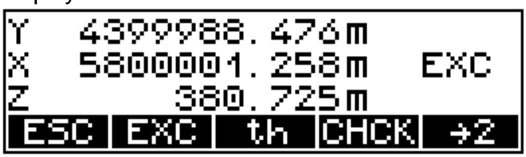
Tv: in front of the centre
Th: behind the centre
Tl: left of the centre
Tr: right of the centre
Ts: spatial relative to the centre

Viewing direction: **Centre of the instrument !**

☞ **Note !**

Height calculation is based on the assumption that centre and eccentricity have the same level. This does of course not apply to the Ts type (spatial) (calculation of the real height of the centre).

Display before eccentric measurement is started



☞ **Note !**

The eccentricity set is effective only once.

Recording

Presettings
First steps

If recording is activated, the following lines are saved in dependence on the settings:

Designation of the mode

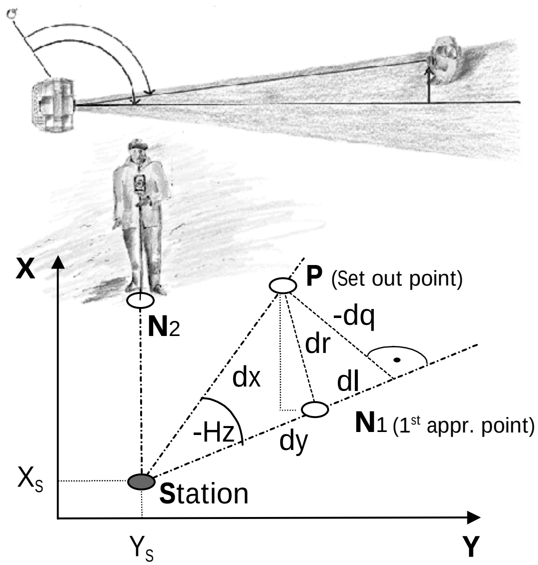
Point numbers and code

m	Scale (only if changed)
ih	Instrument height (only if changed)
Zs	Station height (only if changed)
th	Reflector height at backsight point (only if changed)
Tv,Th,Tr,Tl,Ts	Eccentricity
SD, Hz, V	Polar coordinates
Y, X, Z	Rectangular coordinates

Coordinates

Setting Out

Search for or setting out points in a given system of coordinates. A stationing is the prerequisite for setting out points on the basis of coordinates.



After having entered the coordinates of the point to be set out and measured the approximate point, the Trimble 3300 displays the result in the form of the longitudinal deviation dl, the transverse deviation dq, the angle Hz between the approximate point and the nominal point, the radial deviation dr and the deviation dr and the deviations of the coordinates dx, dy and dz.

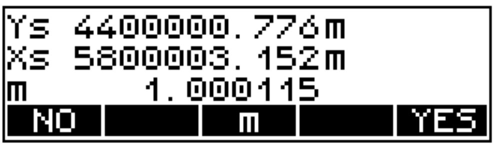
given.: : $(Y,X)_{S,P}$

comp.: :$(HD,Hz)_{S\text{--}P}$

meas.: : $(HD,Hz,V)_{S\text{-}N}$

comp.: : $(dl,dq,dr)_{P\text{-}N}$

Confirmation of Stationing



YES to confirm the station coordinates and to continue in the program

NO to reject, new start - stationing

m to change the scale

Scale:

+, **-** to change m

o.k. to confirm

Reference direction:

YES to confirm and continue in the program

NO to reject, new start - stationing

Instrument and station heights:

YES to confirm and continue in the program

NO to reject, new start - height stationing

ih/Zs to enter instrument and reflector heights

Measurement „Setting Out“

The following options for the setting-out method are available:

or

CHCK

Adjusting and checking

Z-n, **Z-j** Change with / without height

Setting out with or without height

YXZ, **YX** see below

Setting out using given coordinates

or

HDh, **HD** page 4-26

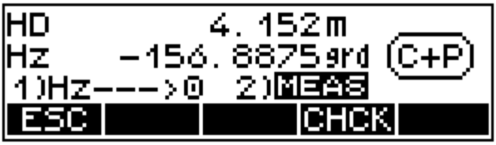
using known setting out parameters

Setting Out using known nominal Coordinates

Principles **First steps**

Editor **Data management**

After defining the coordinates:



to turn the instrument up to Hz=0

th to enter the reflector height

ON + PNo
Point number and code to be corrected?

MEAS to measure the approximate point

to continue see measurement results page 4-24

Setting Out using known Setting Out Parameters

Entering HD:

HD 4.152 m
Confirmation of the old value

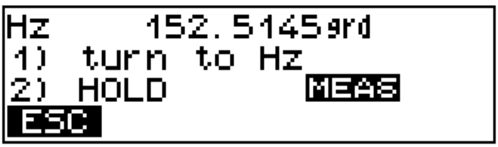
HD=0
Set to zero

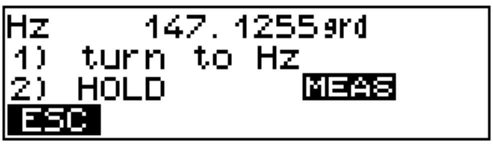
Principles
First steps

Defining the Hz value:

to set the desired Hz value

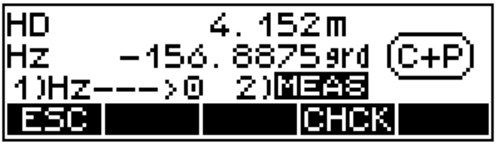
MEAS 1st measurement to the approximate point





ON + **PNo** Point number and code to be corrected?

th to enter reflector height



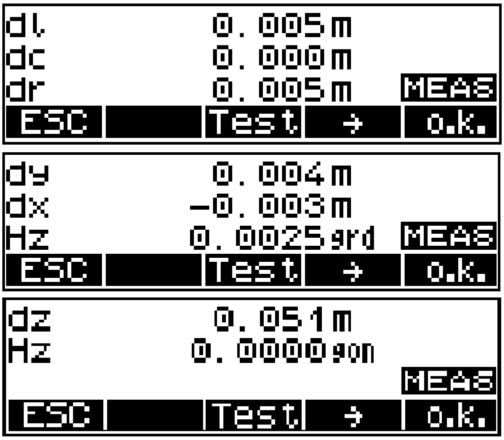
Measurement results see below

Measurement Results

➔ to change over the different displays of results

Test see below

o.k. to confirm the setting out and to record; to set out other points



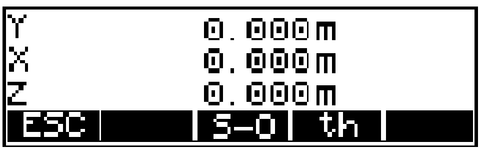
Display of results / recording

MEAS to repeat until the approximate point is close enough to the set out point!

Additional measurement of the set out point:

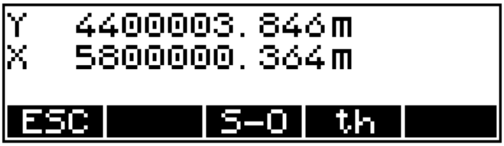
th to enter the reflector height

MEAS to measure



Display of results / recording

S-O Setting out, calling up next point



Display of results and recording

Recording

Presettings
First steps

If recording is activated, the following lines are saved in dependence on the settings:

Designation of the mode

Point numbers and code

HD,Hz, Z or	Nominal values
Y,X,Z	
SD,Hz,V Readings for the point	
dl, dq, dr	Setting-out differences
dy, dx	Setting-out differences (only if nominal coordinates are used)
dz	Setting-out differences (only if the height is set out)
	or
th	Reflector height (only if changed)
SD,Hz,V Readings and	
Y,X,Z	Actual coordinates of check measurement

5 Applications

The chapter *Applications* describes typical configurations and computations for various measuring methods that are frequently used in practice.

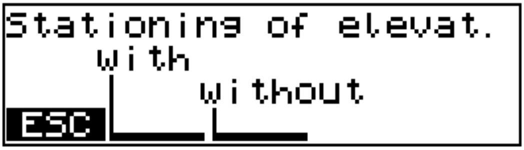
The guidance through the menu is very easy to understand and based on a unique schema for all programs.

Principle

Applications

Conn. Distances

In the Connecting Distance and Point-to-Line-Distance programs, the height reference can be established by a stationing in elevation (with) or by a measurement to the first point (without).
The Object Height and Vertical Plane programs have own modes for a height reference.



with
Coordinates Stationing in Elevation
see page 4-15
without
to start the program

ESC to quit the program

After calling the respective program, a graphics appears with a detailed explanation of the program.

CHCK **Adjusting and checking**

A to start the program by calling point A

☞ **Tip**

The function of adjusting and checking is required for measurements to be carried out without/with compensator or for checking the adjustment of the instrument.

The display of **A** in negative type indicates the possibility to measure to point **A**.

ON + ***PNo*** to enter the point number and code

MEAS to trigger measurement

☞ **Tip**

Prior to each measurement triggered with **MEAS** it is possible to enter a point number and a code for the point to be measured. The point number is incremented automatically by 1 without any need to lift a finger.

In the programs, the codes for defined points are invariably set (A, B, C, S) and cannot be changed.

B to continue in the program by calling point B

ESC to return to the higher-order menu

A to repeat point A if required

If A has been calculated, measured or defined as station, the symbol for A (square) is filled. Now, the point B or P can be treated exactly the same way.

☞ **Tip**

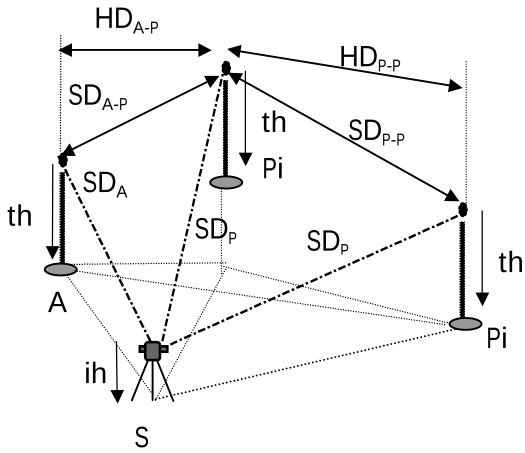
If errors or confusions should occur whilst measuring to the points, the measurement to single points can be repeated immediately.

Applications

Connecting Distance

If it is not possible to measure a distance between two points directly, the measurement to these points has to be started at a station point S. Then, the program calculates the distances SD,HD and the height difference h between the points.

Examples for application:
Measurement of cross sections, checking the distances between points, boundaries and buildings

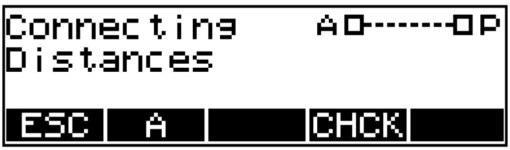


meas.: : $(SD,Hz,V)_{A,Pi}$, th

requ.: : $(SD,HD,h)_{A-P}$, $(SD,HD,h)_{P-P}$, Z_p

Measurement „Connecting Distance“

CHCK **Adjusting and checking**



A to start by calling point A

th to enter the reflector height of A

ON + ***PNo***

MEAS to measure to point A

In measurements with stationing in elevation, the height Z of the point is additionally displayed.

A=S page 5-8

A Measurement to point A to be repeated?

P to call point P

th to enter the reflector height of P

ON + **PNo**

MEAS to measure to point P

P=S page 5-8

☞ **Tip**

After completing the determination of the first connecting distance, there are two different methods for continuing the measurement:

polygonal measurement P-P or
radial measurement A-P.

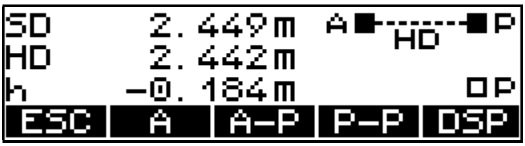
The method can be changed at any time after returning to the higher-order menu and selecting again.

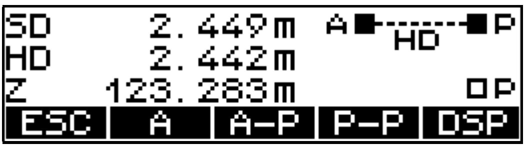
P-P page 5-7

A-P page 5-8

A to repeat measurement to point A

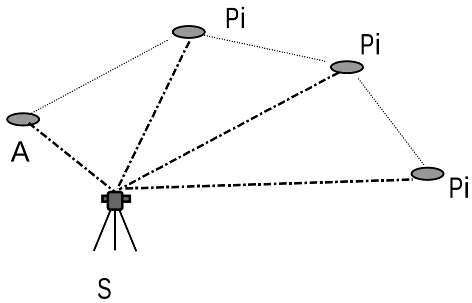
DSP to change over the different displays of results





Display of results and saving

Polygonal Connecting Distance P - P



The results are always related to the last two points measured.

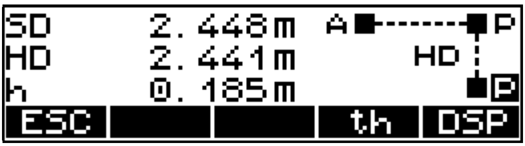
th to enter the reflector height of the next point P

ON + **PNo**

MEAS to measure to point P

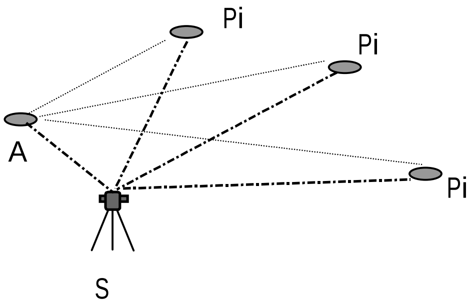
Further points P:

th, **ON** + **PNo**, **MEAS**



Display of results and saving

Radial Connecting Distance A - P

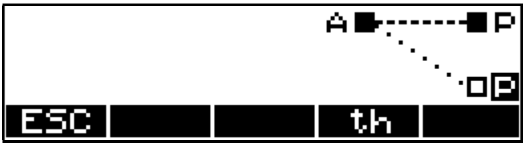


The results are always related to point A.

th to enter the reflector height of the next point P

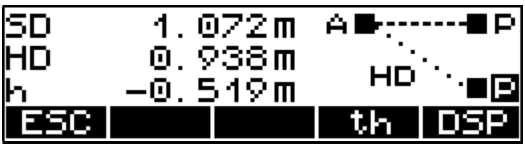
ON + **PNo**

MEAS to measure to point P



Further points P:

th, **ON** + **PNo**, **MEAS**



Display of results and saving

Recording

📖 Presettings
First steps

If recording is activated, the following lines are saved in dependence on the settings:

Designation of the mode

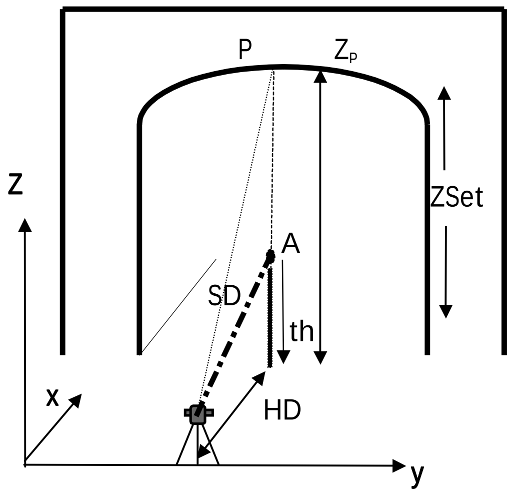
Point numbers and code

SD, Hz, V	Polar coordinates A,P
th, ih	Reflector height, instrument height (only if changed)
SD, HD, h	Connecting distance A-P or
SD, HD, Z	Connecting distance A-P or
SD, HD, h	Connecting distance P-P or
SD, HD, Z	Connecting distance P-P

Applications

Object Height

Heights of inaccessible points are determined by measuring SD,V to an accessible point in the plumb line. Only the angle V is measured to the inaccessible point.



Examples for application:
Determination of tree heights, widths of tree tops and trunk diameters,
power lines,
passageways and bridge profiles,
setting out of heights on vertical objects

meas.: : $(SD,V,th)_A$, V_P

requ.: : Z, HD, (O)

Measurement „Object Height“

CHCK 📖 **Adjusting and checking**

A to start by calling point A

th to enter the reflector height of A

ON + *PNo*

MEAS to measure to point A

Measurement to point P

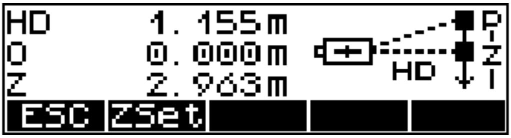
P to call point P

ON + PNo,

→ to sight point P

MEAS to measure to point P

further points P

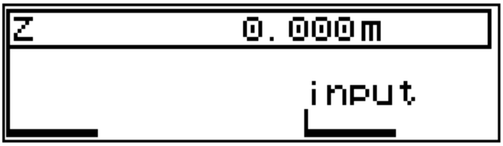


Display of results and saving

Definition of a Reference Height ZSet

With ZSet, a horizon with a given height can be defined.

<u>Z 0.000 m</u>
Confirming the old reference height (in this case 0)



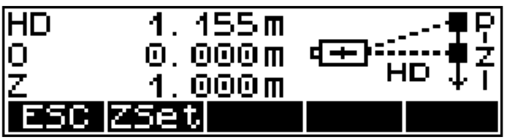
Principles
First steps

ON + PNo

MEAS to measure to the reference height

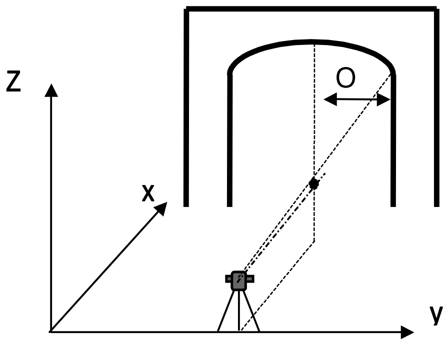
Further points:

ON + PNo, MEAS



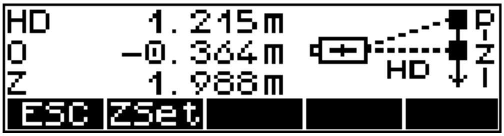
Display of results and saving

Measurement beside the Plumb Line



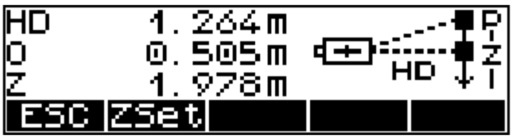
Further points: to the left of the plumb line

ON + *PNo*, MEAS



Further points: to the right of the plumb line

ON + *PNo*, MEAS



Recording

📖 Presettings
First steps

If recording is activated, the following lines are saved in dependence on the settings:

Designation of the mode

Point numbers and code

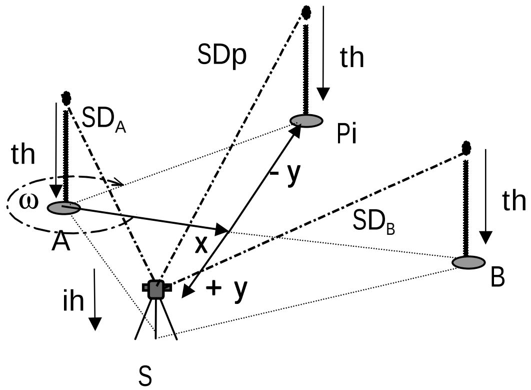
SD, Hz, V	Polar coordinates A
Hz, V	Measuring point P
HD,O,Z	Measuring point P
Z	Set value Z

Applications

Station + Offset

Determination of the rectangular coordinates of any point in relation to a reference line defined by the points A and B.

Examples for application:
Checking of point distances from a reference line,
checking of boundaries,
intersection of sight rails,
determination of the distances of buildings from boundaries, footpaths or streets,
alignment of long straight lines in the event of visual obstacles on the line,
surveying of supply lines and channel routes referred to roads and buildings,
free stationing in a local system



meas.: : $(SD,Hz,V)_{A,B,P}$, th

requ.: : $(x,y,\omega)_P$, referred to the line A-B

h_{A-B}, h_{A-P}

Measurement „Station + Offset“

CHCK 📖 **Adjusting and checking**

A to start by calling point A

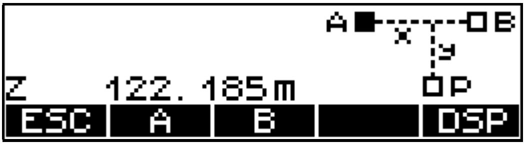
th to enter the reflector height of A

DSP to change over the different displays of results

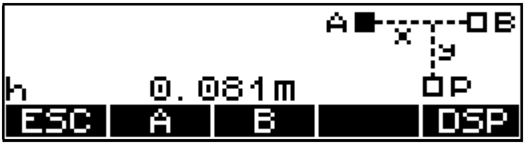
ON + ***PNo***

MEAS to measure to point A

A=S page 5-18



Display of absolute altitude Z (only with stationing in elevation carried out)



Display of height difference h

B to call point B

A Measurement to point A to be repeated?

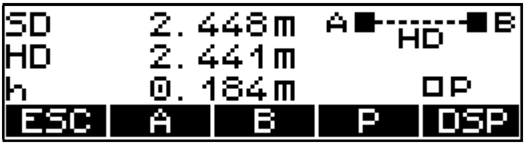
th to enter the reflector height of B

ON + ***PNo***

MEAS to measure to point B

B=S page 5-19

The results refer to points A and B



Display of results and saving

P to call point P

B B to be repeated?

A A to be repeated?

Measurement to point P

th to enter the reflector height of P

ON + *PNo*

MEAS to measure to point P

P=S page 5-18

DISP to change over the different displays of results

CONS to enter constants for x and y page 5-20

The result can now be displayed in three different modes.

Display of results and saving y, x, h

further points P

th to enter the reflector height of P

ON + *PNo*

MEAS

DSP to change over the different displays of results

Display of results and saving x, y, Z

DSP to change over the different displays of results

Display of results and saving x, y, ω

☝ **Attention !**

If the mode is changed after the measurement, the values will be converted and displayed in the new mode, but saved in this form only after the next measurement.

☞ **Tip**

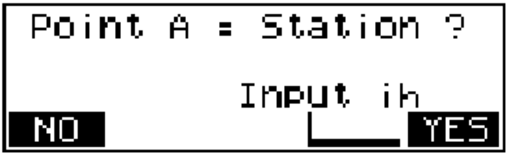
Change the mode before the measurement.

The Station equals Point A A = S

Principles
First steps

YES to confirm

NO to reject



B to continue in the main program

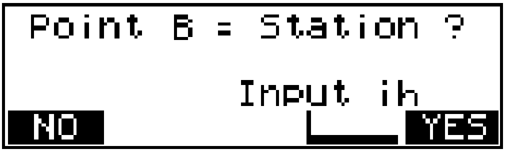
Saving

The Station equals Point B B =S

Principles
First steps

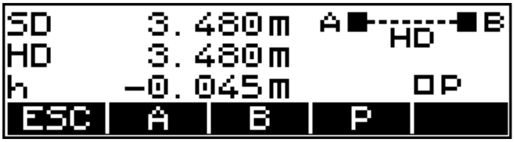
YES to confirm

NO to reject



The results refer to points A and B(S)

P to continue in the main program



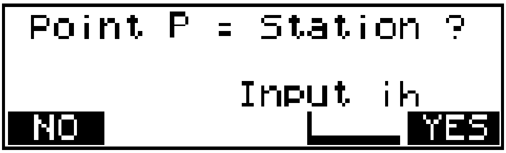
Display of results and saving

The Station equals Point P P = S (checking)

Principles
First steps

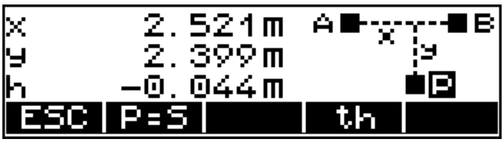
YES to confirm

NO to reject



To continue in the main program:

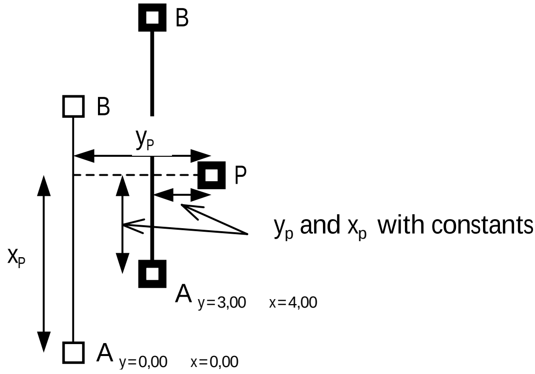
th, ON + PNo, MEAS



Display of results and saving

Shifting the Coordinate Axes y, x

If a line does not begin with the coordinate x=0,00, the corresponding value can be entered after having measured the line. If it is a parallel line, the parallel distance y can be entered in the same way. Consequently, the computation is always related to the new and parallel line.



CONS to call the menu for defining axes

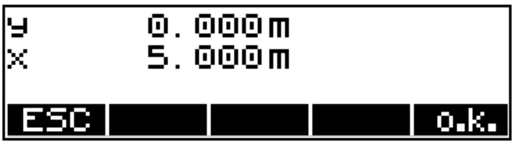
The result of a measurement to a point P is displayed as follows:

Input of shift values for y and x axes

Principles
First steps

Example: x=5,000 m

o.k. to confirm input



The change is recorded

MEAS to measure

Display of result after changing the origin of coordinates

☝ **Tip**

The input of constants for y and x allows to set out parallel and rectangular lines in an elegant fashion making additional computations superfluous. This applies especially to the intersection of sight rails and setting out of axes.

Recording

Presettings
First steps

If recording is activated, the following lines are saved in dependence on the settings:

Designation of the mode

Point numbers and code

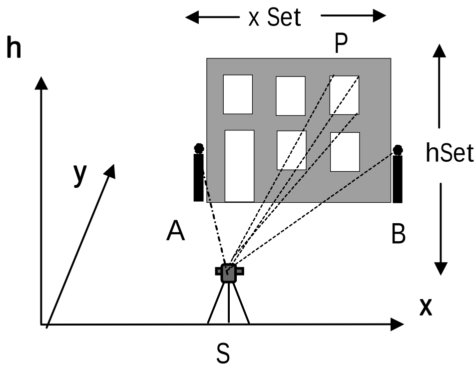
SD, Hz, V	Polar coordinates A,B
th,ih	Reflector height, instrument height (only if changed)
SD, HD, h	Basis A-B
SD, Hz, V	Polar coordinates P
y,x,h y,x,Z y,x,ω	Coordinates P or Coordinates P or Coordinates P and angle ω
A=S, B=S	
and P=S	Information lines
Y,X,h	P=S
Y,x	constants for y and x

Applications

Vertical Plane

A vertical plane is defined by angle and distance measurements to two points. The coordinates of further points in this plane are determined only by an angle measurement.

Examples for application:
Surveying of building façades,
heights of passageways, bridges or motorway signs,
determination of coordinates in a vertical plane for the determination of heights and volume computations,
setting out of sectional planes (planimetry and height) for façade construction



meas.: : $(SD,Hz,V)_{A,B}$, th, $(Hz,V)_P$

requ.: : $(y,x,h)_P$

Measurement „Vertical Plane“

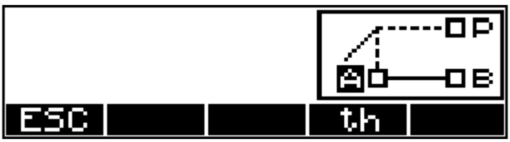
CHCK **Adjusting and checking**

A to start by calling point A

th to enter the reflector height of A

ON + *PNo*

MEAS to measure to point A

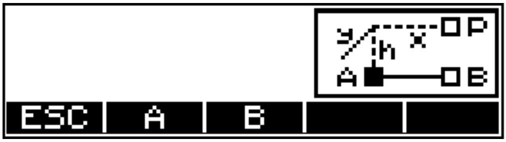


B to call point B

th to enter the reflector height of B

ON + *PNo*

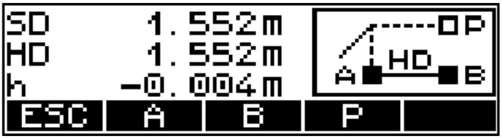
MEAS to measure to point B



P to call point P

ON + *PNo*

MEAS to measure Hz and V to point P



Display of results and saving

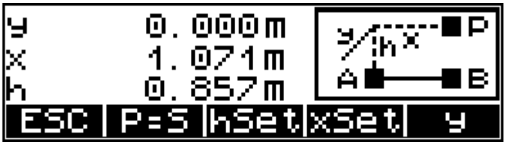
To measure to further points

hSet see below

xSet page 5-21

y page 5-22

P=S page 5-23

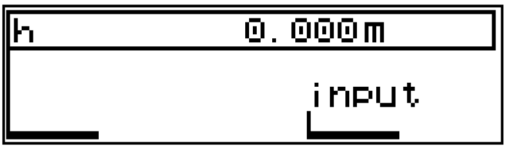


Display of results and saving

hSet - Determination of the Height Coordinate

Definition of the horizon:

h 0.000 m
Confirm the old reference height (in this case 0)



Principles
First steps

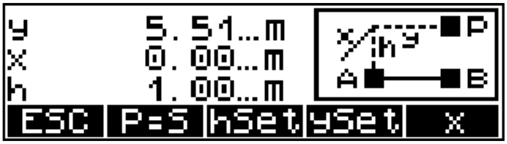
Input (1,00)

ON + PNo

MEAS to measure Hz and V to point P

The results refer to the new height

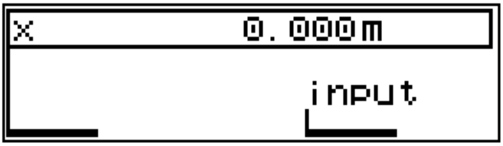
To measure further points



Display of results and saving

xSet - Definition of the x - Axis

x 0.000 m
Confirm the old reference height (in this case 0)

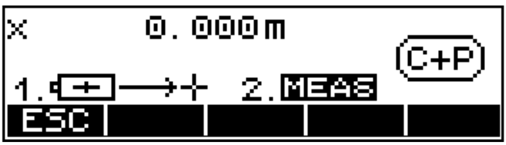


Principles
First steps

Input (1,00)

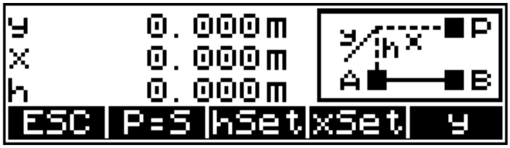
ON + PNo

MEAS to measure Hz and V to the desired point P



The results refer to the new x - axis
(in this case, the desired and set zero point of coordinates has been measured)

To measure further points

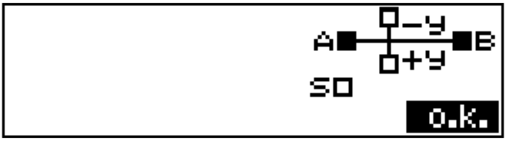


Display of results and saving

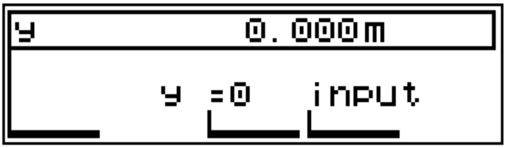
ySet - Points before or behind the Plane

Definition of preceding sign

o.k. to confirm



y 0.000 m
Confirm the old value (in this case 0)



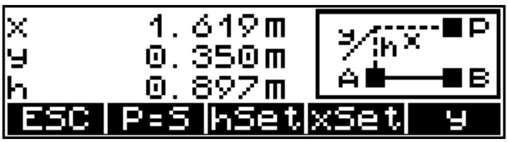
y = 0
Set to zero

Principles
First steps

After entering y=0,350m:

ON + *PNo*

MEAS to measure Hz and V to point P



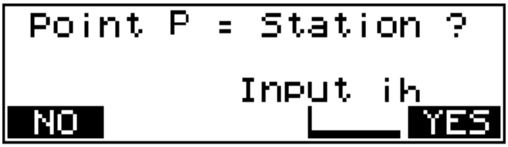
Display of results and recording

The Station equals Point P P=S

└ Principles **First steps**

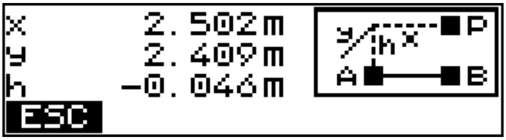
YES to confirm

NO to reject



Coordinates of S with reference to plane A-B

ESC further points



Display of results and recording

Recording

Presettings **First steps**

If recording is activated, the following lines are saved in dependence on the settings:

Designation of the mode

Point numbers and code

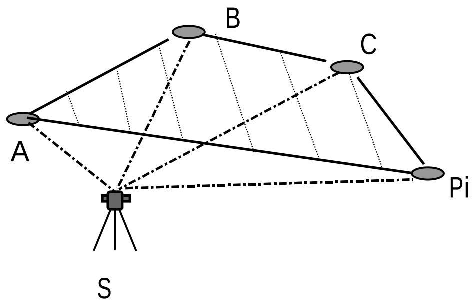
SD, Hz, V	Polar coordinates A,B
th,ih	Reflector height, instrument height (only if changed)
SD, HD, h	Basis
Hz,V	P
y, x, h	P
P=S	Information lines
Y,X,h	P=S

Applications

Area calculation

Area calculation by measurement to the corner points ***or*** input of the corner point coordinates of the area or calling them from the memory. A direct combination of both methods is impossible (see page 29).

The area is limited by straight lines. Any number of corner points can be used.



	meas.:	: $(SD,Hz,V)_{A,B,C,Pi}$
or	given.:	: $(y,x)_{A,Pi}$ $(Y,X)_{A,Pi}$
	comp.:	: Fl (A-B-C-Pi)

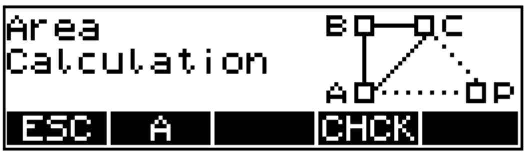
Range:

$0{,}01m^2 \pm 0{,}01m^2 < Fl < 90\,000\,000m^2 + 1m^2$

Measurement „Area Calculation“

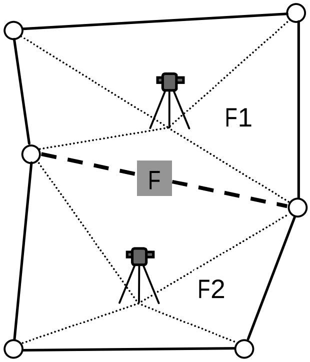
PRUE **Adjusting and checking**

A to start by calling point A



☝ Attention !

The points of the area are to be measured, called from the memory or entered in proper order. In each case, the last point can be repeated. It is not possible to insert a forgotten point subsequently.



☞ **Tip!**

If not all points can be seen from one station, the following procedure is recommendable:

Divide the corner points into groups so that all corner points can be seen from two or more stations.

1st corner point group
Determination of corner point coordinates of the area by means of
- stationing in a local or global network and
- polar measurement of the 1st group
  Coordinates of these points are now stored in the instrument memory

2nd corner point group
Move the instrument to another place from where the remaining points of the area can be seen.
- stationing in a local or global network (as for
  the 1st group) and measurement of the remaining points
- all points are now stored in the memory

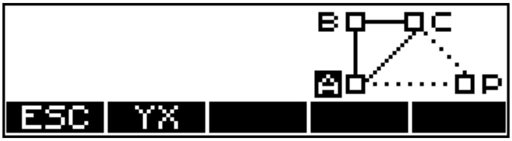
Starting the area calculation
- Call the corner points of the area from the memory considering the order

This method works only in case of instruments with internal memory. The Timble 3306 only allows to measure the points. It is possible, however, to calculate an area (F) to be covered through various stations. The subareas (F1 + F2) are arranged in such a way that they can be assembled to a total area. A stationing is not necessary for this purpose.

F = F1 + F2

MEAS to measure to point A <u>or</u>

YX Input or select memory coordinates



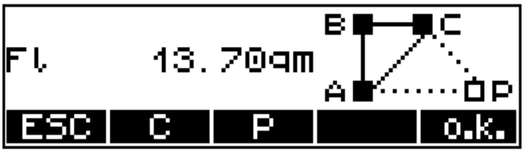
Principles
First steps

Editor
Data management

Input coordinates

The operational steps for point B and C are now carried out in analogy to point A.

After measuring to A,B and C, the area is calculated for the first time:



ESC to quit the program

C to repeat measurement to point C

P to continue in the program by calling point P

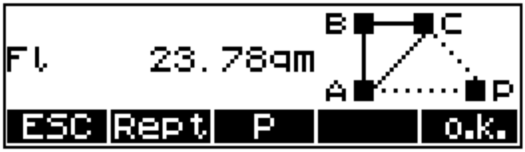
o.k. to quit the area calculation and store the result

Rept **to repeat the last** point Pi

P to continue in the program by calling point P_{i+1}

o.k. to quit the area calculation and store the result

Display of result after measuring to another point Pi:



☞ **Tip!**

Any number of corner points can be used.

Recording

📖 Presettings
First steps

If recording is activated, the following lines are saved in dependence on the settings:

Designation of the mode

Point numbers and code

y,x or

Y,X	Coordinates point A, B, C, P_i
SD,Hz,V	Reading point A, B, C, P_i
Fl	Area

6 Data Management

Decisive features of an efficient work routine are the saving of the measured and computed values as well as the transfer of measured data to a PC and the transfer of coordinates from the PC to the surveying instrument. This chapter describes all processes necessary to meet these requirements. The section *Editor* only applies to Trimble 3303 and Trimble 3305.

Calling the EDIT Menu

ON EDIT

Compensator activated

Indication of battery level

Display of the free data lines and address of the last data line written

Display of Data Lines

Disp to go to memory display

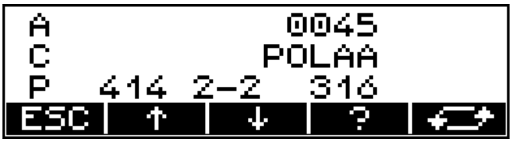
? to call search function

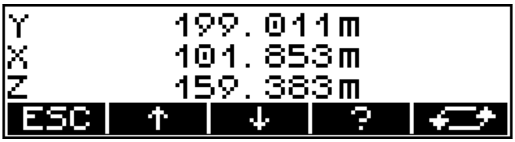
to change page

to display preceding data line

to display following data line

ON PNo allows to change point number and code



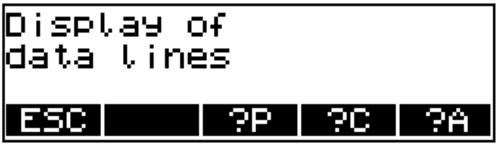


☝ **Attention !**

In the coordinate and application programs, fixed codes are assigned to certain data lines. Such codes cannot be modified by the operator.

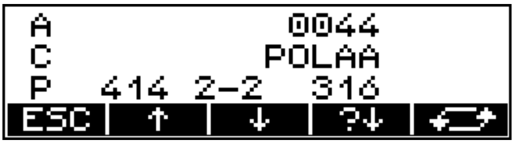
Searching for Data Lines

?	to call search function
?P	to search for point number
?C	to search for code
?A	to search for address



Input of the point number, code or address to be searched for

?↓	to continue search using the same criterion
⇄	to change page
↑	to display preceding data line
↓	to display following data line
ESC	to quit search routine



> ☞ **Tip**
>
> If no data line is found to which the search criterion applies, search is followed by an error message.

Deleting Data Lines

Del to call the function "Delete"

☝ Technical Information

This function deletes all data lines or the data lines from a selected line number (address) to the last data line saved.

☝ Attention !

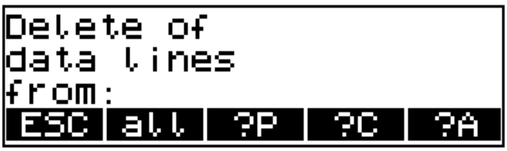
The deletion is definite and irrevocable. To avoid any unintentional loss of data, utmost care has to be taken over this action!

all to select all lines

?P or from the line with point number xx

?C or from the line with code xx

?A or from the line with address xx

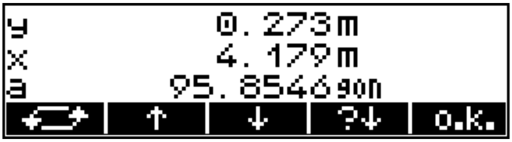


Example: search for point number 2

? ↓ to continue search using the same criterion

to switch over to the page of readings

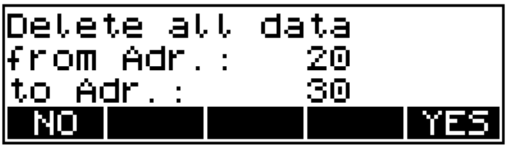
o.k. to confirm the line



For another check, the selected data lines are displayed again and have to be confirmed.

YES to confirm the selection

NO to reject the selection / quit the routine



Entering Data Lines

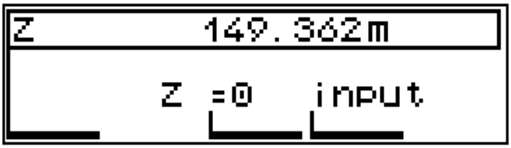
Inpt to call the function "Input"

XY to enter the planimetric coordinates

XYZ to enter planimetric coordinates and heights

Z to enter heights

Example of a height input:



Z 149,362 m
Confirmation of the old value (in this case 149,362 m)

Z = 0
Set the height to zero

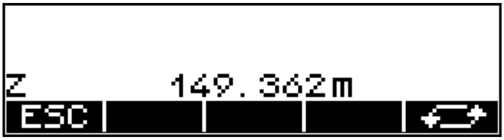
Principles
First steps

← and **→**
to go to the desired position

+ and **-**
to browse through digits

o.k. to confirm

↵ to switch over to the page for readings



ON *PNo*
to enter point number and code

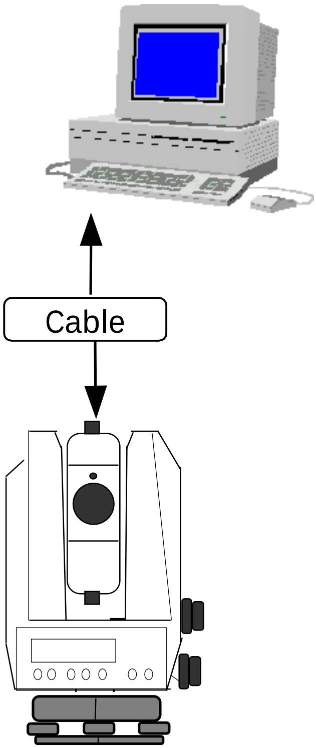
o.k. to confirm and save

Input of further coordinates and heights with point number and code

📖 Presettings
First steps

☝ **Attention !**

The sequence and designation of the coordinate axes depend on the selected system of coordinates and the setting of the display of coordinates. The softkey YX and YXZ, respectively, is labelled according to this selection.



Data transfer can be performed between **Trimble 3300** and **PC** by **Cable**

This allows an easy data exchange between instrument and computer.

Preparing the Instrument for Data Transfer

ON *MENU*

5 Interface

YES to go to the menu

MOD to change settings

Menu Interface Trimble 3300

Trimble 3300 ↔ PC

Connect both devices by the serial interface cable and start the necessary programs for data transfer.

Cable for data transfer Trimble 3300 ↔ PC cable with protocol Xon/Xoff:

Order number 708177-9470.000

Interface parameters for transmitting and receiving project files:

Baud rate:	9600
Protocol:	Xon/Xoff
Parity:	even
Stop bits:	1 (not variable)
Data bits:	8

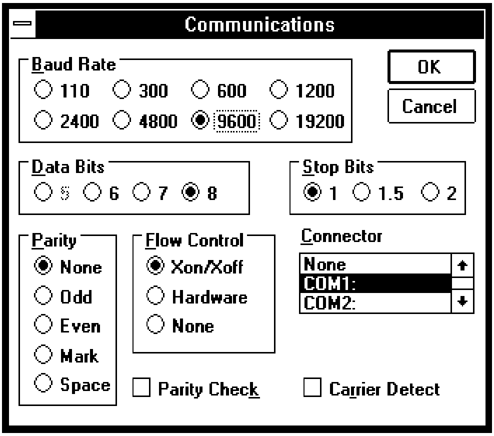
☞ **Tip**

For data transfer to and from the PC, you can use for example the MS-Windows™ Terminal program.

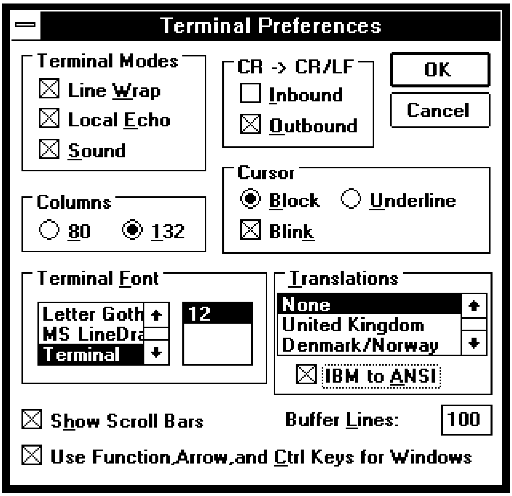
PC Terminal Settings

Example for Windows™ 3.xx Terminal program:

Set the PC for data transfer as follows:



For sending or receiving a project file, set the terminal preferences as shown in the follows:



To transmit a project file, select “Send text file“ or “Receive text file“.

Data Transmission

Instrument Settings:

5 Interface

YES to go to the menu

Data transfer menu between Trimble 3300 and PC.

1 MEM -----> Peripheral

YES to confirm

```
  1 MEM -> Periphery
↓ 2 Periphery -> MEM

ESC |     |  ↓  |     | YES
```

Selection of the required data lines

```
Transfer of
data lines
from:
ESC | all | ?P | ?C | ?A
```

Editor
Data Management

☞ Tip
Now, set the PC to „Receive text file“. The instrument or program at the receiving end must be set to the receive mode before you can transmit the project file.

YES to start

```
Transfer all data
from Adr.:     1
to Adr.:      32
NO  |     |     |     | YES
```

The data lines are transferred to the PC.

ESC to end data transfer

```
data lines
selected:           32
transferred:        32
ESC
```

Data Reception

On the instrument:

5 Interface

YES to go to the menu

Data transfer menu between PC and Trimble 3300.

2 Peripheral -----> MEM

YES to confirm

```
  1 MEM -> Periphery
↓ 2 Periphery -> MEM

ESC        ↓        YES
```

Enter the name of the source file into the PC

Start the transfer from the PC

The data lines are transferred to the Elta® R.

```
     Transferring

ESC
```

> ☝ **Attention !**
>
> The instrument only accepts coordinates.

ESC to end data reception

```
data lines
received:          207
accepted:          207
ESC
```

> ☞ **Tip**
>
> **Time Out** occurs after 30 seconds without data communication.
>
> The message „Time Out“ indicates a data error. After that, the program returns to the data transfer menu.

Introduction

Trimble surveying instruments are used for measurement functions with different data processing requirements.

The 3300 series allow densely packed internal measurement and result data lines to be output in various formats.

M5, R4, R5, Rec500 record format

Four data formats which have grown historically are subject to on-site revision service for compatibility with customer instruments. Currently, M5 is the format

to provide most comprehensiveness in definitions. It should be used preferentially for any other tasks.

This chapter describes the structure of data format and the type identifier of measured and calculated values.

📖 Data transfer
Data management

📖 User interface
Data management

Technical

All instruments have a serial interface which ensures the data exchange.

Attention!

Instead of the usual marks within the 27 digit point identification, the M5 data format of Elta * R is limited to a 12 digit point number and a 5 digit code.

Description of M5 data format

„M5“ -> **5 Measuring data blocks** per data line:

1 Address block
1 Information block
3 numerical data blocks

The Zeiss M5 data format is the common standard for all current Zeiss Elta®surveying systems.

All 5 data blocks are preceded by a type identifier. The 3 numerical data blocks have a standard layout comprising 14 digits. In addition to the decimal point and sign, they accept numeric values with the specified number of decimal places.
The information block is defined by 27 characters. It is used for point identification (PI) and text information (TI e.g.).
The address block is comprised of 5 digits (from address 1 to 99999).

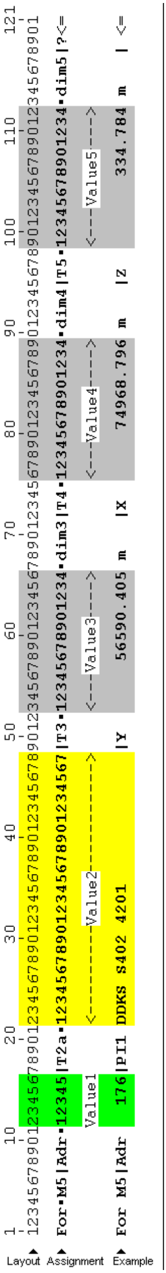
The M5 data line

The data line of the M5 format consists of 121 characters (bytes). The multiplication of this figure by the number of addresses (lines) stored shows the size of the project file in bytes.

Blanks are significant characters in the M5 file and must not be deleted.

The example describes an M5 data line at address 176 with coordinates (YXZ) recorded in unit **m.** The point identification of marking 1 is **DDKS S402 4201**. Column 119 includes a blank (no error code).

The end of the line has CR, LF (columns 120 and 121, shown here as **<=**).



Col. 120-121:	Carriage Return <, Line Feed
Column 119:	Blank field, in case of error „e“
Col. 114-117:	Unit for block5
Column 99-112:	Block5 value block
Column 96-97:	Type identifier5 for block5
Column 91-94:	Unit for block4
Column 76-89:	Block4 value block
Column 73-74:	Type identifier4 for Block4
Column 68-71:	Unit for block3
Column 53-66:	Block3 value block
Column 50-51:	Type identifier3 for block3
Column 22-48:	Information block PI or TI (point identification PI or text information TI, TO etc.)
Column 18-20:	Type identification2 PIa (a=1-0, for 10 Markings) or TI
Column 12-16:	Memory address of data line
Column 8-10:	Type identifier1 *Adr* for address
Column 1-6:	Defines M5 format

■ blank | separator

Explanations to the data line

Abbr.	Description	Digits	Characters	Meaning
For	Format identifier M5	3	alpha	Trimble 3300 Format
	Format type		2	alpha 5
		meas. data blocks		
Adr	Address identifier	3	alpha	Value1
	Value1	5	numeric	Memory address
T2	Type identifier	2	alpha	Value2 (PIa ,TI, TO...)
a	Marking Value2	1	numeric	a=1, 2, 3 ,..., 9, 0
		27	alpha	PI or TI
T3	Type identifier	2	alpha	Value3
	Value3	14	numeric	14-digit value
dim3	Unit	4	alpha	4-digit unit
T4	Type identifier	2	alpha	Value4
	Value4	14	numeric	14-digit value
dim4	Unit	4	alpha	4-digit unit
T5	Type identifier	2	alpha	Value5
	Value5	14	numeric	14-digit value
dim5	Unit	4	alpha	4-digit unit
?	Identifier	1	alpha	Error message, or ■

Special characters			ASCII code	Hex code
|	Separator	1	ASCII 124	Hex 7C
■	Blank	1	ASCII 32	Hex 20
<	CR (Carriage Return)	1	ASCII 13	Hex 0D
=	LF (Line Feed)	1	ASCII 10	Hex 0A

For your information only!
Trimble 3300 - Page 6-23

The point identification PI in M5 Format

The PI is comprised of 27 characters. It starts in column 22 and terminates in column 48 in the M5 data line. The data structure within the PI is defined by markings. A maximum of 10 markings, marked in the preceding type identifier with PI1 to PI0 (columns 18, 19, 20), can be designated to the PI (depending on the instrument).

For your information only!
Trimble 3300 - page 6-26

The type identifier in the M5 Format

In the course of the time, requirements on the data format have increased. Therefore, the M5 Format carries most of the type identifiers of all available formats, always based on the preceding format (Rec500).

Type identifiers are defined by two characters (except for Adr). If only one character is necessary, the second character is a blank.

In the M5 Format there are 5 Type identifiers (TK) defined:

TK1:	Adr	Identifier address (Value1)
TK2:	T2	Identifier information (Value2)
TK3:	T3	Identifier 3. Value field (Value3)
TK4:	T4	Identifier 4. Value field (Value4)
TK5:	T5	Identifier 5. Value field (Value5)

Example:

„PI“ for point identification or „TI“ for text information can be used for T2. For T3, T4, T5, „D“, „Hz“, „V“ or „Y“, „X“, „Z“ can be used.

Description of Rec 500 data format

„Rec500“ stands for the description of the electronic field book Rec500.

With the electronic field book Rec500 a data format was developed which was created for CZ instruments years ago and is today the base for the M5 format..

1 Address block
1 Block Information
3 Numeric data blocks

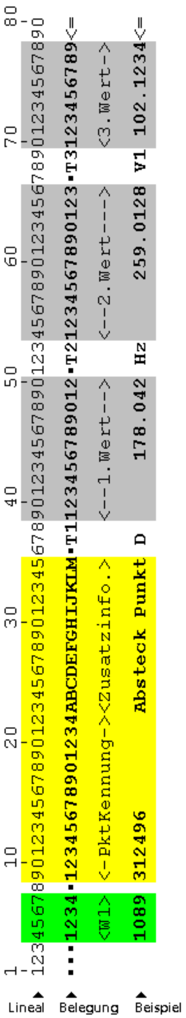
The Rec500 format is divided in 5 marking blocks (analogous the M5 format). These blocks differ in their block length from the M5 format, 80 characters (Bytes) are available on a data line.

The Rec500 Data line

The data line in the Rec500 format is comprised of 80 characters (Bytes).

Abbr.	Description	Digits	Characters	Meaning (w. example)
W1	Address	4	numeric	Memory address
PI	Point identification	27	num / alpha	Point identification (14-digits) and additional information (13 digits)
T1	Type identifier 1. Value	2 12	num / alpha numeric	D = slope distance E = horizontal distance Y = coordinate, etc.
T2	Type identifier 2. Value	2 13	num / alpha numeric	Hz = horizontal direction X = coordinate, etc.
T3	Type identifier 3. Value	2 9	num / alpha numeric	V1 = zenith angle Z = coordinate, etc.

Special characters			ASCII code	Hex code
■	Blank	1	ASCII 32	Hex 20
<	CR (Carriage Return)	1	ASCII 13	Hex 0D
=	LF (Line Feed)	1	ASCII 10	Hex 0A



Column 79-80: Carriage Return <, Line Feed =

Column 70-78: 3. Value block

Column 68-69: Type identifier for 3. Value

Column 54-66: 2. Value block

Column 52-53: Type identifier for 2. Value

Column 39-50: 1. Value block

Column 37-38: Type identifier for 1. Value

Column 23-35: additional information of PI (alpha numeric)

Column 9-35: Point identification PI

Column 9-22: Point Number of PI (numeric)

Column 4-7: memory address of data line

Column 1-3: 3 Blanks

■ Blank

The point identification in Rec500 Format

For information only!
Trimble 3300 – page 6-24

The PI is divided into two areas:

Area 1: numeric area for point marking (point number)

Area 2: alpha numeric area for additional point information

Description of R4 and R5 (M5, Rec 500) format of Trimble 3300

„R4“ stands for the data recording format of the Trimble 3300 instruments containing 4 measuring data blocks:

1 Information
3 numeric Data blocks

„R5“ stands for the data recording format of the Trimble 3300 instruments containing 5 measuring data blocks:

1 Address block
1 Information block
3 numeric Data blocks

Two data recording formats - R4 and R5 - are available in the Trimble 3300 total stations. Both formats can be chosen in the instruments. Depending on the setting with or without address, either data record format R5 (with address) or R4 (without address) can be used.

R4 and R5 format data lines

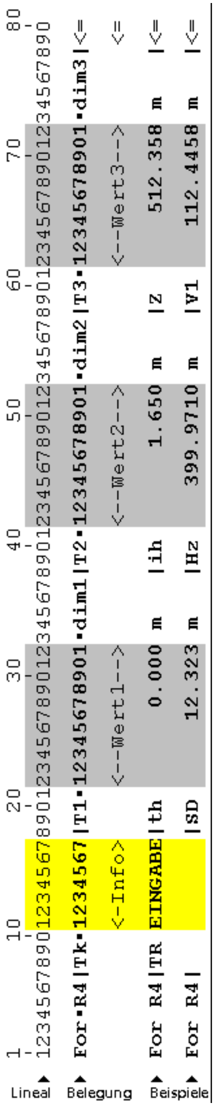
The data line in the R4 format contains 80 characters (Bytes). It is comprised of an information block and 3 numeric value blocks.
The data line in the R5 format contains 89 characters (Bytes). It is comprised of one address block, one information block, 3 numeric value blocks.
Both formats contain the same type identifiers for each block..

Abbr.	Description	Digits	Characters	Meaning
For	Marking format	3	alpha	Trimble 3300 Format
R4,R5	format type R4, R5	2	alpha	4 or. 5 Data blocks
Adr	Address marking	3	alpha	3 digits for marking
<aa>	Value1	4	numeric	Address in R5 Format
Tk	Type identifier Info	2	alpha	Type identifier TR or KR
<Info>	Info	7	num / alpha	Info for data line
Ti	Type identifier Value i	2	num / alpha	Type ID Value block
<Wi>	Value i (i = 1,2,3)	11	numeric	Value block Value i
dimi	dim i (i = 1,2,3)	4	alpha	Unit block Value i

📖 Special characters M5 Data format

The special characters ■, |, < and = are analogous the M5 format.

The R4 Data line



Column 79-80: Carriage Return <, Line Feed =

Column 74-77: Unit for 3. Value block

Column 62-72: 3. Value block

Column 59-60: Type identifier for 3. Value block

Column 54-57: Unit for 2. Value block

Column 42-52: 2. Value block

Column 39-40: Type identifier for 2. Value block

Column 34-37: Unit for 1. Value block

Column 22-32: 1. Value block

Column 19-20: Type identifier for 1. Value block

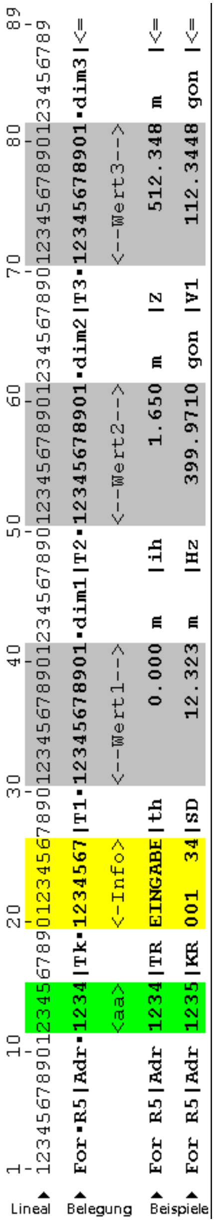
Column 11-17: Data line information (alpha numeric)

Column 8-9: Type identifier information

Column 1-6: Defines R4 format

■ Blank | Separator

The R5 Data line



Column 88-89:	Carriage Return <, Line Feed =
Column 83-86:	Unit for 3. Value block
Column 71-81:	3. Value block
Column 68-69:	Type identifier for 3. Value block
Column 63-66:	Unit for 2. Value block
Column 51-61:	2. Value block
Column 48-49:	Type identifier for 2. Value block
Column 42-46:	Unit for 1. Value block
Column 31-41:	1. Value block
Column 28-29:	Type identifier for 1. Value block
Column 20-26:	Data line information (alpha numeric)
Column 17-18:	Type identifier information
Column 12-15:	Memory address of Data line
Column 8-10:	Type identifier *Adr* for address
Column 1-6:	Defines R5 Format

■ Blank | Separator

The point identification in the R4/R5 Format

For a point identification in the R4 and R5 format are max. 7 digits available.

The PI is controlled by two Type identifiers, TR and KR, which describe the kind of PI.

TR Type identifier for a text information block

KR Type identifier for a PI with code and point number.

Point number: 0...9, right-aligned, 4-digit

Point code: 0...9, Blank, #
3-digit

The 3 digit code can be combined with additional characters. It is suggested to use the character # for marking incorrect measurements.

3300 - Marking in the M5/Rec 500 Format

The Trimble 3300 uses a mark which is saved internal in the instrument. This mark consists of 3 blocks with clearly defined block lengths. The user is able to manipulate the order of the 3 blocks.

Examples:

Layout gage:

```
1        10        20      27
123456789012345678901234567
```

Sample Marking: **`PPPPPPPPPPPP CCCCC  IIIIIII`**

Sample Marking: **`IIIIIII   CCCCCPPPPPPPPPPPP`**

Meaning:

`PPPPPPPPPPPP` 12-digit point number

`CCCCC` 5-digit point code

`IIIIIII` 7-digit information block

☞ **Tip**

The information block (**I**) is left-aligned, the code (**C**) and point number (**P**) are right-aligned.

Upon data conversion to the R4 / R5 format, the point number and point code will be shortened to 5 and 3 digits, respectively. The right-aligned digits remain.

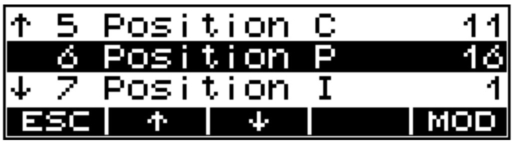
Change settings of Trimble 3300 – Markings in the M5 / Rec 500 format

ON MENU

5 User interface

YES go to the menu

MOD to change setting



☞ Tip

In case of overlapping information in the blocs, the instrument returns into its initial state (Default).

Trimble 3300 –Markings in R4/ R5 format

In instruments of the Trimble 3300 Serie one marking can be used.

In both the R4 and R5 format 7 characters are available for point identification and marking.

The PI is controlled by two type identifiers TR and KR, which mark the kind of the PI.

TR Type identifier for one text information block

KR Type identifier for a PI with code and point number.

Point number:	0...9, right-aligned, 4-digit
Point code:	0...9, Blank, # 3-digit

The 3 digits in the code can be combined with any applicable character. It is sug gested, to use the character # to mark incorrect measurements.

Examples:

Layout gage:	`TI 1234567`
Text information:	**`TR IIIIIII`**
Point number and code:	**KR CCCPPPP**

Meaning:

`IIIIIII`	7-digit Text information block
CCC	3-digit Code block
PPPP	4-digit Point number block

In the M5 / Rec500 Format a 5-digit code and a 12-digit point number are used. In the R4 / R5 Format the established digits (3 and 4, respectively) remain right-aligned.

Definition of type identification

Definition

Type identifiers are assigned to the 5 measuring data blocks of pre-set codes, which show the number or character value of the block.

Type ID´s are defined with two characters.

Type identifiers are (except for **Adr**) defined with two characters. If only one character is necessary, the second character is blank. The code is case sensitive.

The following table lists all Type identifiers in alphabetical order according to the CZ Data Formats and the possible position of characters after the comma (,????) as well as signs (±):

Type identifiers - CZ Formats M5, R4, R5, Rec500 (Trimble 3300)

Type identifier	,????	±	Meaning
A	2,3,4		Distance addition constant
a	6		Horizontal angle of orthogonal line
Adr	-		Address (the only TK with 3 characters)
B			V-angle of control point
c	3,4,5		Collimation correction
c_			Sighting axis error
dl	2,3,4		Longitudinal deviation
dq	2,3,4,5		Transverse deviation
dr	2,3,4		Radial deviation in setting out
dx	2,3,4		Coordinate Difference /Deviation in X direction
dy	2,3,4		Coordinate Difference /Deviation in Y direction
dz	2,3,4		Coordinate Difference /Deviation in Z direction
HD	2,3		Horizontal distance
HV	3,4,5		Hz rotation
Hz	3,4,5	±	Horizontal direction

Type identifier	,????	±	Meaning
h	2,3,4	±	Height difference of a station
i	3,4,5		Index correction
ih	2,3,4		Instrument height
KR			Information Elta® R with code and point number
m	6		Scale
NZ	3,4,5		Compensator reading, sighting direction
O	2,3,4		Transverse distance (indirect height determination)
Om	3,4,5		Orientation (stationing) Omega
P	0,0,1		Air pressure (in hPa, Torr or InMerc)
PI			Point Identification (general)
pa	2,3,4		Parallel distance in 3-D plane
SD	2,3		Slope distance
SZ	3,4,5		Compensator run center: component in line of sight direction
T			Text ID in Rec500 Format
Tv	2,3,4		Type of target eccentricity
Th	2,3,4		Type of target eccentricity
Tl	2,3,4		Type of target eccentricity
Tr	2,3,4		Type of target eccentricity
Ts	2,3,4		Type of target eccentricity
TI	-		Text information line
TR			Information Elta® R as text information
T_	-		Temperature (in °C or °F)
th	2,3,4		Reflector height
V1	3,4,5		Vertical angle: zenith angle
V2	3,4,5		Vertical angle: vertical angle
V3	3,4,5		Vertical angle: height angle

V4	3,4,5	Vertical angle: slope in [%]
vy	2,3,4	backsight point residuals
vx	2,3,4	backsight point residuals
vz	2,3,4	backsight point residuals
X	2,3,4	X - Coordinate
x	2,3,4	x - Coordinate (lokal)
y	2,3,4	y - Koordinate (lokal)
Y	2,3,4	Y - Coordinate
y	2,3,4	y - Koordinate (lokal)
Z	2,3,4	Z - Koordinate (Height above N.N.)

Description Value blocks

3 Value blocks

In each of the Zeiss Elta® Formats three value blocks are available whose number of digits depends on the format:

Format	Value1	Value2	Value3	dim
M5	14	14	14	4
R4/R5	11	11	11	4
Rec500	12	13	9	-

📖 Type identifiers

All value blocks are preceded by a type identifier which specifies the function of the succeeding value.

In the M5 and R4 / R5 Format for the value block exists a unit (dim), which follows , 4-digit (divided by a Blank), the value block.

The values are typed right-aligned in the blocks. Decimal point, digits after the comma and definitions of preceding characters correspond to the internal instrument specifications.

☝ **Caution!**

If the files of the Zeiss Elta® Formats are entered manually, it is important to remember that upon using the data in the instrument the digits after the comma and the units need to be adjusted correspondingly.

The following units are defined:

Angle measurement	gon, DEG, DMS, mil, grad, %
Distances, Coordinates	m, ft
Pressure	TORR, hPa, inHg
Temperature	C, F
Standard, PR etc.	no unit

Zeiss Elta® Format ID and address block

Zeiss Elta® Format ID in Columns 1-6

In the formats M5, R4 and R5 a marking which corresponds to the format precedes the data line.

`For M5` Format marking for M5 Format

`For R4` Format marking for R4 Format

`For R5` Format marking for R5 Format

„For“ and the marking M5, R4 or R5 are divided by a Blank (ASCII 32).
An exception is the M5 Format for the former GePoS® receiver:

`For_M5` Format marking M5 Format for former GePoS® receiver of software versions less than V3.7:

In this case, „For“ and the marking M5 is divided by a „_“ (ASCII 95).

From V3.7 on, the Format marking is **`For M5`**.

Address blocks

The Formats M5, Rec500 and R5 have an address block which marks the data line with the current memory address. In the M5 and R5 format, a type identifier Adr is activated:

Format	TK	Column	Digit
M5	Adr	12 - 16	5
R5	Adr	12 - 15	4
Rec500	none	4 - 7	4

`Adr 00001` or
`Adr     1` is allowed.

The address entry is right-aligned. Zeros can be used but are usually omitted. The first data line starts with the memory address 1.

Data output on a printer

Direct data output from the instrument to the printer or form the PC:

The R4 data recording format ensures problem-free printout on A4 printers, with each print line comprising one data line. To achieve the same with the R5 data recording format, the following should be noted:

- Direct data transmission to a printer
  Select condensed font in the printer
  or use A 3 printer

- Printing data from a DOS editor
  Select condensed font in the printer
  or use A 3 printer

- Printing from a WINDOWS task
  Do not use true type font or proportionally spaced font, but e.g. Courier
  Select a small type size
  Use landscape print format

☝ Attention!

For printing of data lines from the instrument at a printer is a serial type of printer interface necessary.

Introduction

This charpter decribes the conditions of data transfer, the pin assignment of the interface and key codes and function requests for controlling the instrument by a computer.

What is an Interface?

An interface is the point of contact between two systems or system areas, i.e. the point where information is interchanged. To ensure that it is understood by both the transmitting and receiving unit, specific rules must be defined for the transmission of signals and data.

Hardware interface

a physical connection between functional units such as measuring instruments, computers or printers.
Of significance for the user are:

- shape and pin assignment of the connectors on the functional units and connecting cables
- The data transmission method. The parameters and protocols for transmission control

Software interface

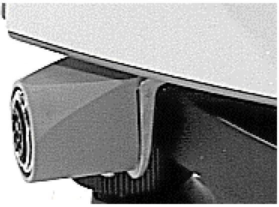
Software interfaces establish the link between programs or program modules. The data to be transmitted must conform to a defined structure: the record format..

User interface

also called user guidance, important for handling of a system.

Interfaces between the user and the system are the monitor, the keyboard and the options for user guidance provided by the software. In the Trimble 3300 concept, special emphasis has been placed on the design of the user interface.

Hardware interface



The interface for the peripheral equipment is of the asynchronous, serial type and conforms to DIN 66020 standard (V 24 / RS 232 C).

The interface is provided on the slip ring connection.

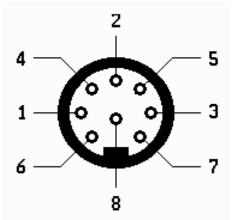
Interface functions:

(1) Data transfer:
Direct transmission of measured data between Trimble 3300 and the connected peripheral instrument (computer, printer,...).
A series of transmission parameters are available for the control of this process.

(2) Software updates for the Trimble 3300 can be loaded via this interface .

Pin assignment of the interface /connecting cable

Pin	Signal	Direction	Designation
1	-	-	
2	Ground	-	Ground ($-U_{batt}$)
3	-	-	
4	SD	Output	Transmitted data
5	ED	Input	Received data
6	Vcc	In	External power supply ($+U_{batt}$)
7	Vcc	In	External power supply ($+U_{batt}$)
8	Ground	-	Ground ($-U_{batt}$)



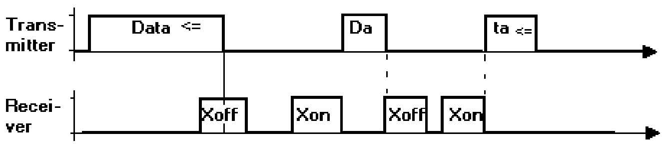
Pin assignment (exterior view of connector), 8-pin female stereo connector

Connecting cable:
Cable 708177 - 9460 is used for external data recording and for data transfer to a PC. You can also use cable 708177 - 9470 (with angled plug) if the Trimble 3300 is installed on a tripod during data transfer.

Introduction

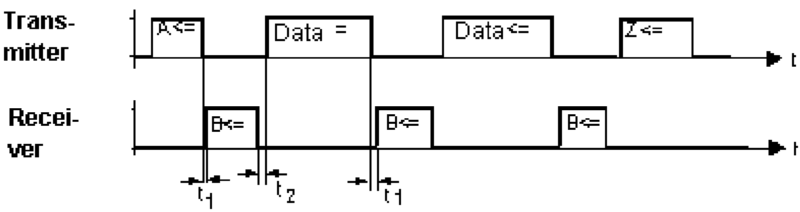
This charpter decribes the conditions of data transfer, data transmission protocols, overviewe about key codes and answers of the PC for the instrument control.

XON/XOFF Control



The XON/XOFF protocol is a very simple, but efficient data transmission protocol. It is preferably employed for so-called terminal programs (e.g. terminal under Windows or Xtalk) and can be used in data recording from the Elta® R to a computer.

Rec 500 Software Dialog (Rec 500 Protocol)



Control diagram of the `Rec 500 software dialog´

The following definitions apply to the time values entered in the control diagram:

t_1: Interval between signal A from Trimble 3300 and the response from the recording unit with signal B, and interval between the end of data transfer and the acknowledgement with signal B.

$0 > t_1 < t_{(Time\text{-}Out)}$ $t_1 = 20$ s

The recording unit may respond without delay to the recording request from the Trimble 3300. However, the selected time-out $t_{(Time\text{-}out)}$ must not be exceeded; otherwise an error message is displayed and external recording is deactivated. The Trimble 3300 assumes that no external recording unit has been connected.

t_2: Interval between the acknowledgement of the reception of a data line by the connected recording unit with signal B and the transmission of a further data line. Depending on the type of recording line involved, this amounts to

10 ms $> t_2 <$ 100 ms

Rec 500 software dialog is also suited for data transmission to the Trimble 3300 The control diagram is identical to the one shown above, with the designations of the transmitted data line and received data line being interchanged, as data is now transmitted by the peripheral unit.

Key Codes and Function Requests

If the Trimble 3300 is controlled by a computer, the keys can be emulated with the following codes:

Key	Code	Key	Code
F1	T31↵	ON+F1	TB1↵
F2	T32↵	ON+F2	TB2↵
F3	T33↵	ON+F3	TB3↵
F4	T34↵	ON+F4	TB4↵
F5	T35↵	ON+F5	TB5↵
MEAS	T4D↵	ON+MEAS	TCD↵

↵ symbol for CR/LF

The Trimble 3300 can be controlled either by key pressure or, equally, from a connected computer. Each recognized key code is acknowledged by the Trimble 3300 with 'Q↵'; in the event of errors such as incorrect syntax of the call or data transmission errors, the response is 'E↵'.

Function requests:

Code	Meaning
FKO↵	Compensator reading in sighting direction
FMD↵	Slope distance SD
FMW↵	Angle readings Hz, V
FMS↵	SD, Hz, V
FMR↵	HD, Hz, h reduction
FMK↵	y, x, h local coordinates

Each function request is answered with a data line in the selected format. The with/without address setting is effective. Only the XON/XOFF protocol is used.

☝ **Attention!**

The values entered for scale, addition constant, index and collimation correction are taken into account in all function requests.

Parameters:

```
Reading:    ?KTTT↵
Response:   !KTTT△△|1234567890123456△unit↵
Setting:    !KTTT△△|12345678901234△unit↵
Response:   Q↵

The response to a reading command is identical
with the setting command.
In the event of errors such as incorrect syntax of
the call or data transmission errors, the response
is 'E↵'.
```

Designations:

?K	fixed character string for reading
!K	fixed character string for setting
TTT	type identifier (see examples)
↵	carriage return/line feed
|	separator, ASCII dec. 124
1-6	numerical value, 16 characters
△	blank, ASCII dec. 32
unit	unit of the associated numerical value, 4 characters or blanks
Q	acknowledgement

Examples for the parameter calls:

```
?K00A↵  Instrument Identification                                  RO
!K00AΔΔ|Δ702718-0000.730ΔΔΔΔΔ↵

?K00a↵  Serial Number                                              RO
!K00aΔΔ|ΔΔΔΔΔΔΔΔΔΔ209187ΔΔΔΔΔ↵

?KSND↵  Acoustic Signal                                            RW
!KSNDΔΔ|ΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔaΔBitΔ↵      (a=0:aus, a=1:an)

?KAPO↵  Automatic Shutoff                                          RW
!KAPOΔΔ|ΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔaΔByte↵      (a=0:aus, a=1:10 min,
                                     a=2:30 min)
?KP20↵  Compensator                                                RW
!KP20ΔΔ|ΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔaΔBitΔ↵      (a=0:off, a=1:on)

?KSPR↵  Vertical Angle Display                                     RW
!KSPRΔΔ|ΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔaΔBitΔ↵      (a=0:Grad, a=1:%)

?KSVR↵  Vertical Reference System                                  RW
!KSVRΔΔ|ΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔZZZZ↵      (ZZZZ=ZEN :  zenith angle,
                                     ZZZZ=VERT:  vertical angle,
                                     ZZZZ=HGHT:  height angle)
?KSKO↵  Coordinate System and Display Sequence                     RW
!KSKOΔΔ|ΔΔΔΔΔΔΔΔΔΔΔΔΔΔabΔΔΔΔΔ↵      (a=1:xy, a=2:yx, a=3:ne
                                     b=1:RW-HW, b=2:HW-RW)

?KSMW↵  Angle Resolution and Unit                                  RW
!KSMWΔΔ|ΔΔΔΔΔΔΔΔΔΔ0.0005ΔgonΔ↵      (0.0005/0.001/0.005 gon
                                     0.0001/0.0005/0.0010 DMS
                                     0.0005/0.001/0.005 deg
                                     0.01/0.1/0.5 mil)
?KSMS↵  Distance Resolution and Unit                               RW
!KSMSΔΔ|ΔΔΔΔΔΔΔΔΔΔΔ0.001ΔmΔΔΔ↵      (0.001/0.005/0.01 m
                                     0.001/0.01/0.02 ft)
```

Δ - blank

```
?KSMT↵ Temperature Resolution and Unit                       RW
!KSMTΔΔ|ΔΔΔΔΔΔΔΔΔΔΔΔΔΔ1ΔCΔΔΔ↵      (1 C/1 F)

?KSMD↵ Pressure Resolution and Unit                          RW
!KSMDΔΔ|ΔΔΔΔΔΔΔΔΔΔΔΔΔΔ1ΔhPAΔ↵      (1 hPa/1 Torr/0.1 inHg)

?KSZΔ↵ Compensator Run Center in Sighting Direction          RW
!KSZΔΔΔ|ΔΔΔΔΔΔΔΔΔ0.00000Δgon Δ↵

?KBzΔ↵ Compensator Reading in Sighting Direction             RO
!KBzΔΔΔ|ΔΔΔΔΔΔΔΔΔ0.00000ΔgonΔ↵

?KiΔΔ↵ Index Correction                                      RW
!KiΔΔΔΔ|ΔΔΔΔΔΔΔΔΔ0.00000ΔgonΔ↵

?KcΔΔ↵ Collimation Correction                                RW
!KcΔΔΔΔ|ΔΔΔΔΔΔΔΔΔ0.00000ΔgonΔ↵

?KHVΔ↵ Hz Rotational Angle                                   RW
!KHVΔΔΔ|ΔΔΔΔΔΔΔΔΔ0.00000ΔgonΔ↵

?KAΔΔ↵ Addition Constant                                     RW
!KAΔΔΔΔ|ΔΔΔΔΔΔΔΔΔΔΔ0.000ΔmΔΔΔ↵

?KmΔΔ↵ Scale                                                 RW
!KmΔΔΔΔ|ΔΔΔΔΔΔΔΔ1.000000ΔΔΔΔΔ↵

?KPΔΔ↵ Air Pressure                                          RW
!KPΔΔΔΔ|ΔΔΔΔΔΔΔΔΔΔΔΔΔ944ΔhPaΔ↵

?KT_Δ↵ Temperature                                           RW
!KTΔΔΔΔ|ΔΔΔΔΔΔΔΔΔΔΔΔΔΔ20ΔCΔΔΔ↵

?KihΔ↵ Instrument Height                                     RW
!KihΔΔΔ|ΔΔΔΔΔΔΔΔΔΔ0.0000ΔmΔΔΔ↵

?KthΔ↵ Reflector Height                                      RW
!KthΔΔΔ|ΔΔΔΔΔΔΔΔΔΔ0.0000ΔmΔΔΔ↵

?KYΔS↵ Y  Coordinate of the Station                          RW
!KYΔSΔΔ|ΔΔΔΔΔΔΔΔΔΔ0.0000ΔmΔΔΔ↵
```

Δ - blank

?KXΔS↵ X Coordinate of the Station RW
!KXΔSΔΔ|ΔΔΔΔΔΔΔΔΔΔ0.0000ΔmΔΔΔ↵

?KN-S↵ N Coordinate of the Station RW
!KN-SΔΔ|ΔΔΔΔΔΔΔΔΔΔ0.0000ΔmΔΔΔ↵

?KE-S↵ E Coordinate of the Station RW
!KE-SΔΔ|ΔΔΔΔΔΔΔΔΔΔ0.0000ΔmΔΔΔ↵

?KZΔS↵ Station Height RW
!KZΔSΔΔ|ΔΔΔΔΔΔΔΔΔΔ0.0000ΔmΔΔΔ↵

?KLN1↵ Request for Language R0
!KLN1ΔΔ|ΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔD--Δ↵

The following parameter Hz0 takes up a special position:

?KHz0↵	the displayed Hz direction is output in the selected format
!KHzΔΔΔ|ΔΔΔΔΔΔΔΔΔ0.00000ΔgonΔ↵	sets the Hz direction to the preset value (here 0.00000 grad)

Designations:

RO	parameter can only be read
RW	parameter can be read and set

All parameters are output in the selected units, resolutions etc. Parameters can be entered irrespective of the parameters currently set. If call or setting commands include errors of syntax or content, the Elta® R answers with 'E↵'.

Δ - blank

Recording data lines
See Data Formats

Mode	Rec. 1	Mode 2	Content of Record P,C,I		T1	T2	T3	Comments
Single meas.	x		CCCCC	PPPPPPPPPPPP		Hz	Vk	HzV mode,k=1,2,3,4 dep. on V syst.
	x		CCCCC	PPPPPPPPPPPP	HD	Hz	h;Z	horizontal distance mode
	x		CCCCC	PPPPPPPPPPPP	SD	Hz	Vk	slope distance mode
	x		CCCCC	PPPPPPPPPPPP	y	x	h/Z	coordinates mode, sequence y,x
	x		CCCCC	PPPPPPPPPPPP	x	y	h/Z	coordinates mode, sequence x,y
	x		CCCCC	PPPPPPPPPPPP	n	e	h/Z	coordinates mode, sequence n,e
	x		CCCCC	PPPPPPPPPPPP	e	n	h/Z	coordinates mode, sequence e,n
Adjustment c/i	x	x	ADJUST		Vk	Vk	I	k=1,2,3,4 depending on V system
	x	x	ADJUST		Hz	Hz	C	
	x	x	ADJUST				SZ	
Adjust. comp.	x	x	ADJUST				SZ	
Input values	x	x	INPUT		th	ih		
	x	x	INPUT		T_	P	A	
	x	x	INPUT		m			
	x	x	S	PPPPPPPPPPPP			Z	Z...station height
Compensator	x	x	COM-ON					compensator activated
	x	x	COM-OFF					compensator deactivated

Rec. mode:
1: MEM/1, V24/1
2: MEM/2, V24/2
3: 1+2

Mode	Rec. mode 1	2	Content of Record		T1	T2	T3	Comments
	1	2	P,C,I		T1	T2	T3	
Point to line	x	x	STA+OFF					point to line
(Station +	x		A	PPPPPPPPPPPP		SD	Hz	Vk
Offset)	x		B	PPPPPPPPPPPP	SD	Hz	Vk	reference point B
	x		A=S					if station is defined as A
	x		B=S					if station is defined as P
		x	A-B		SD	HD	h	base length
	x		CCCCC	PPPPPPPPPPPP	SD	Hz	Vk	meas. pt. P
		x	CCCCC	PPPPPPPPPPPP	y	x	h/Z/ω	meas.pt. P;y,x,e,n dep.on coor.sys.
	x		P=S					if station is defined as P
		x			Y	X	h/Z/ω	
Connect.distance	x		CON.DST					
	x		A	PPPPPPPPPPPP	SD	Hz	Vk	reference point A
	x		CCCCC	PPPPPPPPPPPP	SD	Hz	Vk	meas. pt. P
		x	A-P		SD	HD	h/Z	connecting distance A-P
	x		P-P		SD	HD	h/Z	connecting distance P-P
	x		A=S					if station is defined as A
			P=S					if station is defined as P
Object height	x	x	OBJ. HT					
	x		A	PPPPPPPPPPPP	SD	Hz	Vk	reference point A
	x		CCCCC	PPPPPPPPPPPP		Hz	Vk	meas. pt. P, k=1..4 dep. on V syst.
		x	CCCCC	PPPPPPPPPPPP	HD	O	Z	meas. pt. P
	x		!	PPPPPPPPPPPP			Z	Set Z value
	x			PPPPPPPPPPPP		Hz	Vk	k=1,2,3,4 depending on V system

Mode	Rec. mode		Content of Record				Comments
	1	2	P,C,I	T1	T2	T3	
Vertical plane	x	x	VERT.PL				
	x		A PPPPPPPPPPPP	SD	Hz	Vk	reference point A
	x		B PPPPPPPPPPPP	SD	Hz	Vk	reference point B
		x	A-B	SD	HD	h	base length
	x		CCCCC PPPPPPPPPPPP		Hz	Vk	meas. pt. P, k=1..4 dep. on V sys.
		x	CCCCC PPPPPPPPPPPP	y	x	h	meas. pt. P, y,x,e,n dep. on
coord.sys.							
	x		P=S				if station is defined as P
	x	x	! PPPPPPPPPPPP			X	set value for (y,n)
	x		PPPPPPPPPPPP		Hz	Vk	y, x or n dep. on coord.sys.
	x	x	! PPPPPPPPPPPP			h	Set value for h
	x		PPPPPPPPPPPP		Hz	Vk	
		x		Y	X	h	
Area Calculation	x	x	AREA				
	x		CCCCC PPPPPPPPPPPP	SD	Hz	Vk	meas. pt. P
		x	CCCCC PPPPPPPPPPPP	Y	X	Z	meas. pt. P
		x	CCCCC PPPPPPPPPPPP	Y	X	Z	Stored P
	x	x	AREA	FL			

Mode	Rec. mode		Content of Record					Comments
	1	2	P,C,I		T1	T2	T3	
Unknown station	x	x	UN STAT					
		x	A	PPPPPPPPPPPP	Y	X		reference point A, B, C, D, E
	x		A	PPPPPPPPPPPP	SD	Hz	Vk	measurement to A, B, C, D, E
		x	A	PPPPPPPPPPPP	vy	vx	Vz	residuals point A, B, C, D, E
	x	x	S	PPPPPPPPPPPP	Y	X		station coordinates
	x	x			m	Om	sO	scale, orient., standard deviation
Known station	x	x	KN STAT					
		x	S	PPPPPPPPPPPP	Y	X		station coordinates
		x	A	PPPPPPPPPPPP	Y	X		reference point A
	x		A	PPPPPPPPPPPP		Hz	Vk	measurement to A (Hz,V mode)
	x		A	PPPPPPPPPPPP	SD	Hz	Vk	measurement to A (SD,Hz,V mode)
	x	x				Om		orientation (Hz,V)
	x	x			m	Om		scale, orientation (SD,Hz,V)
Height stationing	x	x	EL-STAT					
	x	x	!	PPPPPPPPPPPP			Z	Height of A
	x		A	PPPPPPPPPPPP	SD	Hz	Vk	Measurement to A
		x	S	PPPPPPPPPPPP			Z	computed station height
Polar points	x	x	POLAR					
	x		CCCCCPPPPPPPPPPPP		SD	Hz	Vk	original readings
		x	CCCCCPPPPPPPPPPPP		Y	X	Z	coordinates
	x	x	CCCCCPPPPPPPPPPPP		T			Eccentricity Tv,Th,Tl,Tr,Ts

Mode	Rec. mode 1	2	Content of Record		T1	T2	T3	Comments
			P,C,I					
Stake out	x	x	S-O					
		x	!	PPPPPPPPPPPP	Y	X	Z	depending on stake-out-method
		x	!	PPPPPPPPPPPP	Y	X		depending on stake-out-method
		x	!	PPPPPPPPPPPP	HD	Hz	Z	depending on stake-out-method
		x	!	PPPPPPPPPPPP	HD	Hz		depending on stake-out-method
	x			PPPPPPPPPPPP	SD	Hz	Vk	reading for backsight point
		x		PPPPPPPPPPPP	dy	dx	Dz	stake-out diff. dep. on meas. method
		x		PPPPPPPPPPPP	dy	dx		stake-out diff. dep. on meas. method
		x		PPPPPPPPPPPP	dl	dq	Dr	stake-out diff. dep. on meas. method
		x		PPPPPPPPPPPP			Dz	stake-out diff. dep. on meas. method
		x		PPPPPPPPPPPP	Y	X	Z	verification measurement
		x		PPPPPPPPPPPP	Y	X		verification measurement

An update is necessary if you load a new software version or if you want to change between the “Topo” and "Construction" models of the instrument.

Before starting the update, please save your data and use a fully charged accumulator battery.

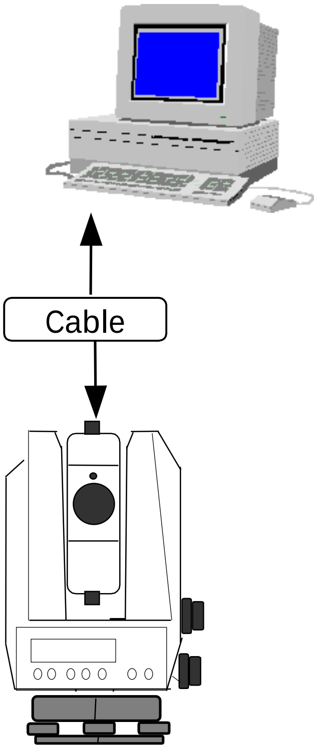
The simplest way to get an update is via the Internet.

☝ **Attention !**

Different hardware versions require different update versions.

In any case, please pay attention to the correct update - the correct instrument name when selecting the update files.

Once unpacked the files, the instrument type can no longer be concluded from them.



The Update is carried out
between and through

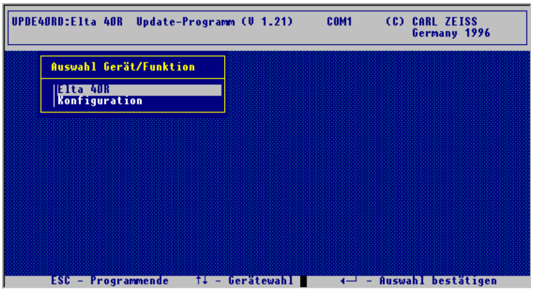
Trimble 3300 **PC** **cable**

This cable is also used for data transfer. The adapter included in the delivery allows the connection to 9 and 25 channel sockets.

Copy the contents of the diskette into a directory of your choice or start the software from the diskette (default).
Switch the instrument on and select the item Update.

Preparation on the PC

📖 Please follow also the update instructions enclosed



Esc : to end the program

↑ ↓ : to select

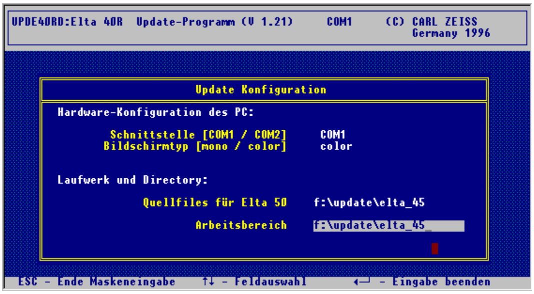
↵ : to confirm selection

Configuration

Enter your data here.
The configuration can be stored subsequently.

Esc : to end mask input

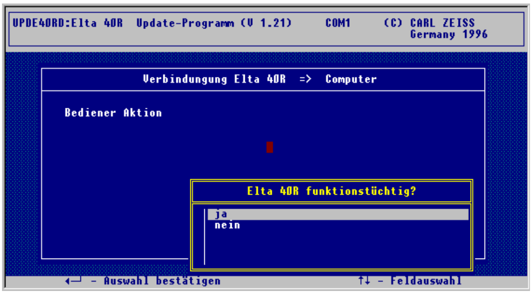
↵ : to end line input



Elta 40R

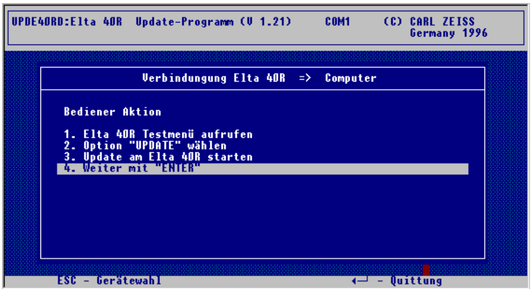
The question whether the Elta is in working order is to be answered in any case with **YES**.

↵ : to confirm



Please follow now exactly the instructions given on the screen.

: to select the single steps



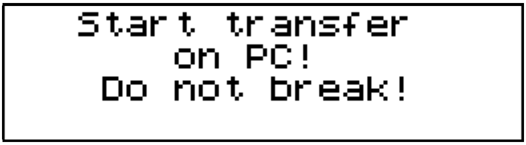
Trimble 3300 display:

Update

NEIN to go to the menu

JA to start update

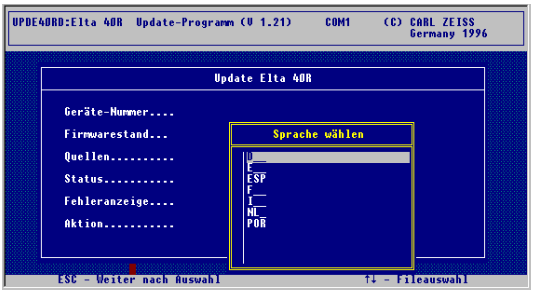
From now on, the PC software controls the instrument.



Update Elta 40R

Selection of the language desired (if available)

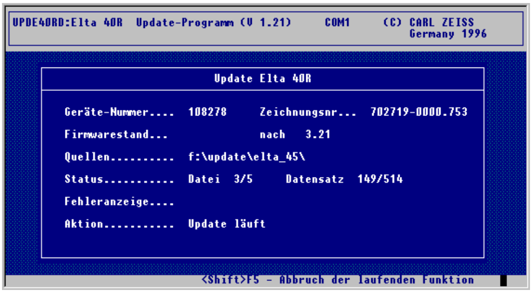
Esc : to end selection of language



Starting Update

Esc to start update

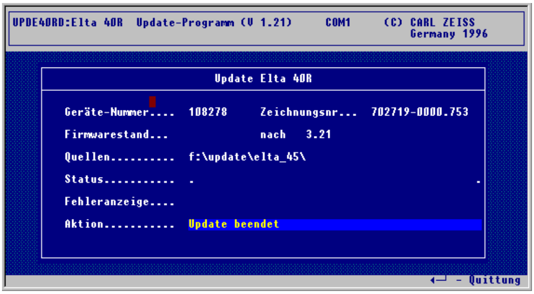
This operation takes some minutes comprising the transfer of one file with 30 and 4 files with 514 data records each.



The end of the update is acknowledged by clear acoustic signals. The instrument is switched off by software. The update has now been completed.

Update completed is flashing

↵ : to go to the start-up menu



☞ **Tip**

If no connection is achieved, in all probability the wrong interface has been selected or there is an error in the reference.

Please pay also attention to a perfect cable connection.

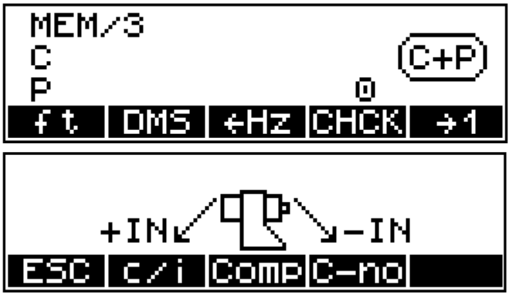
7 Adjusting and Checking

The instrument adjustment defines all corrections and correction values for the Trimble 3300 that are required to ensure optimum measuring accuracy.

Increased strain placed on the instrument by extreme measuring conditions, transportation, prolonged storage and major changes in temperature may lead to misalignment of the instrument and faulty measuring results. Such errors can be eliminated by instrument adjustment or by specific measuring methods.

Display page 2:

CHCK to go to menu "Checking"



📖 Presettings **First steps**

Additionally to activating and deactivating the compensator, this menu offers the following functions of checking and adjusting:

c/i Determination of the vertical index correction (V index) and sighting axis correction (Hz collimation).

Comp Determination of the compensator run centre.

☝ **Attention !**

Before starting any adjustment, allow the instrument to adapt to the ambient temperature and make sure it is protected against heating up on one side (sun radiation).

i Vertical Index Correction

The vertical index error is the zero point error of the vertical circle with respect to the vertical shaft.

c Sighting axis correction

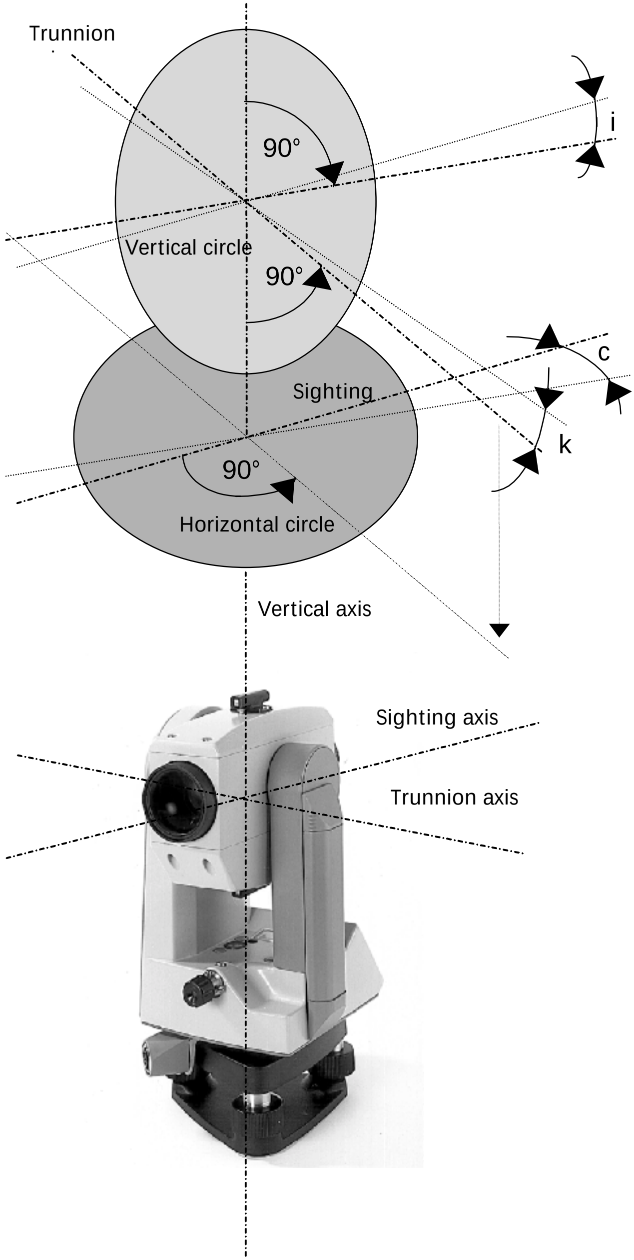
The sighting axis error is the deviation from the right angle between the trunnion axis and sighting axis.

k Trunnion axis correction

The trunnion axis error is the deviation from the right angle between the trunnion axis and vertical shaft (adjusted by the manufacturer).

Another instrument error considered is:

the compensator run centre error



The vertical index and sighting axis corrections should be recomputed after prolonged storage or transportation of the instrument, after major temperature changes and prior to precise height measurements.
These determinations are especially important due to the fact that the measurement is carried out only in the 1st telescope position in order to save time.

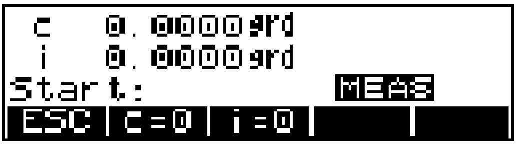
☞ **Tip**

Before starting this procedure, precisely level the instrument using the level.

To determine the corrections, sight a clearly visible target in **Hz** and **V** from a distance of approx. 100 m. The sighting point should be close to the horizontal plane (in the range V = $100^{\text{grads}} \pm 10^{\text{grads}}$).

MEAS to trigger measurement in the 2nd telescope position

c=0, **i=0** Setting of values c = i = 0.



The current **c** and **i** values are displayed in the readings window.

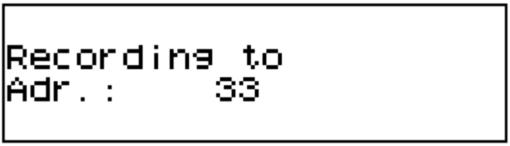
c sighting axis correction
i vertical index correction

MEAS to trigger measurement in the 1st telescope position

new to confirm the new values / to record

old to confirm the old values

Display of results and recording



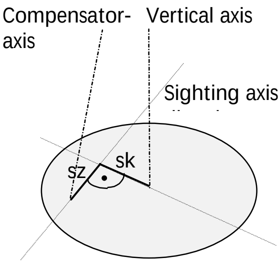
☝ **Attention !**

During the computation of the vertical index and sighting axis correction, the program also determines the compensator run centre.

If either the **c** or **i** value exceeds the admissible range of ± 50 mgrads, the error message appears. The values are not saved, and the menu for new calculation is displayed again.

☝ **Attention !**

If the values remain outside the tolerance range, despite accurate sighting and repeated measurement, you should have the instrument checked by the service team.



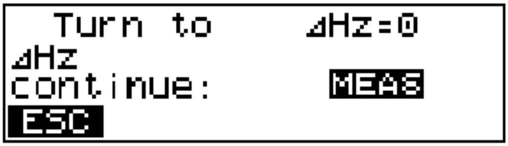
The Trimble 3300 features a compensator that <u>compensates</u> any vertical shaft inclinations remaining <u>after</u> instrument levelling in the sighting axis direction.
To check the compensator, its run centre should be determined at regular intervals and in particular prior to precise height measurements.

MEAS to start measurement in the 2nd telescope position

sz component in sighting axis direction

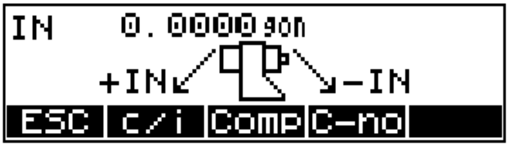
→ to turn Hz = 0

MEAS to trigger measurement in the 1st telescope position



Display of results and recording:

ESC to quit the adjusting menu



☝ **Attention !**

For the accurate determination of the run centre, it is essential that the liquid in the compensator is allowed to settle, i.e. any vibration of the compensator must be avoided.

8 Annex

The annex contains a compilation of symbols, keys, formulae, constants and error messages as well as explanations of concepts used for the Trimble 3300 Routine Total Stations.

Furthermore, it gives an overview of the technical data and instructions for maintenance and care of the instrument.

		Setting the measuring mode:
HD		Measurement of reduced distances
xyh	yxh	Coordinate measurement, sequence X,Y, h Coordinate measurement, sequence Y,X
neh	enh	Coordinate measurement, sequence N,E Coordinate measurement, sequence E,N
SD	HzV	Measurement of slope distances Measurement of Hz direction and V angle
Hz=0		Setting the Hz direction to Hz=0
HOLD		Clamping the Hz direction for electronic circle orientation
END		Ending a function
th/ih		Input of reflector, instrument and station heights
th		Input of reflector height
ih/Zs		Input of instrument and station heights
→1	→2	Calling page 1 of the measurement menu Calling page 2 of the measurement menu
		Changing the distance unit:
m	ft	to meters/entry of scale to feet
		Changing the angle unit:
gon	DMS	to grads to DMS (degrees, minutes, seconds)
deg	mil	to decimal degrees to mils
V %		Display of the height angle in %
V↙∣		Display of the zenith angle (V=0 at the zenith)
V↗∣		Display of the vertical angle (V=0 at the horizon, 0 < V < 400 grads)

V⊿⊥⊾	Display of the height angle (V=0 at the horizon, -100 < V < 100 grads)
→Hz ←Hz	Setting the Hz counting direction to clockwise Setting the Hz counting direction to anticlockwise
CHCK	Calling the checking and adjustment menu
ESC	Terminating a function, quitting a submenu
↑ ↓	Selecting the next upper line in the bar menu / in the internal memory Selecting the next lower line in the bar menu / in the internal memory
← →	Setting the cursor one character backward Setting the cursor one character forward
+ -	Incrementing a value Decrementing a value
MOD	Modification of the displayed value
o.k.	Confirmation of an entry
YES NO	Acceptance of an option Rejection of an option
c/i	Calling the function for the determination of the collimation and vertical index correction
Comp	Calling the function for the determination of the compensator run centre correction
C-on C-off	Deactivating the compensator Activating the compensator
old new	Retaining the old value Entering the new value
Rept	Repeating the process
i=0	Setting the vertical index correction to i=0
c=0	Setting the collimation correction to c=0

A **B** **C**	Activating the reference point A, B, C
P	Activating the new point P
A=S **B=S** **C=S**	Using the station coordinates as reference point coordinates
P=S	Using the station coordinates as the coordinates of the new point
A=P	Using P as the new reference point A (connecting distance)
y **x** **e**	Input of a distance (in the Vertical Plane program)
hSet	Setting the reference height (in the Vertical Plane program)
ZSet	Setting the reference height Z (in the Object Height program)
xSet **ySet** **nSet**	Setting the reference direction: (in the Vertical Plane program) (in the Vertical Plane program) (in the Vertical Plane program)
A-P **P-P**	Referring the connecting distance to: the reference point A the last point used
Inp	Input of a value
m	Calling the scale entry (in the Coordinates programs)
YX **XY** **EN** **NE**	Setting out according to nominal coordinates without height or entry in MEM
YXZ **XYZ** **ENZ** **NEZ**	Setting out according to nominal coordinates with height or entry in MEM

HD **HDh**	Setting out using known setting out elements without with height
Z	Input of a height in the internal MEM memory
Z-j **Z-n**	Changing to setting out: with height without height
Test	Calling the measurement of the setting out points
S-O	Calling the setting out of the next point
Stat	Starting stationing in elevation
S	Input of station coordinates for Unknown Station
Inp	Input of scale for planimetric stationing
Hz	Input of Hz for Known Station
Disp **Del** **Edt**	Display of data lines of the memory Deletion of data lines of the memory Changing the point number and point code of a data line
? **?P** **?C**	Search for: data lines in the memory a point number in the memory a point code in the memory
?A	Search for an address in the memory
?↓	Continue search according to the same criterion
all	Selecting all data lines of the memory

MEAS	First function Starting a measurement
ON	First function Switching the instrument on
ON *OFF*	Second function Switching the instrument off
ON *	Second function Illumination ON/OFF
ON *EDIT*	Second function Calling the memory
ON *PNo*	Second function Calling the input of point number and code
ON *MENU*	Second function Going to the main menu
ON *TRK*	Second function Starting the tracking function

A

Addition constant	Addition value for distance measurement, default 0.
Addition correction	Correction of the addition value (‘’addition constant’’) of the distance measuring instrument, e.g. if using prisms of other manufacturers.
Alignment	Application program for the determination of any number of points on the straight line AB.

B

Backsight point BP	A point with known coordinates used for the station point determination and/or for *orientation.*
Bearing angle	Hz bearing orientated to a reference bearing (generally to grid north).
Bearing (Hz)	Value read in the horizontal circle of the instrument, whose accidental orientation is determined by the zero position of the graduated circle.

C

Calibration scale	Influences systematically the distance measurement. Best possible adjustment to 1.0 by the manufacturer. Without influence on all other scale specifications.
Code, code number	Reference number for the point description, characterises certain point types.
Compensation	Automatic mathematical consideration of the *vertical axis inclinations* measured with the *compensator* in the sighting direction, in V angle measurements.
Compensator	Used to determine the current vertical axis inclination in the sighting axis direction, can be deactivated and activated again, as required; a graphical symbol in the information menu displays the activated compensator.

Compensator run centre
Electronic centre of the clinometer in sighting axis direction.

Connecting distance
Spatial distance, plane distance and height difference between 2 target points.

Control point
Point for checking the *orientation* of the instrument. It is defined at the beginning of a measurement and can be measured at any time for checking.

Coordinates
Measuring program for the determination of points in a higher-order coordinate system.

D

Default
Standard value for an instrument setting.

Distance measuring mode
Depending on the purpose of application, the distance measurement is to be selected by pressing the MEAS key in the normal mode or the continuous distance measurement (tracking) is to be selected by pressing the ON+TRK keys simultaneously.

E

Error limits
Limit values which can be set by the user for certain readings or results.

F

G

H

Hardkeys
See key functions.

Height stationing
The height of the station point is derived from measurements to known height points.

Hz circle orientation
A predefined horizontal bearing value is allocated to the sighting direction to a measurement point.

Hz collimation correction
(also called collimation or sighting axis correction) Correction of the deviation of the sighting axis from its required position right-angled to the

	trunnion axis. Determination by measurement in two positions, automatic correction in the case of measurements in one position. **I**
Incrementing	(increment = interval) Automatic counting of the point number (increase by 1) after the measurement.
Instrument height	Height of the telescope trunnion axis above the station height (ground point).
Interface	Contact point between 2 systems or system areas, in which information is interchanged according to defined rules.
	K
Key functions	First and second functions; for switching the instrument on, starting the measurement, switching off, illuminating the display, calling the memory, entering PI and going to the main menu, starting of tracking.
	L
Levelling	Vertical adjustment of the vertical axis of the instrument; the levels of the instrument are centred by turning the tribrach screws. The levelling can be checked by means of the digital display of inclinations after pressing the softkey **CHCK**.
	M
Measuring mode	In the measurement menu, the following measuring modes can be selected: HzV display in the theodolite mode HD display of reduced distance and height difference yxh local rectangular coordinates SD display of the original readings

O

Object height	Determination of the height of points to which a direct distance measurement is impossible, by means of an angle measurement.
Orientation	When orientating the instrument, the *bearing angle* of the zero of the graduated circle Omega (Om) is calculated. For this purpose, measurements to a *backsight point* can be made or the *bearing angle* of a known point can be entered.
Orthogonal lines	Application program to check lines for orthogonality, setting out right angles and especially for measurements in the case of visual obstacles.

P

Parallel lines	Application program to check the parallelism of straight lines or for setting out parallels with only one point given.
Point identification	Identification of the measured point by a maximum of 12 characters for the point number and up to 5 for the point code.
Point number/Point code	Part of the point identification.
Point-to-line distance	Application program for the determination of rectangular coordinates of any point in relation to a straight line defined by the points A and B.
Polar point determination	Determination of the coordinates and height of new points by distance and bearing measurement.

Q

	R
Recording mode	Selectable in the menu Interface/Recording: Off no recording MEM/1 Recording of measured data sets in MEM (not for Trimble 3306) MEM/2 Recording of computed data sets in MEM (not for Trimble 3306) MEM/3 Recording of all data sets in MEM (not for Trimble 3306) V24/1 Recording of measured data sets through V24 V24/2 Recording of computed data sets through V24 V24/3 Recording of all data sets through V24
Reference point	Used here as reflector station for the indirect height determination.
Reflector height	Height of the reflector (prism centre) above its station (ground point).
Refraction coefficient	Measure for the light-beam refraction in the atmosphere; can be set by the user.
Run centre	See *Compensator run centre.*
	S
Scale	With a *scale,* the measured distance is varied proportionally to the length and can thus be adapted to certain marginal conditions. There exist a series of direct and indirect scale effects: *calibration scale*, *projection reduction*, *height reduction, reticle scale.*
Softkey	Function key which has several functions in dependence on the program.
Standard measurement menu	The determination of points takes place within the local measuring system. The station of the instrument with the coordinates (0,0,0) represents the zero point of this system of coordinates. The *orientation* is determined by the zero direction of the Hz circle. The data are fitted in a given system

of coordinates (Trimble 3306) only during the further processing (possibly in the office) or a stationing is carried out in order to measure in a given system of coordinates.

Standard settings	Values set by the manufacturer for all configuration parameters.
Stationing	Precedes any determination of points in a defined system of coordinates. Consists in the station point determination and/or calculation of the orientation of the graduated circle: Stationing on a known or unknown point (free stationing), height stationing (height only).
Stationing on a known point	Given: Station point coordinates / backsight bearing. The *scale* and the *orientation* of the graduated circle are derived from the measurements to known *backsight points.*

T

Tracking	Continuous measurement of angles and distances. Hz and V values are constantly measured and displayed. Set permanent measurement for distance measurements.

V

Vertical axis inclination	The inclinations of the vertical axis of the instrument in sighting axis direction are measured with the *compensator*, indicated digitally and can be requested on the display.
Vertical plane	Application program for the determination of points in a vertical plane by means of an angle measurement.

W Z

	Trimble 3303	Trimble 3305 Trimble 3306
Accuracy as per DIN 18723		
Angle measurement	1.0 mgrad (3“)	1.5 mgrads (5“)
Distance measurement	3 mm+3 ppm	5 mm +3 ppm
Telescope		
Magnification	26 x	
Aperture	40 mm	
Length	193 mm	
Field of view at 100 m	2.9 m	
Shortest sighting	1.75 m	
Special features	variable reticle illumination, integrated sun shield	
Angle measurement		
Hz and V circles	electronic absolute,	
Measuring units	360° (DMS, DEG), 400 grads, 6400 mils	
Vertical reference systems	zenith, height and vertical angle, slope in percent	
Least display unit (selectable)	1´´/2´´/10´´	
	0.0005°/0.002°0.005°	0.0005°/0.001°0.005°
	0.2 / 1 / 5 mgrads	0.5 / 1 / 5 mgrads
	0.01¯/0.1¯/0.5¯	
Distance measurement		
Method	electro-optical, modulated infrared light	
Transmitter/Receiver optics	coaxial, in telescope	
Measuring units	alternate display of results in m/ft	
Measuring time		
Standard	< 3.0 s	
Tracking	1.0 s	

	Trimble 3303	Trimble 3305 Trimble 3306
Measuring range		
with 1 prism	1500 m	1300 m
with 3 prisms	2000 m	1600 m
Levelling		
Circular level	10’/2 mm	
Tubular level	30“/2 mm	
Compensator		
Type	uniaxial compensator	
Working range	5’/100 mgrads	
Accuracy	1,5“	
Clamps and tangent screws	coaxial, parallel axes	
Optical plummet		
Magnification	2 x	
Shortest sighting distance	0.5 m	
Display screen	4 lines with 21 characters each, graphic capabilities (128 x 32 pixels) display illumination	
Keyboard	7 keys, display-oriented	
Measuring menu	Hz-V/SD-Hz-V/HD-Hz-h/y-x-h setting, input, adjustment	
Application programs (supported by graphics)	connecting distances, object height measurement, vertical plane, point-to-line distance, orthogonal lines, parallel lines, alignment	

	Trimble 3303	Trimble 3305 Trimble 3306
Coordinates programs (supported by graphics)		
	unknown station, known station, stationing in elevation, polar points, setting out	
Recording		
	internal data memory (approx. 1900 data lines)	-
	externally via RS 232 C/V24 interface switchover in the menu interface/recording, slip ring on stationary base	
Power supply		
	NiMH battery pack 6 V/1.1 Ah; sufficient for approx. 1000 angle and distance measurements	
Operating temperatures		
	-20°C to +50°C	
Dimensions		
Instrument (WxHxD)	173 x 268 x 193 mm	
Trunnion axis height with DIN centring spigot/	175 mm	
Wild centring	196 mm	
Weights		
Instrument incl. battery and tribrach	3.5 kg	
Case	2.5 kg	

Electromagnetic Compatibility (EMV)

Die EU Conformity Declaration confirms the perfect function of the instrument in an electromagnetic environment.

☝ **Attention !**

Computers connected to the Trimble 3300 which are not part of the Trimble System delivery, have to meet the same EMV requirements in order to ensure that the overall configuration complies with the applicable interference suppression standards.

Interference suppression as per:
EN 55011 class B

Noise immunity:
EN 50082-2

☞ **Tip**

Strong magnetic fields generated by mid and low voltage transformer stations possibly exceed the check criteria. Make a plausibility check of the results when measuring on such conditions.

Battery Charger LG 20

Battery Management

Electrical and thermo-mechanical fuses protect instrument and battery during the operation and the battery during the charging process.

Change of battery after warning:
connect a charged external battery and remove the empty internal battery from the instrument (or vice versa for empty external battery). Switch the instrument off for as long as the power supply is interrupted for the battery change.

Technical Data

Universal charger for NiCd/NiMH cells of safety class II with
nominal capacity: 0.5 Ah to 7 Ah.
input: 230 V ± 10 % 50 Hz or DC 12 V
output: 9.00 V; 800 mA or 2000 mA DC, resp.

Safety Notes

☝ **Attention!**

Please, read and observe these operating instructions before using the LG 20!

Protect the LG 20 against humidity, use it in dry rooms only.

Only the service or authorised specialists are allowed to open the LG 20.

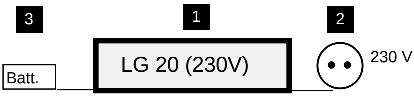
Charge temperature range: 5° to 45°C; optimum: 10° to 30°C.

Charge parameters (nominal charging time, charging current) set automatically by a coding resistor (in battery pack) ⇒ no overcharging, protection of instrument and battery.

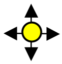
For operating the LG 20/1 with a 12 V battery, the cable (70 84 10 - 000.000) with integrated fuse link delivered by the manufacturer is to be used unconditionally!

Charging the Battery

Connect the power source with the battery as demonstrated in the following picture. Note, that the voltage of the charging unit is identical with the power source.

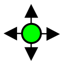


Start charging



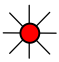
LED flashing 3x yellow
Starting

Charging procedure



LED flashing green (max. 1.5 h)

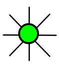
Charging of a fully charged battery: the charging process is stopped after approx. 5 minutes. If the temperature is too high or too low the charging process is stopped automatically



LED permanently red

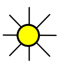
the charging process is stopped; if the charging temperature range is reached again the charging process is resumed

End of charging process



LED permanently green
Trickle charge

> ☞ **Tip**
>
> The batteries cannot be overcharged.



LED permanently yellow
Stand-by mode (no battery connected)

Computational Formulae for Angle Measurements

V angle measurement

$$\mathbf{V_k = V_o + i + SZ_a}$$

V_o = uncorrected V circle reading
i = index correction
SZ_a = current vertical axis inclination in the sighting direction

Hz bearing measurement

$$\mathbf{Hz_k = Hz_o + Hz_1 + A}$$

Hz_o = uncorrected Hz circle reading
Hz_1 = $c/\sin(Vk)$ - collimation correction
A = circle adjustment for orientation

Computational Formulae for Distance Measurements

$$D_k = D_0 \cdot M_i + A$$

D_k = corrected distance
D_0 = uncorrected distance
A = addition constant
M_i = influence of meteorological data

Influence of meteorological data:

$$M_i = (1 + (n_0 - n)\, 10^{-6}) \cdot (1 + (a \cdot T \cdot T)\, 10^{-6})$$

n = current refractive index
= (79.146 · P) / (272.479 + T)
n_0 = reference refractive index = 255
P = air pressure in hPa or torr or in Hg
T = temperature in degrees C or degrees F
a = coefficient of vapour pressure correction
= 0.001

carrier wavelength	0.86 microns
modulation wavelength	20 m
precision scale	10 m

Reduction Formulae

Slope distance SD

Distance between the instrument´s trunnion axis and the prism. It is computed from the measured slope distance and the entered scale:

$$\mathbf{SD = D_k \cdot M}$$

$SD =$ displayed slope distance
$D_k =$ basic distance
$M =$ scale

Horizontal distance HD

$$\mathbf{HD = (E_1 + E_2) \cdot M}$$

$HD =$ displayed horizontal distance

$E_1 = D_k \cdot \sin(Z + R)$
$R =$ influence of refraction
$= 6.5 \cdot 10^{-7} \cdot D_k \cdot \sin(Z)$
$E_2 =$ influence of earth curvature
$= -1.57\ 10^{-7} \cdot dh \cdot D_k \cdot \sin(Z)$
$D_k =$ corrected slope distance
$Z =$ measured zenith angle [grads]
$M =$ scale

Difference in elevation h

$$\mathbf{h = dh_1 + dh_2}$$

$h =$ displayed difference in elevation

$dh_1 = Dk \cdot \cos(Z)$

$dh_2 = (Dk \cdot \sin(Z)) \cdot (Dk \cdot \sin(Z))\ 6.8 \cdot 10^{-8}$

= influence of earth curvature and refraction (k = 0.13)

Distance reduction to MSL

Distances measured at elevation Z can be reduced to MSL by computing the following scale outside the instrument (computation formula applies to all earth radii):

$$m = R / R + Z$$

$$S_2 = S_1 \cdot m$$

R	= earth radius (6370 Km)
Z	= elevation above MSL (Km)
S_1	= measured distance at elevation Z
S_2	= reduced distance at MSL

If this scale is entered into the Elta® R, the computed distances are reduced directly in the instrument.

Verifying on Calibration Distances

Basically, all measured distances are corrected with reference to:
the entered scale,
the entered addition constant,
the influence of pressure and temperature,
internal influencing variables.

☝ **Attention!**

Prior to the practical realisation of the calibration measurement, the current values of the parameters scale, addition constant, pressure and temperature are to be entered. The scale is to be set to default: 1.000000. This is to secure that all corrections are made completely and perfectly. Furthermore, this allows a direct comparison of nominal and actual values in the case of given distances.

If a weather correction is to be carried out externally, the temperature must be set to 20°C and the air pressure to 944 hPa. Then, the internal correction goes to zero.

Prism and Addition Constants

All total stations Zeiss Elta series, in combination with their reflectors are adjusted with the **addition constant 0.000**.

In case of measurements to reflectors of other manufacturers, a possibly existing addition constant can be determined by measurement and entered.

Another possibility consists in calculating an addition constant by means of the known prism constant of the reflector used and entering it. This prism constant is calculated as function of the geometric value of the prism, the type of glass and the place of the mechanical reference point. The prism constant for Zeiss reflectors determined that way is **-35 mm**.

Relation between the addition constant Acz for Zeiss Elta instruments, the prism constant Pcz for Zeiss reflectors and the prism constant P_f for other manufacturers:

$$A_{CZ} = P_F - P_{CZ}$$

Example:

Zeiss reflector P_{CZ}	prism constant = -35 mm
Foreign reflector P_F	prism constant = -30 mm

Addition constant for Zeiss Elta instruments in connection with this

foreign reflector A_{CZ} = + 5 mm

In this case, in the Trimble 3300 the addition constant + 0.005 m is set.

Error Message		What to do
001	ROM error	It is not advisable to continue the measurement as all basic settings of the instrument may have been changed.
002	RAM error	
003	Data EEPROM was initialised	
005	Data EEPROM error	
40 - 59	Error in dist. measuring unit	If this error occurs repeatedly, please inform the service.
201	No Compensator	Time Out in contact with the Compensator Call the service
202	Compensator oper. range exceeded	Compensator range of 5' exceeded
203	No Compensator-Value	No measurement possible – instrument inclination to big
204	No Angle Sensor	Time Out in contact with the angle sensor Call the service
205	No Initialisation Angle Sensor	No Initialisation of the angle sensor Call the service
206	No Angle Value	No angle measurement possible, to fast movement in angle tracking The digits are replaced by dashes
207	Data-EEPROM Error in writing	Error in reading or writing EEPROM of the angle sensor or compensator It is possible that there are changed important settings Call the service
208	Data-EEPROM Error in writing	
209	Data-EEPROM Error in reading	
210	Daten-EEPROM Error in reading	

Code	Message	Remedy
211 **212**	Error Communication Error Communication	Error in communication with the angle sensor or compensator, call the service
410	MEM not initialised!	Initialisation can only be performed by service staff
411/ **412**	Defect in system area	Work with the data memory is not possible, call the service
413 **415** **416**	Defect in system area, reading is possible MEM reading error MEM writing error	In the event of error messages 413...416, try to save the content of the data memory by transmission to the PC. If the error occurs again when recording is repeated, call the service. .
417	MEM is full	Read out the memory content, delete the memory.
418 **419**	Pointcode or Point-number not found	Correct the entry.
581 **584** **586** **587** **588**	Transmission error (in data transmission) Transmission time out (in XON/XOFF protocol) Transmission time out (in XON/XOFF Rec 500 protocol) I/O time out, Rec 500 protocol REC 500 protocol error	If the general recording errors 518...588 occur, first try to repeat recording. If the error occurs again, check the interface parameters, the cable and the recording program at the other end.

> ☞**Tip**
>
> If the warning "inadequate geometrical conditions" is ignored in the application programs, the last digit of the displayed values is replaced by 3 dots.
> If a recording error occurs, the last data line has usually not been transmitted.

Before you call the service

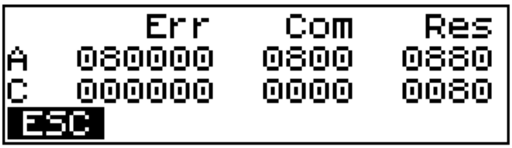
Before you contact the service please notice the following service menu information. This information is very important to analyse the instrument errors.

ON *MENU*

Update/Service

YES Go to Menu

Service



Instructions for Maintenance and Care

Instrument	Allow sufficient time for the instrument to adjust to the ambient temperature. Use a soft cloth to remove dirt and dust from the instrument. When working in wet weather or rain, cover the instrument during longer breaks with the protective hood.
Object lens and eyepiece	Clean the optics with special care using a clean and soft cloth, cotton wool or a soft brush, do not use any liquid except pure alcohol. Do not touch the optical surface with the fingers.
Prisms	Steamed prisms must have sufficient time to adjust to the ambient temperature. Remove afterwards the moisture using a clean and soft cloth.
Transportation	For transportation over long distances, the instrument should be stored in its case. When working in wet weather, wipe the instrument and case dry in the field and let it dry completely indoors, with the case open. If, for the purpose of changing the station, the instrument with the tripod is transported on the shoulder, please make sure that instrument and person will not be damaged or injured.
Storage	Let wet instruments and accessories dry before packing them up. After a long storage, check the adjustment of the instrument prior to use. Observe the boundary values for the temperature of storing, especially in the summer (interior of the vehicle).

Keeping the Measurement System in the Case

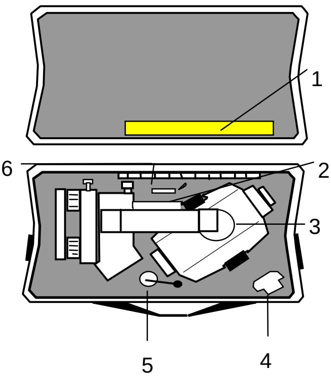


Fig. 1: Instrument case

1	Protective hood
2	Adjusting tools: Pin for adjusting the optical plummet, Pin for adjusting the clamping power of the tripod legs
3	Instrument
4	Battery
5	Plumb line
6	Operating instructions

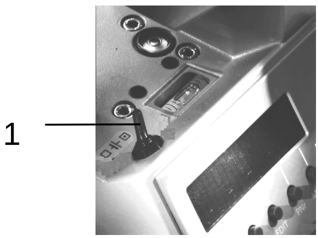
Using the Instrument in the Low Temperature Range to -35°C

For surveying in extreme climatic conditions, a version of the instrument suitable for an extended temperature range to -35° is available, broadening the operative range of the Routine Total Stations considerably as far as seasons and geographical features are concerned.

Due to the heated display, the instrument works just as in the normal temperature range. The required heating energy is provided by the external battery.

For operations in low temperatures change switch 1 over to external battery •□

(external battery) •□ ╂├ ⊡ (internal battery)



The heating switches on automatically at about -10°C.if the instrument is connected with the external battery.

The external battery provides energy for about 8 hours at -35°C.

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