Trimble 3600 Zeiss Elta

Basic & Expert Software User Guide

Part no.: 571 703 011

1 Trimble 3600 The System

2 First Steps

5 Advanced Applications

6 Data Management

7 Adjustment

8 Configuration

9 Annex

This chapter gives you an overview of the **C**ontrol **U**nit Zeiss Elta.

It describes the operation and controls of the instrument with the Control Unit as well as the sensors and peripheries which are a special feature of the Trimble 3600 Total Stations.

Operation

Software Overview

Switching the instrument on and off

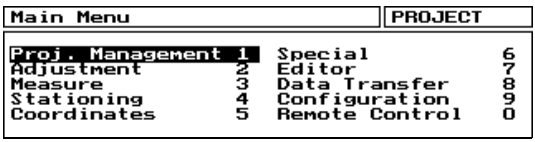
Switching the instrument on

When you press the PWR key, the startup logo is briefly displayed:

Display of

- Instrument type
- Instrument serial no.
- Software release data

Unless otherwise defined in the configuration, this is followed by the display of the main menu of the Trimble 3600 Zeiss Elta software:



The project last processed is loaded and displayed. If there is no project stored on the data drive D:\DATEN on the PC, a project named "NONAME" will be automatically opened.

Use ↑ ↓ ← → to select the application and press ↵ to start the program.
A shorter way is to use the hotkey numbers 1 - 0 to start the application directly from main menu.

📖 **Configuration**
Instrument
On/Off Configur.

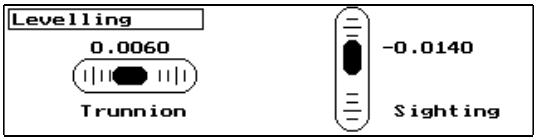
The instrument configuration permits you to define which functions should be executed after the PC is booted or which menu should be directly accessed by the program. There are two options:

Station Input

After starting the application *Measure* (in a local system) the program goes directly to the station input with input parameters like point identification, instrument height, reflector heigt, temperature, air pressure or type of prism.

Levelling

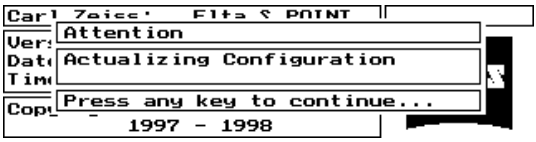
After loading the Trimble 3600 software the program goes automatically to the levelling menu.



Press any key to exit this menu.

Hard- and Software Scan

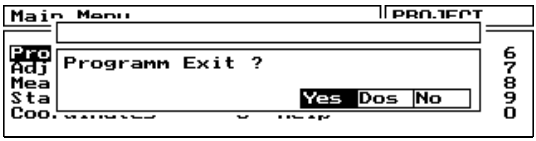
Starting the program checks automatically for all necessary Hard- and Software Components are rightly installed and set. If not, a message like this appears:



e.g.: Missing configuration data.
Default values will be set.

Switching the instrument off

Esc in the main menu to quit the program after answering the inquiry:



Yes Quitting the program; the instrument is automatically shut off.

DOS Quitting the program, back to the Trimble 3600 System Control Menu.

No Return to the main menu.

Trimble 3600 **System Control Menu**

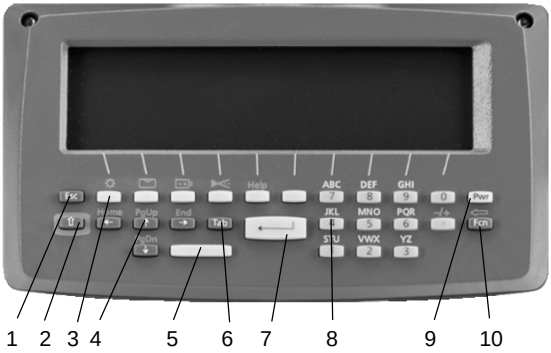
The following actions are possible from this control menu:

Trimble 3600	Starts the Software
Remote Service	Update Service Program
DOS	Change to the MS-DOS® Prompt D:\ELTAC\BIN>_
C_xxxxxx	Calls up an installed API Program (xxxxxx = Name)
OFF \ AUS	Switches the instrument off.

Attention !

A change to the MS-DOS® prompt from the System Controller needs to change another keyboard mode.

Zeiss Elta® keyboard



Dual assignments (yellow function keys) can be activated with the shift key (2).

Keys and their functions

Esc 1 Escape
Quitting program levels

⇧ 2 Shift
Dual assignment switchover

3 Function keys
Instrument Control and Softkey activation (in the display above)

4 Cursor keys
Cursors positioning

5 Space key
Space and selector key

Tab 6 Tabulator
Selector and tab key

7 Enter key
Confirmation and trigering of measurement

4 8 Numeric block
Alphanumeric Input

PWR 9 Power key
Switching the instrument on

Fcn 10 Function key
Softkey activation in the measurement programs

Instrument Control

Further key functions

The yellow signed symbols above the function keys 1-6 are used for controlling of significant instrument switches and parameters and can be activated pressing Shift + key:

📖 **Annex**
Symbols and keys

 Illumination Crosshair + Display On / Off

 Instrument Levelling

 Battery Control

 PositionLight On / Off

Help Online-Help

 EDM Mode

 Laser Pointer

Alphanumeric Input

⇧ 7 7 = „**B**“
press shortly Shift + 2x

7 7 7 7 = „**7**“
press shortly 4x

The keys 1-9 have multiple assignments for entering numbers and letters as well. Capitals can be activated by simultaneous pressing of the ⇧ Shift key. Multiple pressing of the key in an input field displays the 4 characters associated to the key. At first the alpha characters will be displayed following by the key number. The exception is pure numeric fields (as defined in the Marking) where only the number is displayed.

📖 **Configuration**
Markings

Throughout the software, the keys will be automatically assigned (e.g. Target height input is only possible in numerics).

📖 **Configuration**
Instrument
Switches
Alphanumeric Input

The frequency of multiple key pressing for the alphanumeric input can be configured user optimized in the instrument configuration.

Softkeys

In every measurement menu the lower display row is filled with softkeys. They can be activated (deactivated) by pressing the F key and can be switched by the 6 function keys below and the keys 7 8 9 and 0 .

The key 0 is for toggling the next available softkey row (→1 / →2 / →3).

☞ **Importand Note**

If the Softkeys are activated, the numerical key block for entering an alpha-numerical point identification is locked. Press Fcn again to unlock.

Graphic display

The display is a LCD screen with 320 x 80 pixels in the display window.

📖 **Configuration**
Instrument
Switches

You can switch on the display and the crosshair illumination using either the illumination switch or the hotkey

☞ **Tip**

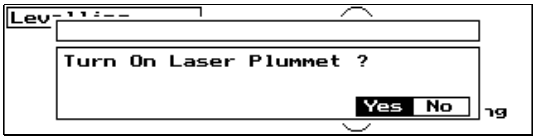
Contrast variation is also possible.

Laser Plummet (Option)

The Laser Plummet is used to center the instrument over a station point. The plummet is a Laser Pen with an additional optical element which illustrates a center circle on the ground. The instrument has to be moved on the tripod head for centering over the station point.

The Laser Center Cirlce has a diameter of 45 mm at an instrument height of 1,5 m.

The Laser Plummet can be switched on from the configuration menu or calling up the levelling menu of the Instrument.



Yes The Laser Plummet is switched on until exit the levelling menu.

No No switch on.

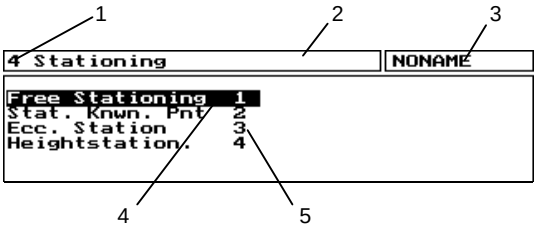
Attention!

Never look directly into the laser beam!
Please read the given warnings and hints for laser beam safety in this chapter.

Menu guidance

Menus support the user at any stage of the program.

Options menu

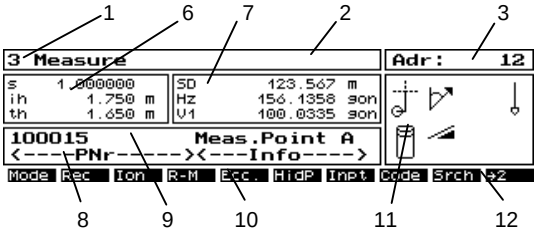


Key:

1 Menu number
2 Menu title
3 Project name or address
4 Selection cursor
5 Option + number
6 Additional data
7 Meas./comp.values
8 Marking
9 Point identification
10 Function keys
11 Status symbols
12 Next row of function keys

To select an option, use either the selection cursor plus [↵] or the appropriate hotkey for the option number.

Measurement menu



Switch on/off the function keys with [Fcn].

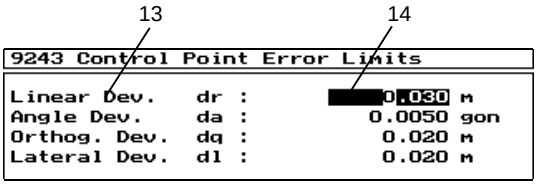
[ ] 1-6 for the first 6 Softkeys.

[7] [8] [9] [0] for Softkeys 7-10.

[Tab] and [↑] for navigation between the input fields for PI and target height .

[↵] or [●] to start the measurement.

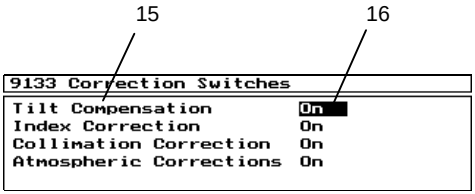
Input menu



 can be used in the input field.

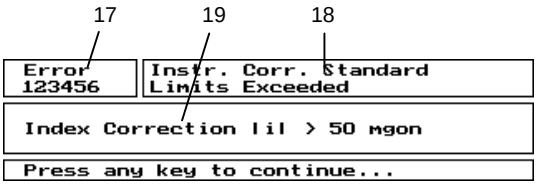
 ends the entry.

Switch menu



For toggling, use the  (space bar) key in the switch field.

Error messages in the display



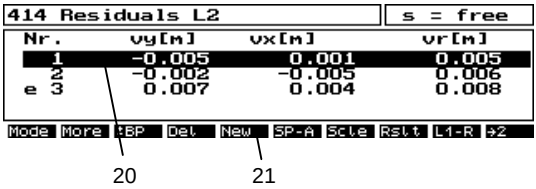
Key:

13	Input option
14	Input field cursor
15	Switch
16	Switch field
17	Error number
18	Error type
19	Error information

Lists

Key:

20 List cursor
21 Function keys



↑ ↓ PgUP PgDn for scrolling.

All 10 Softkeys are activated automatically in the list menu.

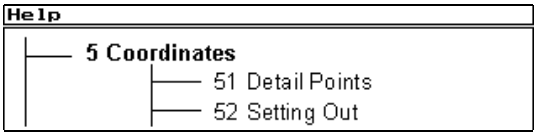
Quitting the menu

You can quit all menus with Esc. If any entries have been made or edited, an inquiry is first displayed as to whether the changes should be saved.

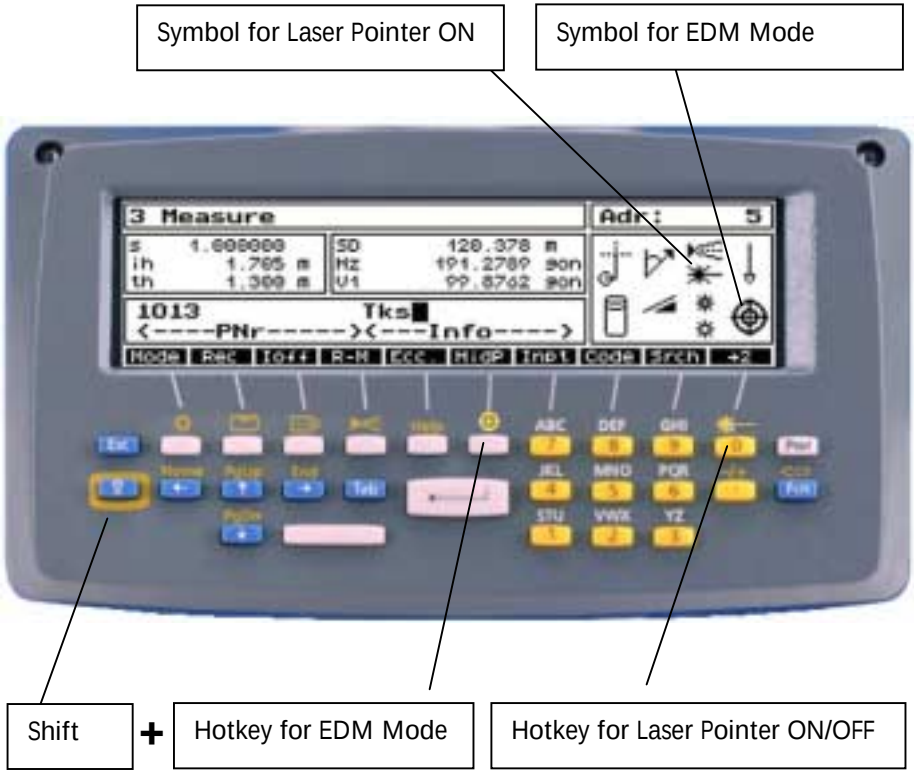
Help function

The integrated on-line help is available in all program parts. The help function will be called using the hotkey

⇧ + **Help** at any point of the program.



Distance Mode (Option 3600 DR)



☞ Note

Laser Pointer and EDM mode switches via Hotkey are only possible in measurement menus.

Default EDM Mode:
Prism Mode

☞ Note

After instrument start the EDM Mode is set to Prism Mode PM.

SwtP Configuration Instrument Periphery Switches.

EDM Mode:

DR = Direct Reflex Mode
PR = Prism Mode

Switches

In the Configuration Menu the EDM functions can also be switched ON or OFF. Enter to configuration menu **9132** or use the softkey **SwtP** in the measurement menus:

Use space key to toggle

Press ↵ to save settings.

In measurement menu the actual settings are displayed in the instrument status window.

The following EDM modes are possible:

Direct Reflex mode.
The „reflectorless“ mode.

Direct Reflex mode.
The reflector „high power“ mode.

Prism mode.
The reflector mode.

In measurement menus the EDM Mode can be switched using the hotkey

⇧ + .

The Laser Pointer can be switched ON/OFF using the hotkey ⇧ +

EDM Mode and reflector typ

Inpt Input Menu

The EDM modes are combined with reflector types set in the Input Menu of the measurement program. To enter this menu, press **Fcn** to activate the softkeys and press softkey **Inpt**:

```
Input of Parameters
R.Type: Normal      Temp. :      6 °C
Refl. :    1.300 m
Inst. :    1.705 m  Press :    969 hPa
                    PrismC:    -30 mm
Scale : 1.000000    ppm   :      0
```

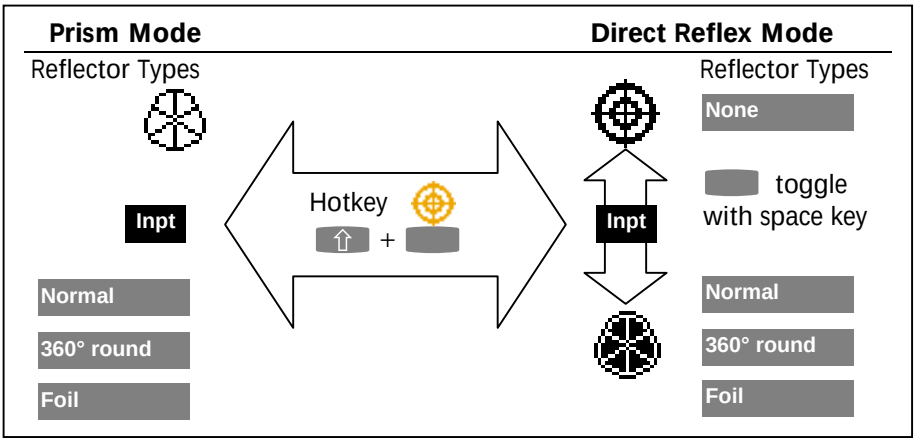
Use [ ] space key to toggle between reflector types Normal Prism, 360° round Prism, Foil and None Reflector.

Press [↵] to save settings.

☞ **Note**

If Prism Mode is set, only one of the three reflectors can be selected. A „None reflector“ type can be activated only in EDM DR mode.

The last used mode will be stored and activated again after reload the program.



When using EDM Modes ?

Direct Reflex Mode (reflectorless)

When measuring without prisms or other reflectors. The prism constant and reflector height is set to Zero (default). If needed both values can be changed in the Input Menu for the „None“ reflector type.

Measuring Range: 1,5 ... 80 m (depending on the object surface and light conditions)

Prism Mode

When measuring to prisms or other reflectors like foil. The prism constant and reflector height refers to the actual selected reflector type and can be changed in the Input Menu.

Measuring Range: 0 ... 2500 m (for one prism)

0,5 ... 100 m (for foil reflector)

Direct Reflex Mode (prism high power)

When measuring to prisms or other reflectors at large distances or bad weather conditions. The prism constant and reflector height refers to the actual selected reflector type and can be changed in the Input Menu.

Measuring Range: 1000 ... 5000 m (for one prism)

0 ... 500 m (for foil reflector)

> ☛ **Note**
>
> Prisms should be measured in Prism Mode, because the EDM is then not so sensitive to disturbing influences and has the highest accuracy.

Direct Reflex Distance Measurement

📖 Appendix
Technical Data

EDM Modes: 

The values given in the technischen Datenblatt concerning accuracy, range and measurement time depend on the following effects:

- Atmospheric influences (sight conditions, rain, wavering heat)
- Radiation of the sun at the aim
- Disruption of the beam by moving objects

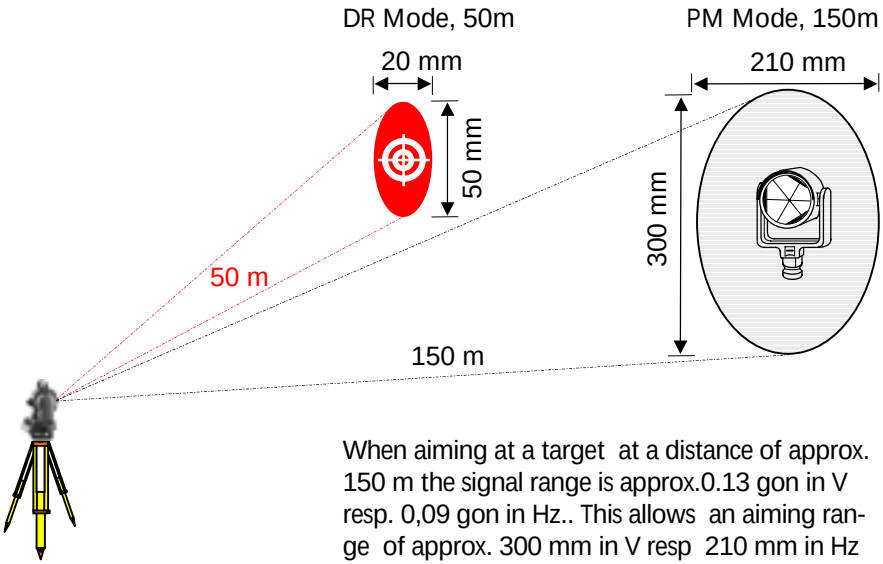
To ensure a maximum result in distance measurement a time out (of the measuring time) has been set to max. 50 secs. This way even at bad conditions greater distances can measured. Usually however a measurement takes 2 seconds.

☛ Tip

If there are unfavourable sighting distances or measuring conditions , you should await the time – out of the measurement. Every measurement taken within that time matches the accuracies granted for this mode of measurement.

The range of unambiguity of an indicated measurement covers up to 9 km using Prism Mode as well as Direct Reflex Mode.

When measuring in Direct Reflex Mode the following measuring range at the target is significant for a measured distance of 50 meters.



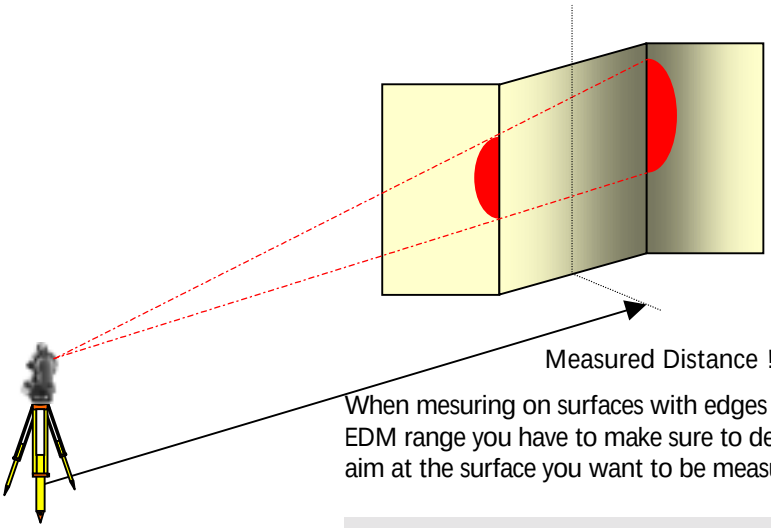
When aiming at a target at a distance of approx. 150 m the signal range is approx.0.13 gon in V resp. 0,09 gon in Hz.. This allows an aiming range of approx. 300 mm in V resp 210 mm in Hz to grant a secure distance measurement. To make sure that there is always enough signal no distance measurement should be taken out of this range.

Attention !

When using Direct Reflex Mode avoid any interruptions of the beam. If the beam is interrupted while measuring (e.g. shortly by moving objects) the mesured distance has to be checked by remeasuring.

DSet Activation of multiple measurement

You can avoid incorrect distance measurement by activating multiple measurement in the measurement program. This is especially advisable when measuring across much used roads.



When mesuring on surfaces with edges within the EDM range you have to make sure to definitely aim at the surface you want to be measured.

☛ Tip

To seperately measure angle and distance or indirectly determine points – „Eccentricity“.

When measuring greater distances the accuracy of the distance measurement depends on the correction of the atmospheric influences such as temperature pressure and humidity. In order to restrict the atmospheric correction to exactly 1ppm (mm/km) temperature has to be determined up to 1°C, pressure up to 4hPa and humidity up to 20% along the measuring section.

🕮 Appendix
🕮 Formulas and constants

The correction formulas are given in the appendix.

☛ Tip

Using Direct Reflex Mode be aware of a minimum distance of 1.5 m. If there are unfavourable conditions you cannot fall short of this minimum distance.

Prism and Addition Constants

The input function for prism constants has been changed with the software version 1.36 (Elta S, Trimble 5600 with Zeiss Elta® Control Unit) and 1.06 (Trimble 3600). The first reason was to have conformity between all total stations in the Trimble Group. The second reason was conformity to the way in which prisms are marked.
Now it is necessary to enter the prim constant, and the addition constant isn't readable.
The calculation and the save function were not modified, only the method used to display.

Prism constants K:

Carl Zeiss :	
KTO	-35 mm
KTR	-35 mm
KTM	-35 mm
Mini prism Kit	-18 mm
360°Prism	- 3 mm
Spectra Precision	
Super prism	0 mm
Prism ring	2 mm

It is necessary to enter the correct value.

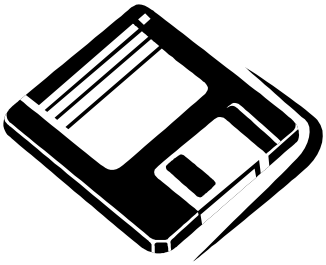
In case of measurements to reflectors of other manufacturers the user has to enter the prism constant and check the correctness by measurements to known distances.

Storage:
The connection between addition constant A and prism constant is shown in the following calculation formula:

$$A = P_F + 35 \text{ mm}$$

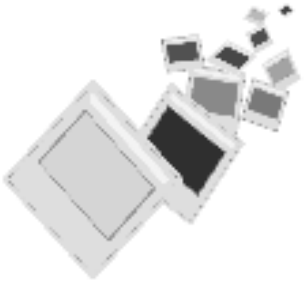
Example:
Foreign reflector prism constant P_F = -30 mm
Addition constant in connection with this foreign reflector A = + 5 mm

Software overview



- **Main Menu**
  - **1 Project Management**
  - **2 Adjustment**
    - 21 Instrument Correction Standard
    - 22 Compensator
  - **3 Measure**
  - **4 Stationing**
    - 41 Free Stationing
    - 42 Stationing on a known Point
    - 43 Eccentric Stationing
    - 44 Heightstationing
  - **5 Coordinates**
    - 51 Detail Points
    - 52 Setting Out
    - 53 Traverse
    - 54 Intersection of Lines
    - 55 Intersection of Arcs
    - 56 Transformation
    - 57 Roadline lite
  - **6 Special**
    - 61 Multiple Rounds
    - 62 Point to Line Distances
    - 63 3D-Plane
    - 64 Area Calculation
    - 65 Connecting Distances
  - **7 Editor**
  - **8 Data Transfer**
  - **9 Configuration**
    - 91 Instrument
    - 92 Programs
    - 93 Marking
    - 94 Codelists
    - 95 Update
  - **0 Remote Control**

Modular structure of the system software



The Trimble 3600 modular software comprises four packages. Thanks to the full MS-DOS® compatibility of the Elta® PC, you can integrate your own software while making allowance for the programming interfaces.

The *Basic* package provides the basis for *Expert*, i.e. *Expert* enhances the functionality.

Basic

The *Basic* software is standard in all hardware packages and offers the following functions:

- Project management
- Adjustment
- Measurement in a local system
- Editor
- Data transfer
- Configuration

Expert

The software with the basic functions for surveying in coordinates.

- Stationing
  - Free Stationing
  - Stationing on a known point
  - Eccentric Stationing
  - Heightstationing
- Coordinates
  - Detail Points
  - Setting Out
- Special
  - Point-to-line distance

The *Expert* module can be optionally enhanced by the *Professional* and *Special* upgrades.

Professional

Professional surveying with

- Coordinates
  - Traverse
  - Transformation
  - Intersection of Lines
  - Intersection of Arcs
- Special
  - Area calculation
  - Connecting distances

Professional Plus!

The Plus! Package in Detail Points program which allows to make Verification Points by either point number or position. It´s a great tool for controlling the quality of surveys.

Special

For special tasks in surveying such as

- Coordinates
  - RoadLine Lite
- Special
  - Multiple Rounds
  - 3D Plane

The first steps cover the setup and check of the instrument. The data is stored projectwise, and is controlled via the *Project Management*.

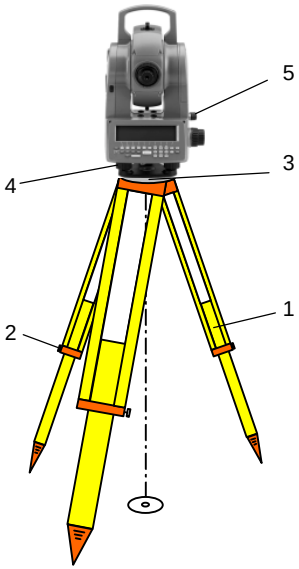
In the Program *Measuring in a Local System*, one can measure using all functions of the Trimble™ 3600 series Total Station.

Before Measurement

Project Management

Measuring in a Local System

Set Up and Centering



Attention !

In order to guarantee the stability of measurement we recommend the use of a Tripod and an Tribrach from Trimble.

Setup:
Fix the the tripod legs (1) over the required point using the tripod locking screw (2). Screw the instrument tribrach to the tripod head (3).

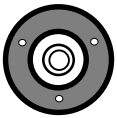
Centering:
With the tripod set over the station point, look through the optical plummet (5) and position the center over the station point using the tribrach screws (4).

Attention !

For precise measurement it is necessary to control the tribrach-instrument connection.

1. Make sure, that the tribrach is stabil and OK.
2. Set the instrument on the tribrach correctly.
3. Lock the DIN tribrach screw strong enough.

Levelling and Fine Centering

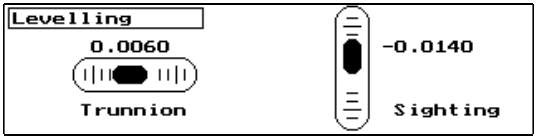


Coarse Levelling:

Level the Circular Bubble (6) by adjusting the tripod legs (1).

Fine Levelling:

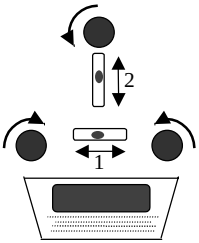
The digital fine levelling is accessed using the hotkey for the levelling menu:



📖 **Adjustment**
Compensator

📖 **Configuration**
Instrument

The inclination values displayed are in the same unit as set in instrument configuration.



Position the instrument parallel to two of the tribrach screws. Turn the two tribrach screws together in opposite directions, and the third alone. Level the instrument in the Trunnion Axis (1) and Sighting Axis (2). Turn the instrument to check the verticality of the instrument. The Mis-Levellment should be within the working range of the compensator (±0.092 grad).

After adjustment press Esc to return to the program screen.

Fine Centering:

Check the final position over the point. Move the instrument on the tripod head and repeat the fine levelling if necessary.

Telescope Focussing

Focussing the Cross Hairs:

With the telescope focussed on Infinity, bring the cross hairs into focus.

☝ Attention !

Do not use the telescope to look at the sun or other bright and concentrated light sources or you risk permanent eye damage.

☞ Tip

Check the telescope Parallax: Move the position of your eye slightly whilst looking throught the telescope. If the cross hairs are not correctly focussed they will appear to move. If this occurs, refocus the crosshairs as above.

Check-List

Before measuring, it is a good idea to check the status of the instrument. You will find the symbols in the display are very helpful. It will also be useful to use the following check List:

1. Set Up OK ?

- Levelling, Centering

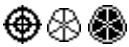
2. Adjustment OK ?

- V-Index- and Hz-Collimation
- Compensator run center point

3. Data OK ?

- Enough internal memory ?

4. EDM Mode ?

- DR or PR Mode 
- Laserpointer On ? 

5. Battery OK ?

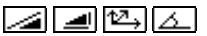
- Battery Strength  , use 

6. Project OK ?

- Is the current Project OK ?

7. Switches OK ?

Configuration / Instrument / Switches /

- Compensation activated  ?
- Units / Decimal Points are set ?
- Measure system  OK ?
- Recording  on ?
- Recording mode R-C, R-M, R-MC selected?
- Measure mode  selected?

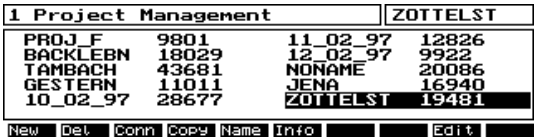
Create a New Project

Proj.-Management 1

↵ or **1** to select from the main menu.

New to create a new project. Input a new project name and

↵ to confirm.



The Projects and their file size are displayed in the project screeen (121 Byte per Data Line).

Select an existing Project

↓ Select the Project with the cursor keys.

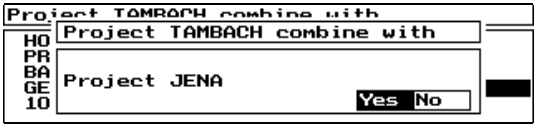
↵ to confirm as the current Project.

☞ Tip

Scrol with **PgUp, PgDn, Home, End** . Edit Project data with the **Edit** softkey.

Connect Projects

Conn to connect one Project with another.



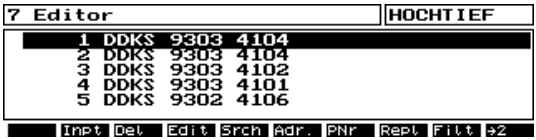
☝ Attention !

After connection, the Project („JENA“) will be completely integrated and still exists on as a separate project file.

Edit a Project

Edit to call the editor

📖 **Data Management**
Editor



Editor Menu.

Delete, Rename, and Copy a Project

Del Delete Project

Name Rename Project

Copy Copy Project

Attention !

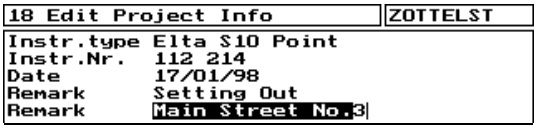
It is not possible to rename or copy a Project if the same name exists.

Project Information

Info Input the Project Information.

Input of up to 10 Information lines in each Project Information. 16 alphanumeric characters per line.

PgUp PgDn to select the other page.

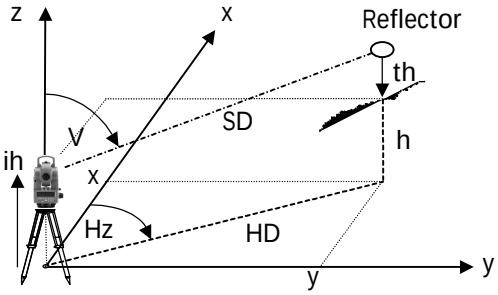


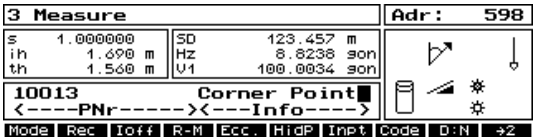
Measure **3**

Mode Press to toggle the measure mode:

SD Hz V
HD Hz h
y x z
Hz V

Rec to copy the last measurement (measure buffer) and the PI with respect to the measure and registration mode to the current project.





or to start measuring,

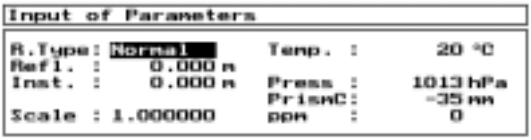
to directly input the target height.

> **Tip**
>
> Use MODE and Rec to store different measure values without remeasuring the point.

Input of Parameters

Inpt Input

(1) Instrument and Target Height
(2) Prism Constants
(3) Temperature and Pressure
(4) Scale Factor of Local System / pip
(5) Reflector Type (to select)



to select, to confirm.

☞ Tip

For each reflector type a reflector height and a prism constant will be stored. If the type of reflector was changed, the last reflector height input for this reflector type is selected automatically. For controlling this leave the reflector type toggle field by pressing  or  .

The local scale factor will be used to correct the distance measurements in a local system.

Default: s = 1.000 000

The scale factor of the local system will not be that calculated using the stationing routines. Entering a local scale factor will only effect measurements in a local system.

The values of addition and prism constant and the values of Scale Factor and PPM are connected. Changing one value will effect the other partner value.

If in the Instrument Switch Configuration the Thermometer are **On**, it is not possible to edit this value. The auto-measured value will be displayed.

R-MC Recording Mode

(1) **R-M** for original measured data
(2) **R-C** for computed data
(3) **R-MC** for meas. and computed data

Recording **On**
Configuration
Instrument
Switches

Selection of the Record mode is only possible when the recording Configuration is switch to **On.**

Ioff Incrementation of the point number **On** / **Off**

✍ -9999 ≤ Inc ≤ 9999

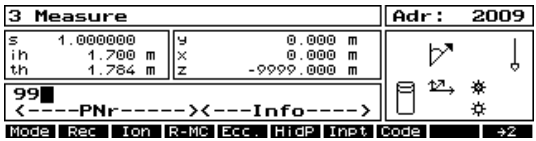
Set the increment step.

↵ to accept.

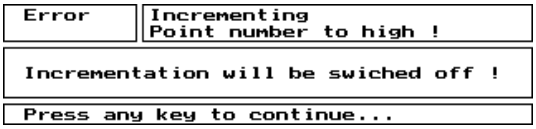
☞ Tip

The furthest numerical part on the right of the point number will be incremented. For the incrementation it is necessary, that the point number can be moved to the left in the point number block of the marking.

Changing the Marking will cause the Incrementation to be switched off.



If the point number 99 was entered on the left side of the block, it cannot be incremented to 100. Then the following error message appears:



The incrementation will be automatically switched off. For an incrementation from 99 up to 100 it is necessary, to enter the number more to the right in the block.

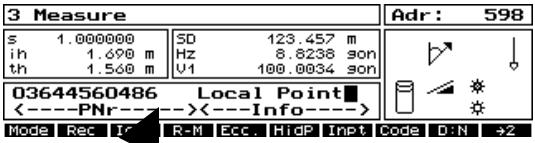
Input of the Point Identification PI

Use the cursors to navigate the input field.

Switch between code fields using **Tab**.

Input the PI using the keyboard or a Codelist.

Mark Changes the actual marking



📖 **Configuration** Marking

Input field of the Point Identification PI (27 characters) with freely configurable fields.

Using Codelists

Code Call Codelist

To activate this softkey, the PI field must have a codelist already attached to it (as defined during the Configuration of the Marking).

The cursor must be positioned within the required code field.

Example: Codelist ***ROAD_points_18***

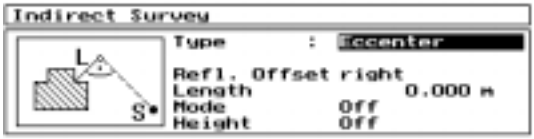
📖 **Configuration** Codelists

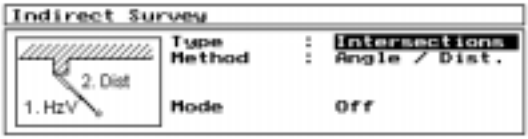
Select the required Code with ↑ and ↵.

The correct Code is then implemented in the PI field.

Indirect Survey

Ecc. Eccentricity / Intersection

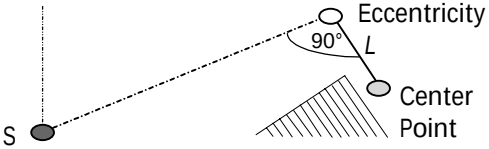




toggling between options.

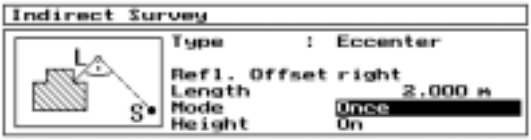
Type: Eccentricity

Type: Intersection



Eccentricity

✍ Length L < 100 m



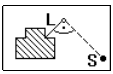
toggling between options.

Mode **Once** for a one off Measurement,

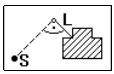
Mode **Perm** for a permanent eccentricity,

Mode **Off** to cancel.

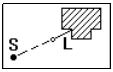
Reflector Offset:



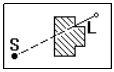
right of



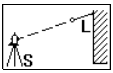
left of



front of



behind



slope (in sighting axis)

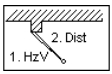
to the Center.

Height **On** To use the height of the eccentric point in position left, right, front of or behind to the center. The center height is calculated for a slope eccenter.

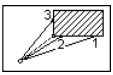
Off no height coordinate.

Intersection

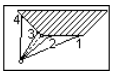
Case of measurement:



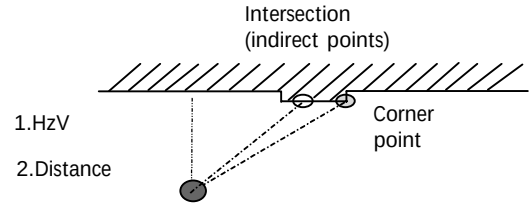
Angle/Dist.

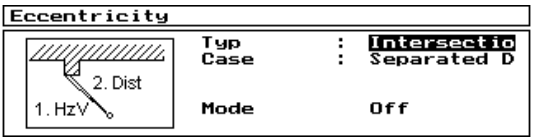


perpend.



general





toggling between options.

Mode **Once** for a one off Measurement,

Mode **Perm** for a permanent eccentricity,

Mode **Off** to cancel.

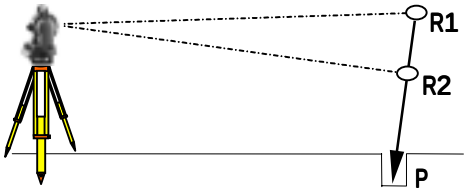
Attention !

If the height difference between the eccentric point in position left, right, front of or behind to the center is large, then set the height to **Off.**

The function **Ecc.** is not available during the Hidden Point Measurement.

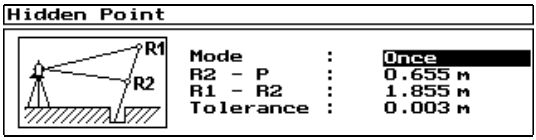
Hidden Point Measurement

HidP Hidden Point



R2-P Distance between the reflector R2 and the Prism Point P

R1-R2 Distance between the Reflectors R1 and R2 on the Prism Rod.



Modes: see Eccentric Measurement

Tolerance: Error limit used to check the accuracy of the measurement of R1 - R2.

Default Value: 0.003 m

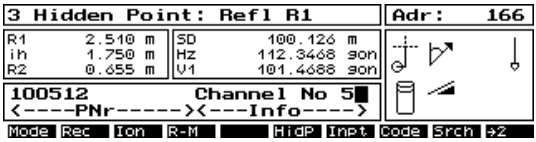
If the error limit is exceeded a message appears.

Record Mode - Hidden Point:

R-M

R-M, R-C, R-MC

R-M, R-C, R-MC



The program guides the user through the measurement of R1 and R2.

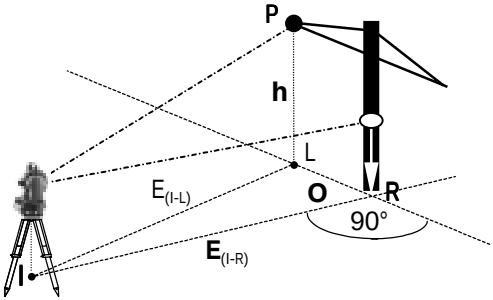
The height Z_P will always be calculated from $Z_{STATION}$, ih and R1-R2-P values.

Object Height Measurement

ObjH After measuring to one reference point in Mode:

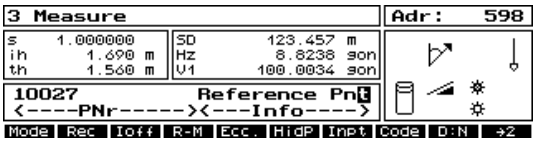
SD Hz V
HD Hz h
y x z

is this softkey accessible.

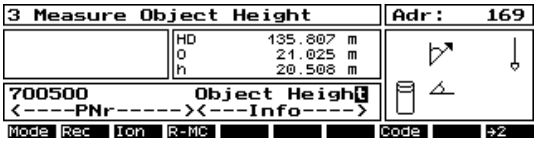


The Reference Point defines the line of the Instrument - Reflector (I-R) and the vertical plane normal to I-R. It is then possible using only the angle measurement **HzV** to define heights and offsets in the plane:

HD Horizontal Distance I-R
O Perpendicular position L-R (90° to I-R)
h Object Height from R



Measure Reference Point with . Eccentric measuring is also possible.



to measure Object Height + Offset in Hz V measure mode.

Toggle the **Mode** softkey to see **HD Hz h** and record with **Rec**:

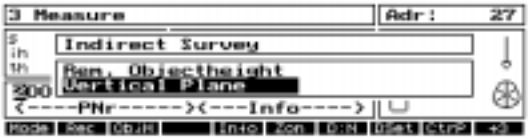
HD Horizontal Distance I-L
h Height difference with respect to Station I

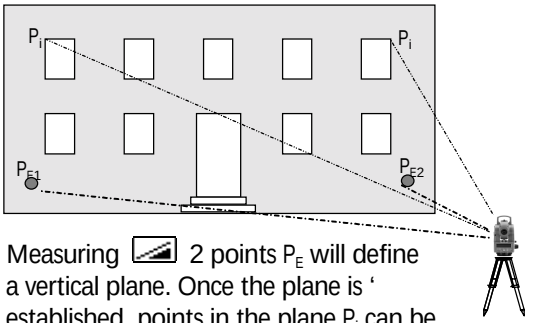
Vertical Plane

ObjH After measuring to two reference points in Mode

D Hz V
E Hz h
y x z

is this function accessible.





Measuring 2 points P_E will define a vertical plane. Once the plane is ' established, points in the plane P_i can be measured only by the use of angles . There is no need to measure a distance. The coordinates of P_i are measured in the defined Coordinate System.

Measure Reference Point or .

Toggle the **Mode** softkey to see **HD Hz h** and record with **Rec**:

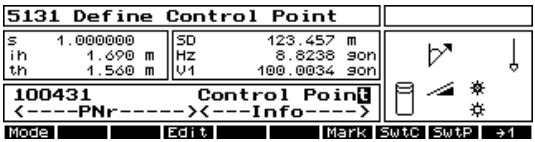
h Height difference with respect to Station

Control Point Measuring

CtrP Control Point

To set a Control Point (CtrP). The measurement is available in all measuring modes:

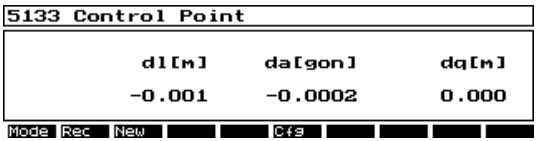
Define **2**



Sight CtrP, Measure with ↵ or ⊙.

Check **1**

Sighting and checking a CtrP is possible in every measurement routine:



Mode switch to **dr**

New Repeat Measure

Cfg Configuration
Error Limits CtrP

📖 **Configuration**
Programs

Results of CtrP Measuring with :

dl	Length misclosure	[m]
da	Angle misclosure	[gon] (Hz)
dq	Cross misclosure	[m]
dr	Radial misclosure	[m]

Hz-Circle Orientation

HzOr Call up

↑ Input the Hz direction.

📖 **Configuration**
Instrument
Switches
Reference System

Sight the direction, ↵ or ⊙ to measure and set the new Hz-Orientation. In the Instrument Configuration the recording of original Hz-Circle readings or oriented Hz-Directions can be defined.

Corrections of the Measured Values

The measured values will be subjected to the following corrections:

- Influence of Temperature and Pressure (SD)
- Prism Constant (SD)
- Inclination of the Vertical Axis (HzV)
- Horizontal Collimation + Vertical Index (HzV)
- Trunnion axis (Hz)
- Circle Eccentricity (HzV)

The calculated values (HD, h, x, y, z) will be computed from the corrected measured values and are corrected by the configured local scale factor.

SwtC With this switch, One can toggle the various corrections **On** and **Off**.

```
9133 Correction Switches
Tilt Compensation          On
Index Correction           On
Collimation Correction     On
Atmospheric Corrections    On
```

Toggle with , Confirm with .

After switching on the instrument all corrections are switched to **On.**

Compensator **On**

When the Compensator is switched on, the compensator symbol will be displayed.

Attention !

In order to improve the accuracy of the temperature measurement, the instrument should not be subject to direct sunlight.

Technical Tips in Further switches and Technical Matters

Further Switches and Technical Matters

SwtP Periphery Switches

PositionLight **On**

Laserpointer **On**
Laser Plummet On

Zon Height **On** / **Off**

Info Input info line up to 27 characters.

Mark Change the actual Marking.

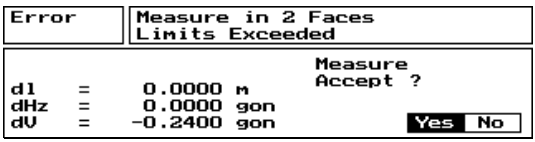
Technical Tips

The Temperature, Pressure and Humidity will have the following influence on the Distance accuracy:

Δt ± 1 °C	±1 ppm (parts per million)
Δp ± 4 hPa	±1 pip
Δh ± 20%	±1 ppm

1Fce Measurement in 1

2Fce or 2 faces.



The measurement values and mean values of measurement in face 1 and face 2 will be computed and stored as defined in the program configuration. If the error limits are exceeded, comes

Yes To accept and save the mean value.

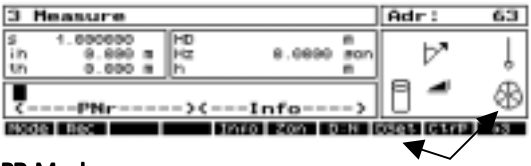
No No saving. New measurement is possible.

D:N Toggle the distance meter Mode: **N**ormal / **R**apid **T**racking

Technical Tips

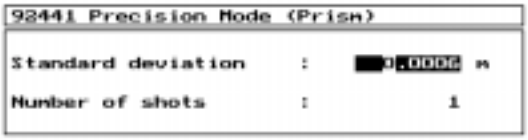
The different measuring modes have the measuring times / accuracy:

Annex Technical Data

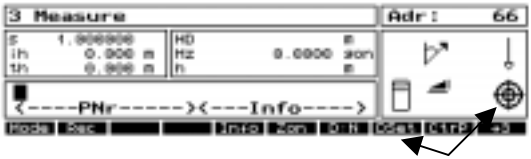


PR Mode:

Dset Configuration multiple measure-ments for distance meter mode N

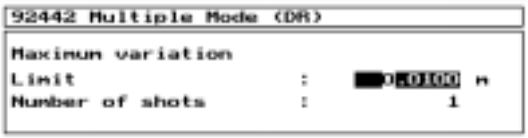


Setting the standard deviation and/or a number of shots



DR Mode:

Dset Configuration multiple measure-ments for distance meter mode N



Setting a limit between the shots and/or a number of shots

3 Stationing

In order to operate the instrument in a coordinate system, it is necessary to position and orientate the instrument within the system.

Free Stationing

Stationing on a Known Point

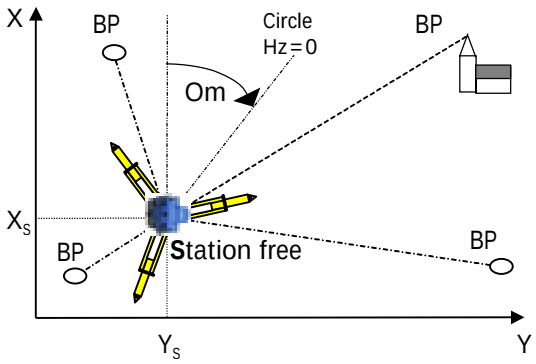
Heightstationing

Eccentric Stationing

Stationing **4**

Free Station. **1**

If it is not possible to occupy a point with a known position, one can carry out a free Station.



⇨ : $BP_{YX(Z)}$

⌖ : $SDHzV_{S-BP}$ or HzV_{S-BP}

💻 : $S_{YX(Z)}$, Om , s

✍ $2 \leq BP \leq 20$

Through measuring up to 20 known Backsight Points, the instrument will calculate the station position, the circle orientation **Om** and the scale factor **s**.

The program is separated into the plane adjustment and the height adjustment.

In order to calculate the station height, the instrument height **ih** and the target height **th** must be measured.

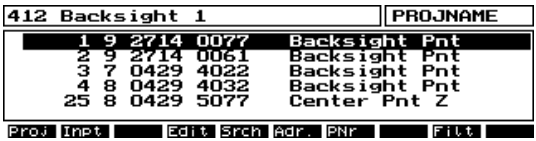
↑ to input the instrument height **ih**.

↵ to confirm input of the station name.

Proj Change projects to recall BP's from another.

📖 see ***Editor*** for other functions.

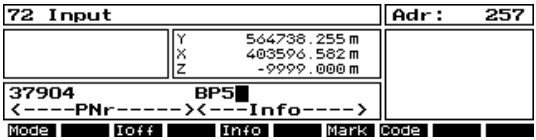
After the coordinate filter, select the required BP



↑ ↵ Select first Backsight Point.

Inpt to input a new BP

If BP is not in list, input BP:



Mode for switching between YXZ, SDHzV and HDHzh.

✍ Z = -9999.000 for points without known height

Select the input fields with ↑.

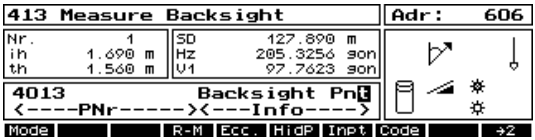
Record with ↵. End Input with Esc.

Free Stationing Measurement

Mode Toggle measure mode **SDHzV / HzV**

BP with distance measurement

BP without distance measurement



Start BP measurement with ↵ or ◎ .

> **☛ Tip**
>
> With Cursor ↑ it is possible to edit the target height **th**.

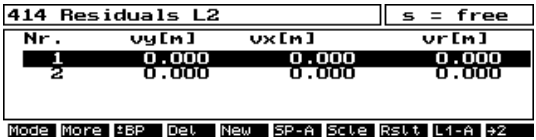
For a proper calculation it is possible to have a minimum of 2 BPs measured with distance or 3 BPs measured with only angle. Therefore:

↑ Select the second BP and measure.

You will then see the first adjustment screen:

More to measure further BPs

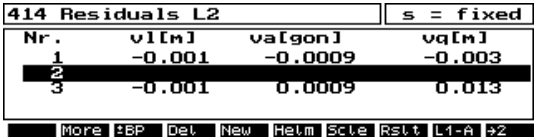
→ 2 + **PI** to show the PI



The residuals here are zero, as this kind of selected adjustment method requires a third point for the residual computation.

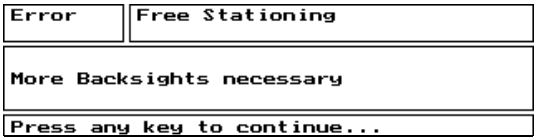
± BP Off/On to skip the BP measurement

It is possible to remove BPs from the adjustment to check their influence for the adjustment.



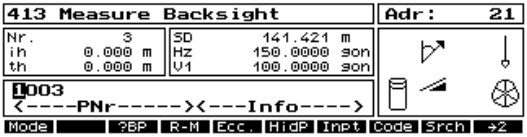
Use the cursors ↑ ↓ to select the point and then **±BP**. The adjustment will be recalculated. Pressing the function key again, this point comes back into the adjustment.

If more points will be removed than required for the calculation, the following notice will be displayed:



The program will automatically allow the measurement of further BPs as an adjustment.

? AP Call up the point for intermediate Setting Out

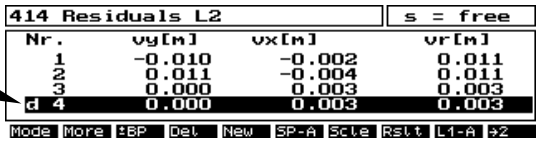


☞ **Tip**

If further BPs are not required for the calculation, the program will go immediately to the adjustment.

Del will mark the point with a **d** to be deleted

New New adjustment



BPs marked with a **d** are removed from the adjustment, and will be deleted when a new adjustment computation is needed or selected.

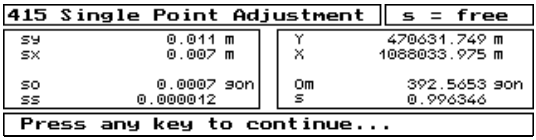
Rec to record the current adjustment and result

☞ **Tip**

Rec will allow the storage of intermediate adjustments and results that will not be stored with the final calculation.

Rslt Results Display

The display screen will show the result of the Free Stationing and the standard deviations:



Coordinate Position
Y, X (sy, sx)

Circle shift
Om (so)

Scale Factor
s (ss)

You will then return to the adjustment menu.

Adjustment Procedure

The Least Squares Adjustment (L2 Norm) has 2 variations:

(1) Single Point Adjustment
(2) Helmert Transformation

Measured distances will always be adjusted with a scale factor **s = 1.000 000** .

The adjustment menu will allow the selection of both adjustment methods. That means that the results can be seen from both adjustment types.

The switch is fixed when

- when the Configuration Change is set to Off ,
- Measurement without distances, or less than two distance measurements (switch from SP-A to Helmert-Transf.)

The Residual Menu

The adjustment L2-Norm with a default setting of single point adjustment.

L1-A Switch to an adjustment with Σ absolute Residuals → Min (L1-Norm)

☞ **Tip**

An "**e "** in the first column means that the residual is outside the error limits set in the Configuration.

L1-A Norm will allow the detection of a gross error in one of the BP measurements. This can then be deleted, and a new adjustment calculated.

Helm Switch to Helmert Transformation

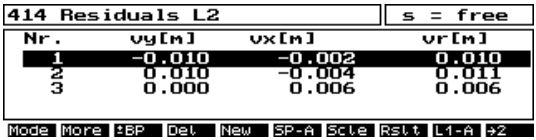
Helmert Transformation

Measurements to the BPs require a distance measurement in order that this adjustment type can be used.

The Helmert Transformation has the same weighting for direction and distance.

Adjustment:

vy **y**-coordinate
vx **x**-coordinate
vr **r**adial



Adjustment L2-Norm of the Helmert Transformation. A BP without distance measurement will not be used.

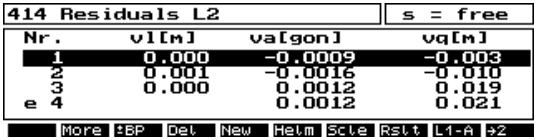
Mode Is used within Helmert Transformation to switch between **vl, va, vq**

> ☞ **Tip**
>
> **Mode**: Compare with the residuals of the single point adjustment..

SP-A Switch to Single Point Adjustment

Single Point Adjustment

With SP-A it is possible to control error limits and direction and distance weighting in the Configuration menu. It is also possible to have BPs without a distance measurement.

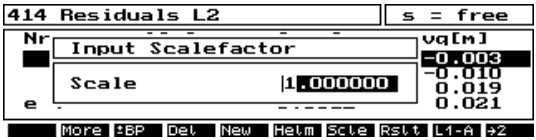


Residuals of the SPA:

vl is only displayed for points with a distance.

vl Residuals in length
va Residual in angle bearing
vq Residual in normal to direction

Scle Scale Factor **Free** or **Fixed**



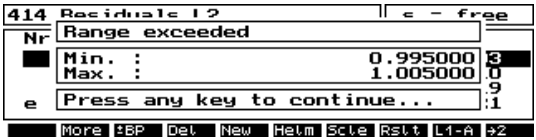
after input.

Standard: **s = free**

Default value **s = fixed**: 1.000000

Choosing a fixed scale factor will recall the scale range values set in the Configuration.
If **s= Free** , then a scale factor is computed for the adjustment.

If the scale factor input is outside the scale range values set in the Configuration, then the following screen is displayed:



I.e.: ± 5000 ppm scale range value.

> **Tip**
>
> If the scale factor is **fixed** the number of unknowns of the adjustment decreases. I.e. even for the minimum geometry (2 BP´s with Helmert Transformation) residuals can be computed.
>
> You also can detect a faulty scale factor due to displaced BP´s or measurement errors, as such errors normally have an impact on a free scale factor.

Scle to switch back

Pressing **Scle** again sets the scale free and the adjustment will be computed again.

Configuration of Free Stationing

Cfg Configuration Free Stationing

Setting of standard deviations for both observations and centering define the weighting within the SP-A.

```
9211 Free Stationing

Adjustment Type  1   Scale Range      6
Stand. Deviation 2
Error Limits     3
Adjustment       4
Reductions       5
```

Configuration menu Free Stationing.

Stand. Deviation 2

```
92112 Single Point Adjust.

Orientation        :      0.0003 gon
Distances constant :       0.003 m
Distances linear   :           0 ppm
Levelling          :       0.000 m
```

Default values are given as below:

Accuracy of directions:

Directions: 0.0003 gon

Accuracy of distances:

Distance, constant: 0.001 m
Distance, linear: 0 ppm

Accuracy of centering:

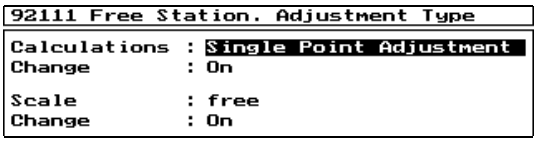
Centering of target: 0.000 m

> ☞ **Tip**
>
> When you enter 0.0, the appropriate parameter has no impact on weighting.
>
> The weights are used for the SP-A only, but not for the Helmert Transformation.

Cfg Configuration
Free Stationing

Adjustment Type **1**

You can define as a standard, whether to use the **SP-A** or the **Helmert Transformation** and also whether to have a **fixed** or a **free** scale factor.

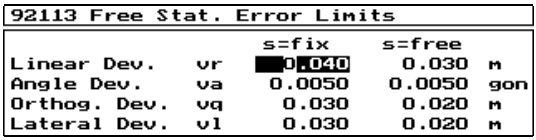


Select with , confirm with .

If **Change** is **Off**, you cannot change between different types of adjustments in your stationing.

Error Limits **3**

Possibility to change error limits, without necessarily breaking off your stationing process.



Select with , confirm with .

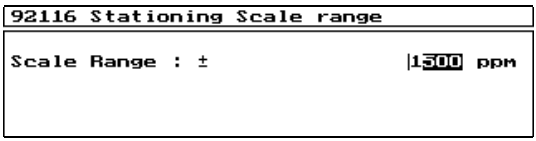
📖 **Configuration**
Instrument
Switch

The error limits will only be used, if the switch **Error Limits** is set to **On** within the configuration menu.

Scale Range **6**

Defining the range within which a scale factor will only be accepted.

The scale factor might change within the stationing process.



✍ -9999 ≤ SR ≤ 9999

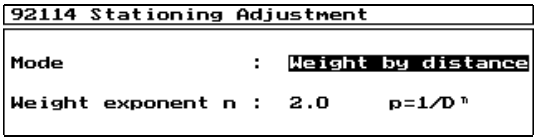
Example: ±1500 ppm would accept scale factors of 0.998500 < s < 1.001500 as a result of the stationing. So for distances of 100 m you would accept deviations of ±0.15 m.

Neighbourhood principle and Distance Reductions

Cfg Configuration
Free Stationing

Adjustment 4

The residulas for all BP´s of stationing will proportionally be spread over the coordinate space for all detail points and set out points, in order to comply to the so-called neighbourhood principle.



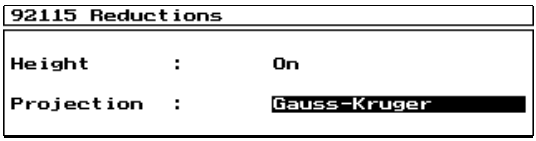
Mode: **Off / Distance weights**
n: **0.5 / 1 / 1.5 / 2**

The residuals are spread according to distance dependent weights which are applied to a weighted average. So the coordinates of any new measured point are corrected by that individually averaged value.

> ☞ **Tip**
>
> The higher the value of **n**, the smaller the impact of a far distanced BP.

Reductions 5

Measured distances can be corrected for projections into the Gauss-Krueger or the UTM system. They can also be corrected by a reduction from the site height to the mean sea level.



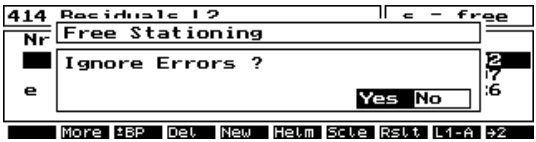
Height : **On / Off**
Projection: **Gauss-Krueger / UTM / Off**

If distance reductions are applied, they are used additionally to the existing scale factor **s**. In that case the scale factor **s** only represents tensions of the BP network and uncertainties in the measurements.

> ☝ **Attention !**
>
> Make sure that the Reductions are set ON or OFF during both Stationing and on-board coordinate computations!

Error Handling

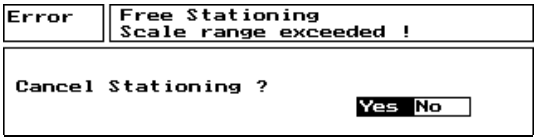
If at the end of your stationing error limits are exceeded for any BP, you will find that BP marked by **e** in column 1 and see the message:



Yes Accept stationing despite the errors.

No Back to displaying the residuals.

If the preset range for the scale factor is exceeded, the following display appears:



Yes Stationing is cancelled.

No Return to displaying the residuals. Solve the problem or extend the acceptance range for the scale.

In case of a SP-A with directions measured only to 3 BP´s, the software checks the standpoint and the 3 BP´s not to be approximately located on a circle (no solution possible).

Attention !

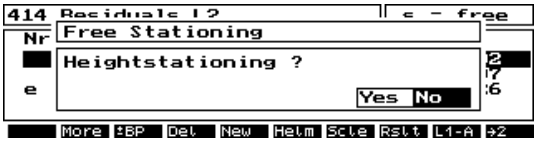
If stand point and 3 BP´s are on a circle and only directions are measured, there is a warning.

You can solve the problem by at least 1 additional distance measurement.

Heightstationing

After 2D stationing, a height stationing can be carried out using the BP measurements. At least one BP must have a known height value that was measured.

If no BP has a height value, it is possible to carry out a seperate heightstationing from the stationing menu.



No The results of the Free Station will be 2D.

Yes The height of the Free Station will be calculated from the BP measurements and the programs goes into the adjustment menu of the height stationing.

📖 Heightstationing

If it is not possilble to compute the height from the measured points of the planimetric stationing, then a normal Heightstationing follows.

After Heightstationing the final stationing result will be displayed:

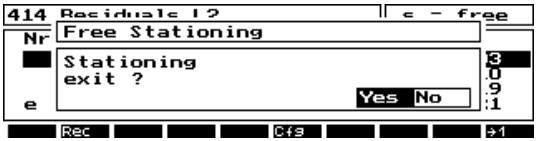
Attention !

No The complete stationing (plane stationing as well) will be ignored.

Yes Free Stationing results will be stored.

Results of the Free Stationing

Esc to exit the Free Stationing program:



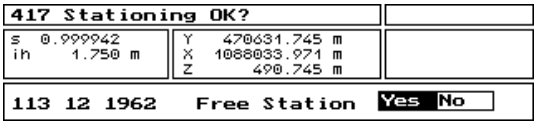
No Remain in the adjustment menu.

Yes If the results of the Free Station are okay, then it is possible to go exit to the results display.

📖 Error Handling

The program will check the computed residuals against the error limits set in the Configuration.

Results Display



Results Display of the Free Stationing in 3D.

Yes to record the results and use the coordinate orientation.

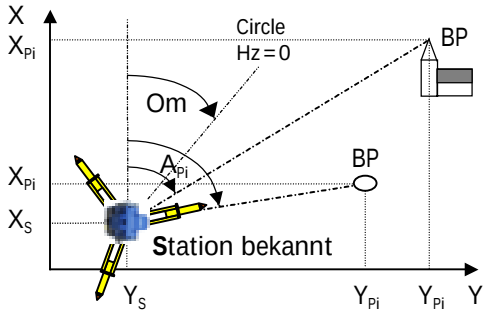
No Cancel the results of the Free Stationing without saving.

Stationing **4**

Stat. knwn. Pnt. **2**

By measuring up to a maximum of 20 Backsight Points from a known coordinate, it is possible to achieve position and orientation of the instrument within a coordinate system.

✍ $1 \leq BP \leq 20$



⇨ : $S_{YX(Z)}$, $BP_{YX(Z)}$

⌖ : $SDHzV_{S-BP}$ or HzV_{S-BP}

💻 : Om , s

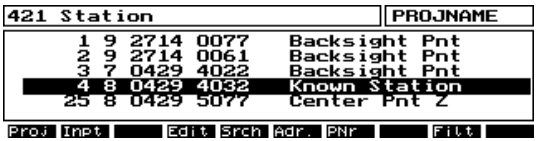
The circle orientation shift **Om** and the scale factor **s** will be computed.

If no height coordinate is available for the known point, it is possible to compute a Heightstationing.

Selecting Known Station

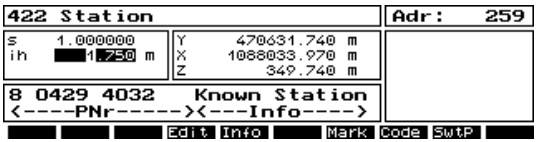
Coordinate points are filtered into the editor ready for selection:

Proj to select a point from another project



Inpt to input a new station coordinate

If the required station is not in the file, it is possible to manually enter the data into the editor. Select the known point with ↵ .



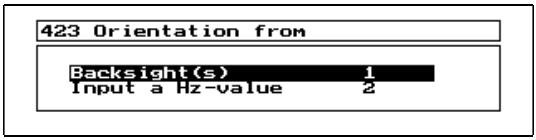
📖 see ***Editor*** for other functions

↑ to input the instrument height **ih**.

↵ to confirm the station.

Orientation of the known station is through:

(1) Backsight Points
(2) Input of a horizontal angle value



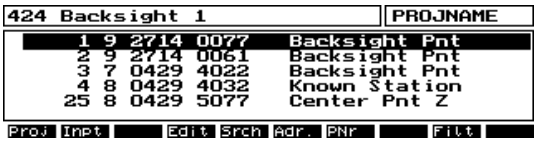
Select with ↓ and press ↵ .

Orientation through Backsight Measurement

Backsight(s) 1

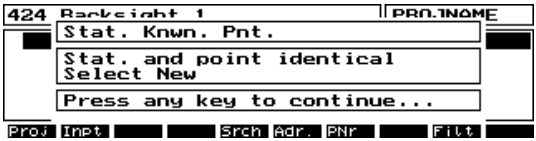
📖 **Free Stationing** Measurement and Adjustment

Select and measure up to 20 BPs from the Project:



Select with ↑ ↓ and press ↵.

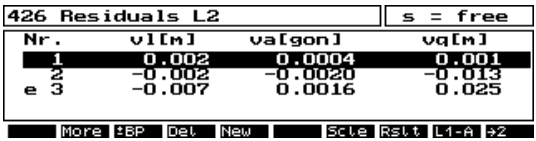
If BP = Station, comes the message:



After measurement to the first BP, the Residual Screen will be shown.

More Measure further Backsights

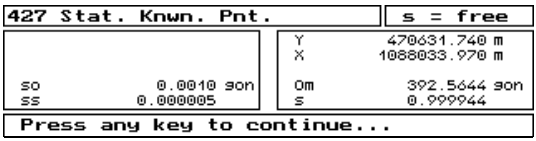
Press **More** to call up and measure further Backsight Points.



Residual Screen. Softkeys similar Free Stationing.

If there is a distance measurement to one BP, a scale can be computed.

Rslt Results display

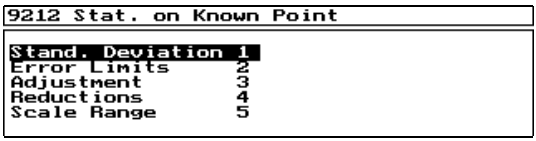


The display screen will show the results of the Stationing and the standard deviations:

Circle shift **Om** (so)

Scale factor **s** (ss)

Cfg Configuration of Stationing on a known point



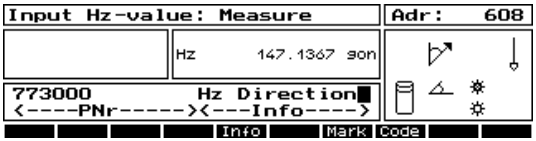
📖 **Configuration** Programs

The Configuration is the same as that for Free Stationing.

Orientientation through input and measurement of a bearing

Input a Hz - Value 2

Input a bearing angle A_{Pj}.



to input , to meaure and orientate the Hz-Circle.

After orientation, the results of the stationing are displayed.

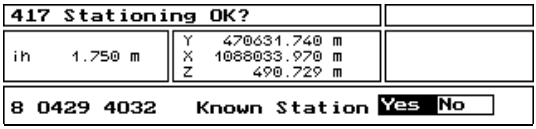
Results of Stationing on a Known Point

📖 **Heightstationing**

Esc from the residual screen to exit. If no height is known for the station, then the height-stationing routine will be automatically called.

📖 **Free Stationing**
Error Handling

The program will check the stationing results against the set error limits.



Results display of a 3D Stationing of a known station point.

Check the results,

Yes to save the results, implement the otientation and exit the program.

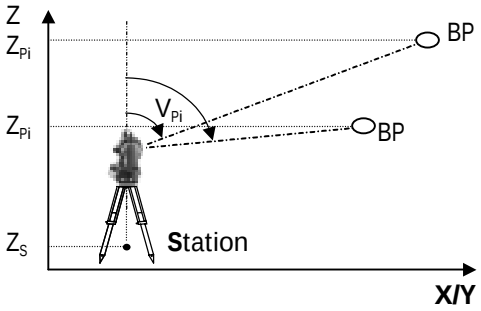
No Leave the Stationing without saving the results.

Stationing **4**

Heightstation. **4**

The heightstationing is used in conjunction with a 2D stationing or as a seperate menu program.

✍ $1 \leq BP \leq 20$



⇨ : $BP_{(YX)\,Z}$

⌖ : $SDHzV_{S\text{-}BP}$

: Z_S

The Station height $\mathbf{Z_S}$ will be calculated from up to a maximum of 20 Backsightpoints.

All measurements are performed in the **SDHzV** mode, with scale factor s=1. After height-stationing the previously used scale factor is re-activated.

Enter station point ID and instrument height **ih** after selection in menu *Stationing*.

Continue with ↵. To be proceeded with Heightstationing in the same way as after any stationing in the x-y plane:

2 alternatives for Heightstationing:

(1) Measure to BP´s
(2) Enter a height value

Measurement and Adjustment

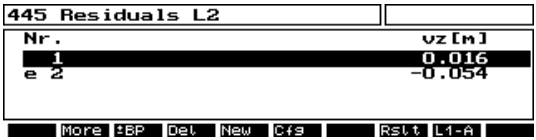
Backsight(s) 1

Select BP with known height and measure.

More to measure more BP´s

±BP **Off / on** to skip or to activate BP´s in the adjustment.

Selction of BP´s and measurements to be performed the same way as in 🕮 Measurement Free Stationing. After one BP being measured the display for residuals appears.



Display of residuals in Heightstationing. For analysis of the results use the same function keys as in Free Stationing.

Cfg Configuration Heightstationing

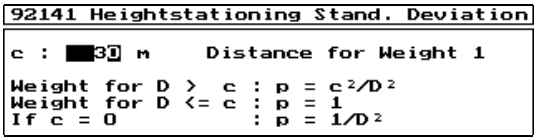
Standard deviation 1

Definine distance range for weight p = 1.

Error limits 2

Define maximum deviation in height.

Heightstationing uses the principle of a weighted average according to the predefined weights (set in Configuration).

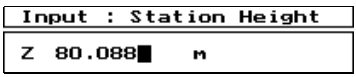


Exam.: up to 30 m distance → p = 1
from 30 m distance on → p = c^2 / D^2
c = 0 → p = $1 / D^2$

Entering a height value

Input of Height 2

You can manually enter the height of the station point. Then there is no measurement.

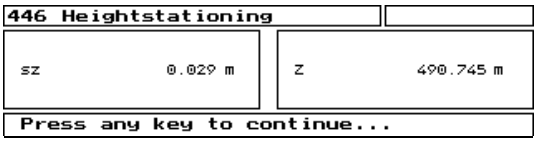


After the height entry, Heightstationing is done.

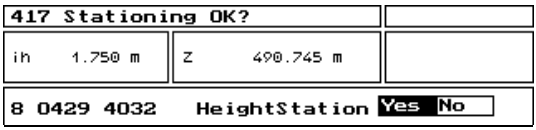
Results of the Heightstationing

Rslt Show result of Heightstationing

The height of your station and is standard deviation are displayed:



Esc When pressed in the display of the resiudals: Heightstationing is finished and the result is checked in accordance with the preset error limit for the actual deviation in height. That error limit to be previously defined in Configuration.



Check the results,

Yes to save the results, implement the Heightstationing and exit the program.

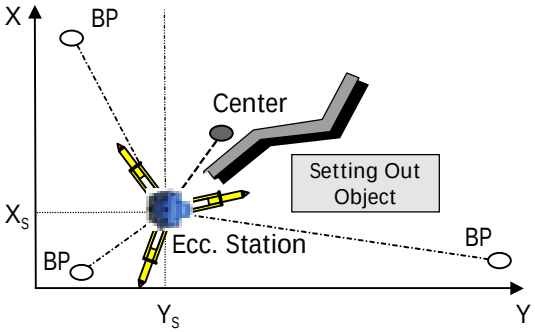
No Leave the Heightstationing without saving the results.

If Heightstationiong was previously called from a stationiong in the x-y plane, the program automatically returns to that stationing menu, to show the overall stationing results.

Stationing 4

Eccentric Station 3

If the detail points and the set out points cannot be measured from a station on a known point, it is feasible to set up the station on a unknown point close to the known point (the so-called center point).



⇨ : $BP_{YX(Z)}$, $Center_{YX(Z)}$

⌖ : $SDHzV_{Exz.-Z}$, $HzV_{Exz.-BP}$

💻 : $Ecc._{YX(Z)}$, Om

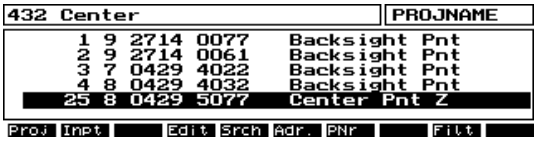
📖 $2 \leq BP+CP \leq 20$

Measure directions to the BP´s and combined distances and directions to the center point: With these data the coordinates of your station and the orientation **Om** of the horizontal circle are determined. Up to 20 BP´s (including the center point) can be measured.

Stationing in the x-y plane and Heightstationing are done separately. In case of Heightstationing, you have to input instrument height and prism height.

to confirm the entry of ecc. station

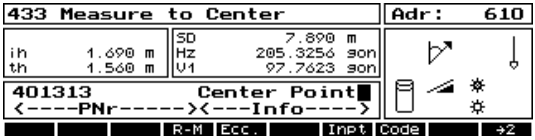
Then you can display the coordinates of the center point in the editor:



Select the center point and press **Enter**.

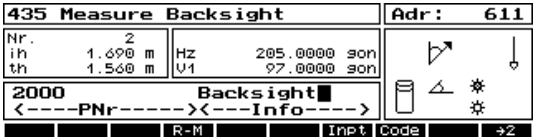
📖 all function keys please see ***Free Stationing***

Measurement Eccentric Station



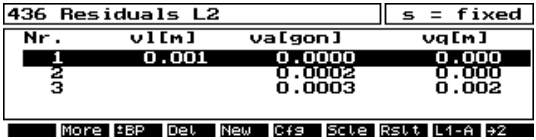
Measure SDHzV (Center) by or .

Then select and measure first BP in the measurement mode HzV:



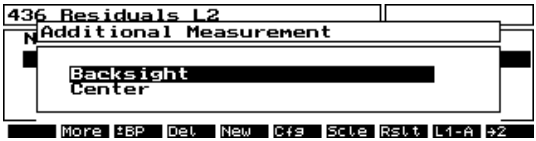
Free Stationing
Measurement Free Stationing

The display of the residuals is similar to the other types of stationing:



The adjustment is according to a weighted average.

More More BP Measurements



Backsight: Measure another BP

Center: Re-measure center point (optional).

Scle Scale factor

In Eccentric Stationing the scale factor **cannot be free**. However, you can enter any fixed scale factor, as long as it is in accordance with the pre-configured scale range.

Default: **s = 1.000000**

📖 all other function keys please see ***Free Stationing***

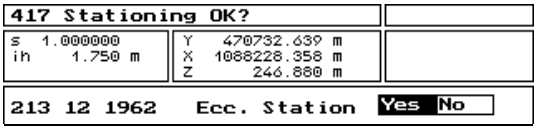
☞ Tip

Do not locate the eccentric station point too far away from the center point.
A feasible distance is 10 m.

For greater distances it is better to choose the regular Free Stationing, the center point then being used as one of several BP´s.

📖 **Free Stationing** Results of Free Stationing

The Eccentric Stationing concludes in the same way as Free Stationing. You can then proceed with Heightstationing, if required.



Display of the results of Eccentric Stationing and Heightstationing.

Yes for storing the results and then finishing the Eccentric Stationing.

No Leave Eccentric Stationing without recording the results.

4 Coordinates

After a stationing in a higher-order coordinate system the program *Coordinates* follows with the measurement of detail points or the setting-out of points in this coordinate system.

Detail Points

Setting Out

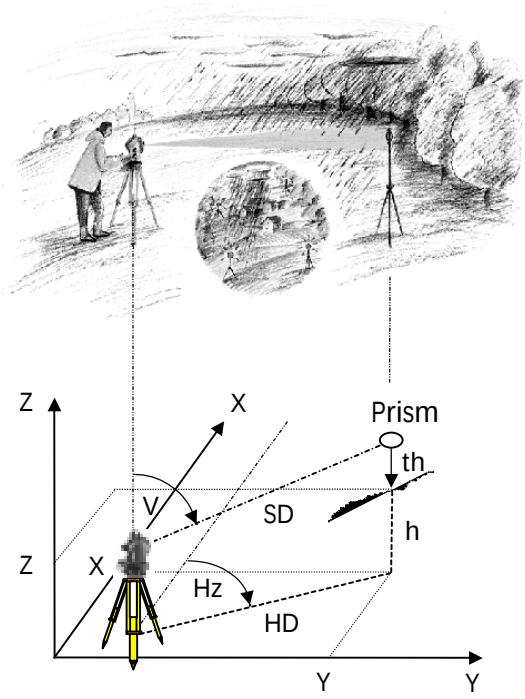
Coordinates **5**

Detail Points **1**

Determination of the coordinates and heights of new points by distance and angle measurement in a higher-order coordinate system.

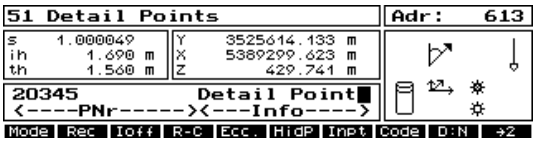
The actual stationing will be used by the *Detail Point* program (including the scale factor).

The program *Detail Points* is similar to the program *Measure in a Local System*.



Mode Selection of the measuring mode

Y X Z
SD Hz V
HD Hz h



or to measure the point.

R-MC Recording Mode:

R-M, R-C, R-MC
R-M
R-M, R-C, R-MC

R-M for original measured data

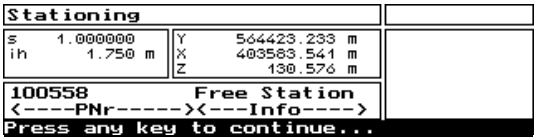
R-C for computed data

R-MC includes R-M and R-C

Configuration
Instrument
Switches

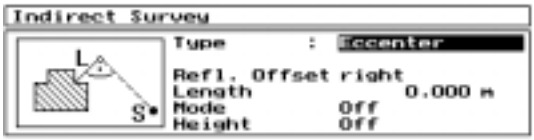
It is possible to record oriented (by stationing, see figure) or not-oriented Hz-directions. For coordinate computation oriented Hz-directions will be used.

StCk Stationing Check, displays the actual Stationing.



Indirect Survey

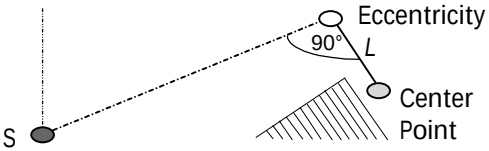
Ecc. Eccentricity / Intersection



toggling between options.

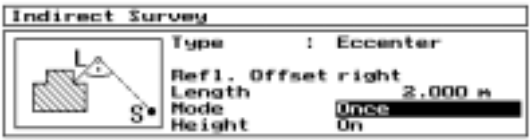
Type: Eccentricity

Type: Intersection

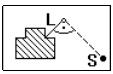


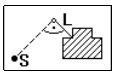
Eccentricity

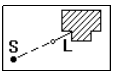
✍ Length L < 100 m

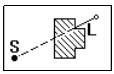


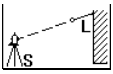
Reflector Offset:


right of


left of


front of


behind


slope (in sighting axis)

to the Center.

toggling between options.

Mode **Once** for a one off Measurement,

Mode **Perm** for a permanent eccentricity,

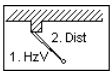
Mode **Off** to cancel.

Height **On** To use the height of the eccentric point in position left, right, front of or behind to the center. The center height is calculated for a slope eccenter.

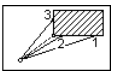
Off no height coordinate.

Intersection

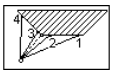
Case of measurement:



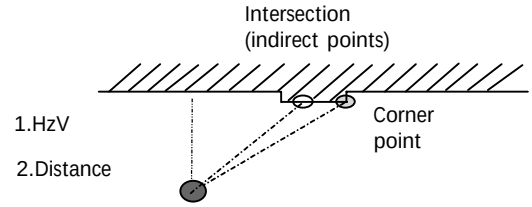
Angle/Dist.

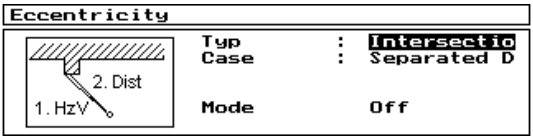


perpend.



general





toggling between options.

Mode **Once** for a one off Measurement,

Mode **Perm** for a permanent eccentricity,

Mode **Off** to cancel.

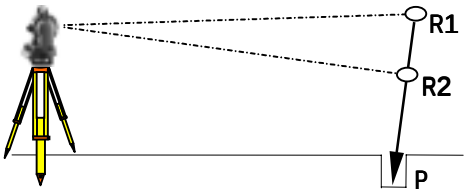
Attention !

If the height difference between the eccentric point in position left, right, front of or behind to the center is large, then set the height to **Off.**

The function **Ecc.** is not available during the Hidden Point Measurement.

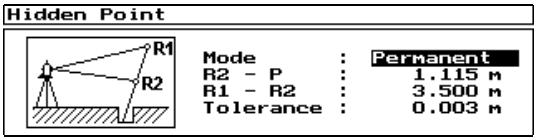
Hidden Point Measurement

HidP Call Hidden Point



R2-P Distance of the reflector point R2 to the rod point

R1-R2 Distance of th reflectors R1 and R2 on the rod



Mode: similar to eccentric measure

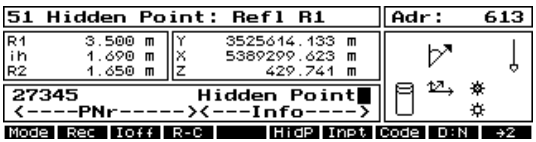
Tolerance: permitted maximum value for accuracy of the R1-R2 distance.

Default value: 0.003 m

The program gives a hint, if the tolerance value is bigger than permitted.

Recording Modes HidP:

- R-M
- R-M, R-C, R-MC
- R-M, R-C, R-MC



The program defines the order of measuring R1 and R2 by the help of the display information.

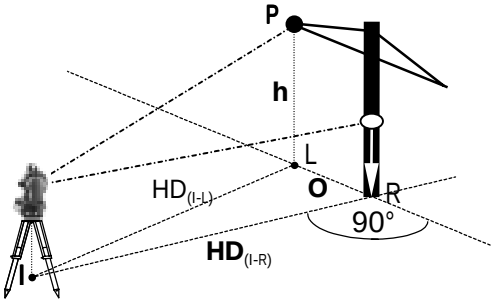
The height Z_P will be computed from the station height $Z_{STATION}$, the instrument height **ih** and the **R1-R2-P** distance.

Object Height Measurement

ObjH After measurement to <u>one</u> reference point with modes

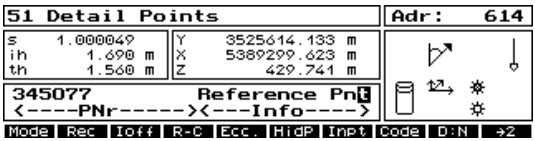
SD Hz V
HD Hz h
Y X Z

this function key is available.

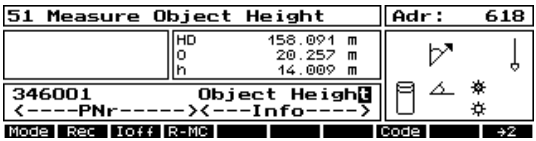


The reference point defines the line Instrument-Reflector (I-R) and the vertical plane normal to I-R. Now it is possible, to measure object heights to points in that plane only by **HzV** angle measurement:

HD Horizontal distance I-R
O Orthogonal dev. L-R (90° to I-R)
h Object height to R (reference point)



Measure in modes . Eccentric point measurement also possible.



to measure object height + orthogonal deviation with .

Mode Switches the display of HDOh, HzV ,SDHzV HD Hz h , Y X Z

Mode is a switch between the display of **HD O h** and **HD Hz h**. Recording with **Rec**.

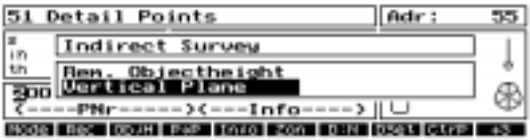
HD Horizontal Distance I-L
h Height difference with respect to Station I

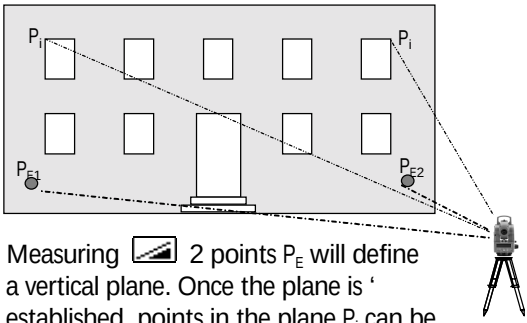
Vertikal Plane

ObjH After measuring to two reference points in Mode

D Hz V
E Hz h
y x z

is this function accessible.





Measuring 2 points P_E will define a vertical plane. Once the plane is ' established, points in the plane P_i can be measured only by the use of angles  . There is no need to measure a distance. The coordinates of P_i are measured in the defined Coordinate System.

Messung Referenzpunkt mit   oder  .

Mode Switches the display of HzV ,SDHzV HD Hz h , Y X Z

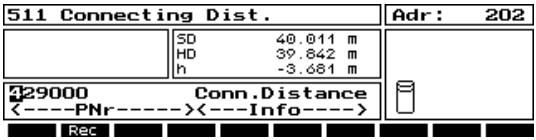
Toggle the **Mode** softkey to see **HD Hz h** and record with **Rec**:

h Height difference with respect to Station

Connecting Distances

P→P The connecting distance to the last measured point will be computed.

Rec To record the connecting distance



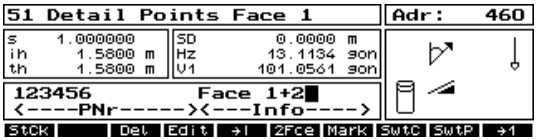
Press **Rec** to record the connecting distance.

↵ or **Esc** back to the measuring menu without recording.

2 Face Measurement

1Lg toggles between face 1 and

2Lg face 2.

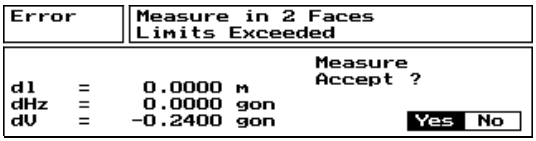


After measurement in face 1 comes the request to turn the instrument in face 2. Turn the instrument through 180 degrees in Hz and V for measuring in face 2.

📖 **Configuration**
Programs
General Functions
2-Face-Measurem.

The measurement values and mean values of measurement in face 1 and face 2 will be computed and stored as defined in the program configuration.

If the error limits are exceeded, comes



Yes To accept and save the mean value.

No No saving. New measurement is possible.

Value Corrections

📖 **Configuration**
Instrument

The measured values will be subjected to the following corrections:

- Influence of Temperature and Pressure (SD)
- Prism Constant (SD)
- Inclination of the Vertical Axis (HzV)
- Horizontal Collimation + Vertical Index (HzV)
- Trunnion axis (Hz)
- Circle Eccentricity (HzV)
- FineLock Corrections (HzV)

📖 **Configuration**
Programs

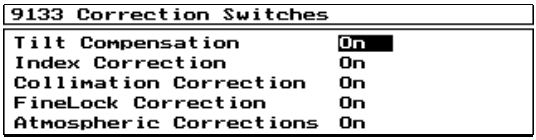
The calculated values (HD, h, X, Y, Z) will be computed from the corrected measured values and are corrected by the following (selectable) influences:

- Scale factor from stationing
- Projection reduction (Gauss-Krueger or UTM)
- Height reduction
- Refraction and earth curvature
- Best-fit Adjustment

📖 **Annex**
Formulae

The exact formulae are given in the annex.

SwtC With this switch, One can toggle the various corrections **On** and **Off**.



Toggle with , Confirm with .

After switching on the instrument all corrections are switched to **On.**

Compensator **On**

When the Compensator is switched on, the compensator symbol will be displayed.

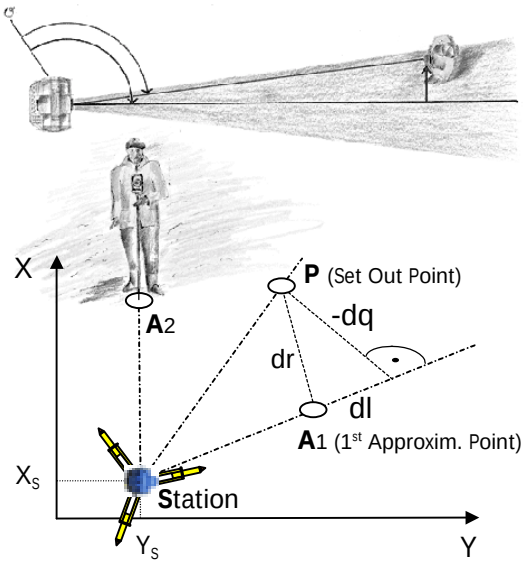
Coordinates **5**

Setting Out **2**

Setting-out of coordinated points.

The actual stationing will be used by the *Setting Out* program (including the scale factor).

The *PositionLight* of the Trimble™ 3600 is very useful for setting out points and will drastically reduce the time needed to set out a point.



52 Setting Out	PROJECT
Coordinates 1	
Stat. Check 3	

Setting out menu.

📖 **Configuration**
Instrument
Switches
Reference System

It is possible to record oriented (by stationing) or not-oriented Hz-directions. For setting out parameter computation, oriented Hz-directions will be used.

Rectangular Coordinates

Rectangular Coord. **1**

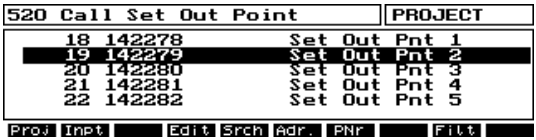
⇨ **:** S , P
⌖ **:** (SD, Hz, V)$_{S\text{-}A}$
💻 **:** (dl, dq, dr)$_{P\text{-}A}$

Setting out using coordinates Y, X, Z with orthogonal corrections dl, dq, dr or coordinate corrections dy, dx, dz. After the call-up there is a selection of the set out points supported by a coordinate filter from the project file.

Inpt to enter a co-ordinate

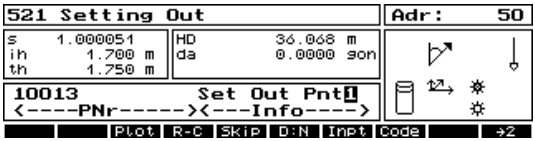
Proj select another project

📖 **Data Management** Editor



Recall the set out point from the project data. It is possible to recall points from another project, or input directly.

Skip Call up a new point from project file without saving the last point measurement.



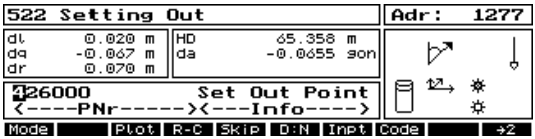
After selection the direction and distance to the set out point is displayed.

📖 **Trimble 3600** PositionLight

The prism should be aligned to the telescope direction. Use the PositionLight of Trimble 3600 for an optical aid for aligning the prism.

measure the position of the prism and displayes the setting out screen.

The Setting Out screen



to save the set out coordinates and to select another point e.g. from another project file.

Pressing **Mode** will display other values:

Mode Selection of misclosures: **dl**, **dq**, **dr** or **dy**, **dx**, **dz**

dl, dq, dr	length, cross, and radial misclosures
dy, dx, dz	coordinate differences
HD	Horizontal Distance
da	Angle misclosure

If the errror limits for a set out point are exceeded, then the display will show a star as a warning.

Setting out with Tracking

 PositionLight

Using PositionLight and Distance Tracking together provides the fastest solution.

D:T Distance: Tracking

D:N Distance: Normal

The distance softkey is used to turn the distance tracking on and off.

Recording of the set out point is only possible after a normal distance measurement

A single measurement is activated with

 or  .

R-MC Record mode

Cfg Configuration Recording

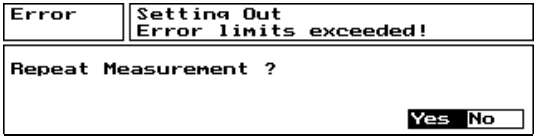
Recording

The recording mode is set using the softkey **R-M**, **R-C**, **R-MC**. In the Configuration *Coordinates Setting Out Recording can be set*, which values should be registrated.

 **Configuration**
Program
Coordinates
Setting Out

Before recording, the error in the setting out is compared with the error limits set in the configuration.

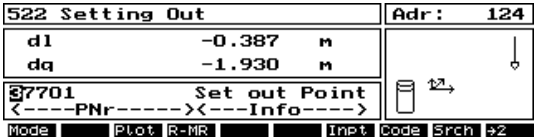
If the error limits are exceeded:



Yes to repeat the measurement.

No Record and call the next point.

Plot Zooming the dl, dq display.

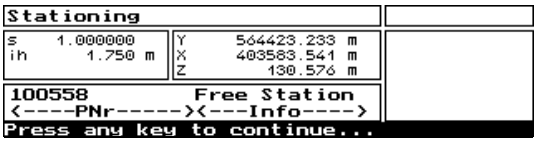


Press **Plot** again for normal viewing.

Station Check

Stat. Check **3**

This is used to check that the correct station coordinates are occupied, and that the orientation of the circle is correct for the coordinate system.



5 Advanced Applications

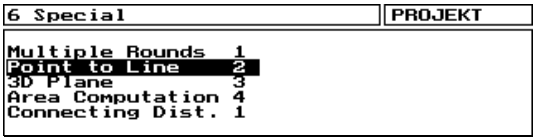
This chapter descripes advanced applications in the daily surveyors practical work. This applications are implemented in the menu *Coordinates* and *Special* of the Elta® S software.

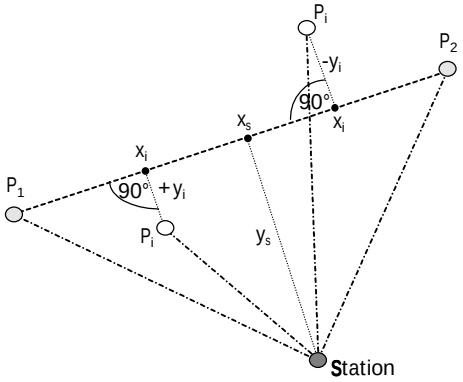
Point-to-Line Distance

Special 6

Point to Line 2

Determination of Point-to-Line distances. The line is defined by angle and distance measurement of two points or the recall of these points from the project file.





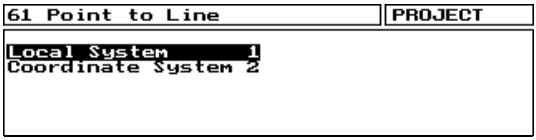
Survey by quasi-perpendiculars or staking out of points or profiles orthogonal to a line can be done by the help of this measuring method.

The line defining points **P_1** and **P_2** can be measured from a free selectable Station **S**.

For the point measuring **P_i** orthogonal to the line in a local system the x-axis will be defined by **$P_1 P_2$** with **P_1** as the coordinate origin.

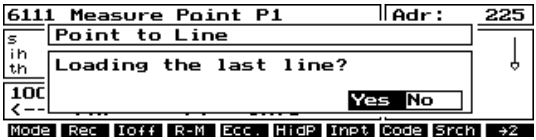
The heights refer to line point **P_1** with height z = 0 or a heightstationing.

Selection of measuring in a local system or a coordinate system.



Measuring in a local system

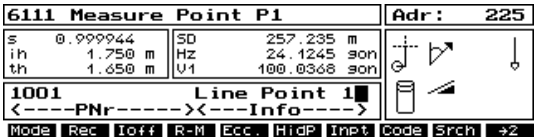
Local System **1**



Yes The last measured line and their coordinates will be loaded by the program.

No Program goes further with.

Line measuring:



Zon Switch on and select the height reference

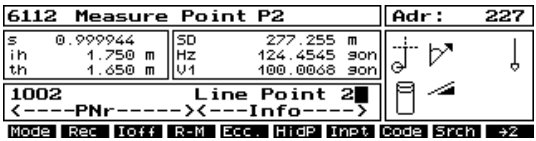
The height reference for defining the line can be selected by the Softkey **Zon**:

1. Height from P_1
2. Height from heightstationing
3. No height (**Zoff**)

Zoff No height

If no other height reference is defined, the height from P_1 is default

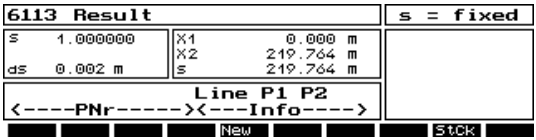
or ◎ to measure line point P_1



or ◎ to measure line point P_2

If P_1 and P_2 are identical, a message appears in the program.

New New line measuring

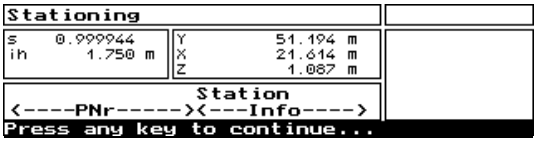


Result of the measured line $P_1 P_2$. The x-axis is defined by both points with point P_1 as the coordinate origin.

Accept the line measurement.

StCk Station check

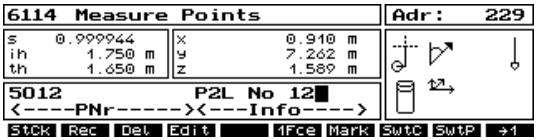
To check the station coordinates refering to the coordinate system defined by the line.



Point-to-Line distance measurement

After defining the line, point P_i measuring can be done. The orthogonal position and the line distance of the points (y_i, x_i) to the line $P_1 P_2$ will be computed:

Mode Switching the display to show
y x z or y x Z
HD Hz h
SD Hz V



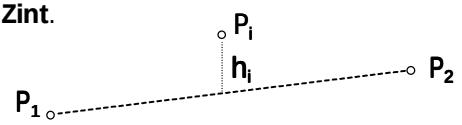
or to measure the points P_i.

Zon Height on

Zint Interpolated height

Zoff No height

The heights h_i of the P_i can be interpolated to the defined line P_1 - P_2 by toggling the height softkey to **Zint**.



Measuring in a coordinate system

Coordinate System 2

A stationing must be done before measuring poin-to-line distances in a coordinate system.

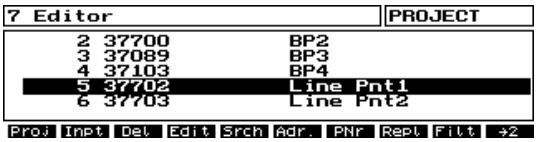
The program starts similar to the local system. You will be asked whether or not you wish to use the last line.

Line definition

can be done by

- Measuring both line points (similar to the local system),
- Call-up of both points from project file,
- Combination between measuring and call-up for both points.

In case of a new line definition the program leads automatically to the call-up (**Edit**) for the first point P_1:

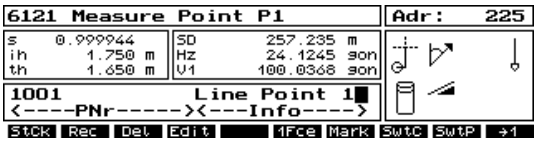


↵ call-up the point P_1 from project file

or

Edit Back to the Editor to call-up the line point from project file

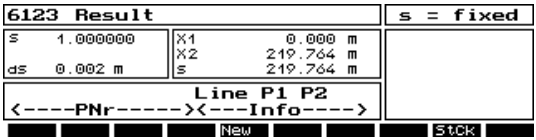
Esc goes to the measurement menu:



↵ or ◎ to measure line point P_1

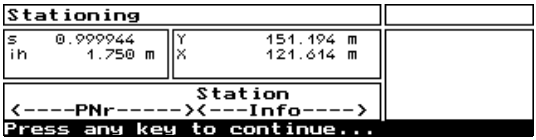
Measuring or calling-up of the second line points leads to the result display:

s Length of line



StCk Station check

The local Station coordinates refering to coordinate system defined by the line will be displayed (not the higher-order coordinates):



Display of the station coordinates.

📖 **Configuration**
Programs
Special
Point to Line

☞ Tip

To activate recording Grid Coordinates**,** switch **On** in the Configuration of Instruments (menu 92313).

Point-to-Line distance measurement

📖 **Point-to-Line Distance**
Local System

The measurement is similar to measuring in a local system.

6 Data Management

This chapter describes the entry, transfer and storage of data.

Editor

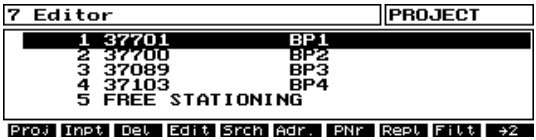
Data Transfer

Data Format

Editor 7

For the entry of point information and coordinates.

Display and editing of the project file using selectable output filters.



The editor menu displays the addresses of the current project file and their contents in an abbreviated form (27 PI characters).

If an output filter has been set, this is indicated in the menu title bar.

Keys frequently used in the editor

↑ ↓	Up and down cursor keys
PgU^{p} PgD$_{n}$	Scrolling the display by four address items
Home End	Jump to the first and last addresses
Tab	Navigating between input fields
↵	Recording entries
Esc	Quitting the editor

Quitting an input menu (Inpt, Edit)

Esc Quitting the current input menu.
If any entries made have not been saved with

↵ the following enquiry appears:

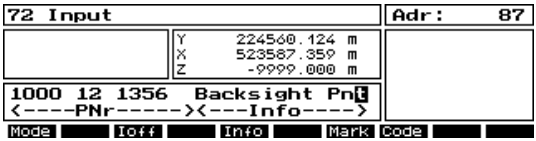
Yes The change (entry) is saved.

No The change is not saved.

Entering a data record

Inpt Editor input menu

Select **Inpt** to get to the editor input menu:



Entry of:
Point identification (PI)
Coordinates
Directions and distances

Mode Switching between the entry of
Y X Z / y x z
SD Hz V
HD Hz h

The **Mode** button permits you to switch between different input modes (corresponding to the measuring modes).

Ioff Incrementation for the entry **off**

Ion Incrementation for the entry **on**

Mark Changing the marking

Code Calling the code-list

📖 **Measurement in a local System**
Use of codelists

Attention !

In the YXZ mode, you have to enter the value **Z=-9999.000** m for points of unknown height. The height **Z=0.000 m** is considered to be a known height and is used as such by the programs.

Recording the entry

The data line entered is saved at the end of the current project file at the address displayed in the address window.

↵ For recording.

The line entered remains available in the display and can be edited for the next input line.

The memory address for the next input line is incremented by 1.

Esc Quitting the input menu.

Editing a data record

Edit Editing a data record

Select a measured or entered record in the editor menu using the cursor buttons. Press the **Edit** button to have the complete record displayed.

Mark Changing the marking

Code Calling the code list

Only coordinates or values defined by input can be edited here in the displayed input mode. Original measured data cannot be edited.

PgU^{p} PgD$_{n}$ Selecting further records for displaying and (if possible) editing.

If you select a record to which attributes such as headers, scale, ih, project info line etc. have been assigned by the program, the record is displayed and the PI can be edited using **Edit**:

Display of an attribute line (e.g. Info Line).

↵ Save and Quitting the display

Rec Recording a record

The edited record is saved without the need to quit the editing function. The same address in the project data file is used for saving.

Srch Search for record

Adr. or address

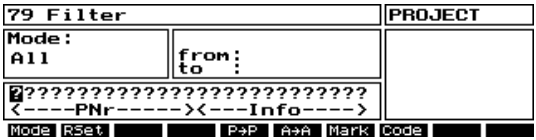
Searching for a record or address

📖 Searching for records

Filtering of records

Filt Setting an output filter

For data transfer or deletion, it is often advisable to define a filter by combining several optional criteria. Only the relevant records are then displayed for further use in the editor.



Menu for the generation of filters. The filter currently selected is displayed. If no filter has been set, the input fields are blank.

Filter options

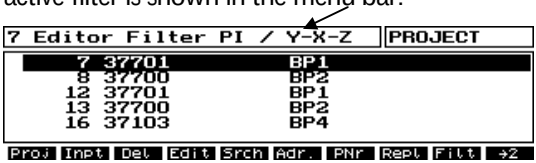
- Point identification (text or code blocks)
- Addresses from – to
- Point numbers from – to
- Attributes of values (Y-X-Z, SD Hz V, etc.)
- Combinations of these options

Filter effect

- If the PI is used for filtering, only the records with the selected marking are filtered.
- If other criteria are used for filtering, the filter applies to all markings
- With a combination of PI + other criteria, the selected marking applies.

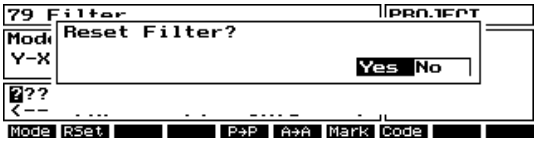
Setting a filter

Press ↵ to activate the selected filter. After that, the filtered brief display appears again. The active filter is shown in the menu bar:



RSet Resetting an output filter

Resetting a filter



Yes All the data of a project is displayed.

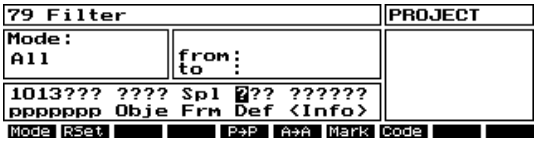
Mark Activating or changing the marking

Code Filtering acc. to coding with code-lists

Point identification filter

Select **Mark** to activate the current marking or to change to a different marking.

If the marking defines code blocks, you can select these as filter attributes using **Code**.



Example: Filtering for records with "Spl" code and point numbers with the leading numbers 1013.

Enter your data in line with the format of the selected marking (blanks are significant).

A→A Address filter

Filtering according to address ranges

Set an output filter from address i to address j.

Delault address range:

from: first address

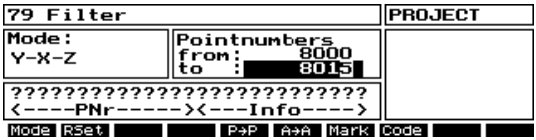
to: last address

Example: Filtering for records in the address range 1 to 88 of the complete project file.

P→P Point number filter

Filtering according to point number ranges

Set an output filter from point number i to point number j.



Example: Filtering of the point numbers 8000 to 8015 for data records which include the data attributes Y X Z for the selected marking.

Filtering according to point numbers is independent of the marking, unless PI is used as a filter criterion at the same time.

Other in-between records containing information (headers, text lines, etc.) are omitted.

Mode Filtering acc. to data attributes

Filtering according to data attributes

By default, all data attributes are accepted for filtering. The **Mode** input field shows ***All*** in this case.

The **Mode** softkey permits you to filter out the following 11 data combinations:

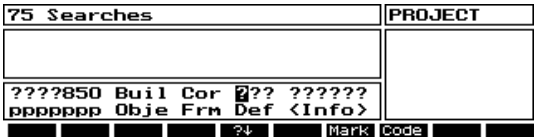
? is like a wildcard

All / SD-Hz-V / Hz-V / HD-Hz-h / y-x-z / y-x-? / ?-?-z / Y-X-Z / Y-X-? / ?-?-Z / HD-O-h

> ☞ **Tip**
>
> In this way, you can simulate coordinate files or measured data files, for example.

Searching for data records

Srch Calling up search



Mask-oriented search for data lines according to different criteria. The output filter currently selected is effective.

Search options: **Point number**
Code or text
Time (if incl. in marking)
Combination of these options

To enter the search criterion, proceed in the same way as for the setting of a PI filter.

If you have searched for a mask before, this mask is offered for editing or for continued search.

> ☞ **Tip**
>
> The search is only made in records with the selected marking.
>
> The placeholders "**?**" in the mask permit the use of any character for the search, i.e. if no search is necessary in the PI position, "**?**" can be retained. Entered blanks are significant.

Mark Changing the Marking

When you select a different marking, the search mask is deleted. The layout of the placeholders "**?**" is automatically adapted to the new marking.

Code Calling the Codelist

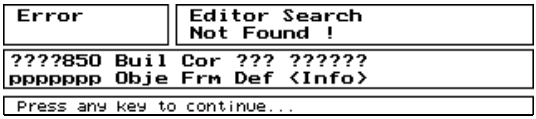
If code fields have been defined in the selected marking, you can search the code from the associated codelist.

↵ Starts the search.

?↓ Search to file end

?↑ Search to file beginning

The search starts at the current address and continues downwards to the file end. You can use the up and down keys **?↓** and **?↑** to change the search direction. If the search is not successful, the following message is displayed:



If the search is successful, the cursor moves to the relevant record in the editor brief display.

> **☞ Tip**
>
> Searching for PI in a large project file, it helps to save time if you start the search from an address near the PI required.

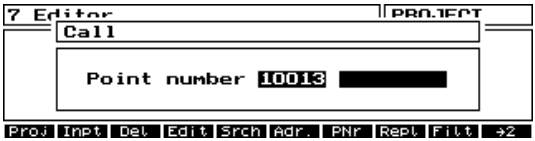
Adr Search for/calling up addresses

Enter: **1 ≤ address ≤ n**
(**n** = last address used)

The last address **n** of the project file is always displayed by default.

The start and result of the search correspond to those of the **Srch** function. The output filter currently selected is effective.

PNr Search for/calling up point numbers

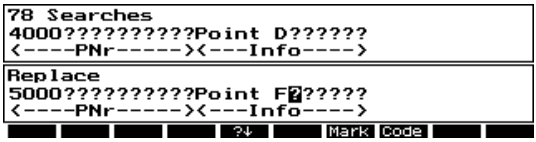


Enter: **Point number**

The start and result of the search correspond to those of the **Srch** function. The output filter currently selected is effective.

> **☞ Tip**
>
> The search for an address and point number is made irrespective of the marking. The markings PI1, PI2 etc. used in the project file must be configured in the instrument.

Repl Search and replace



Mask-oriented search for and replacement of data lines in the same way as in the **Srch** function.

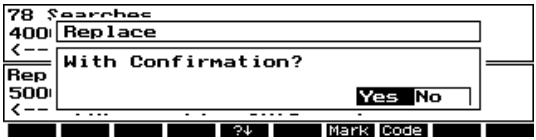
Enter: **Search mask** (-string)
Replacement mask (-string)

 To entry of the replacement string

 Start search / replace

?↓ Search direction

Confirmation of replacement:



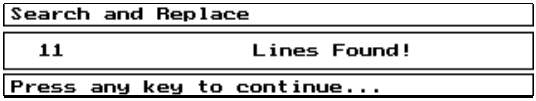
No All strings conforming to the search criterion are replaced by the new string without prior enquiry.

Yes Each replacement is preceded by an enquiry, with a display of the data line found:

Yes The displayed data line is replaced by the new line.

No No replacement, search is continued.

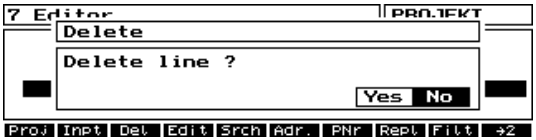
After completion of the search / replacement, the result is displayed:



Deleting data records

Del Deletes data records

This function deletes the data line marked by cursor in the project file:



Yes The record is deleted.

No No deletion, return to the editor menu

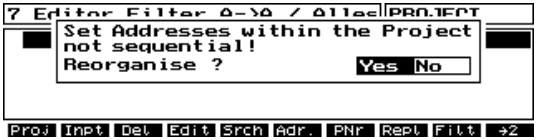
If an output filter is set, this function deletes all records set in the current output filter:

Yes All records in the current output filter are deleted.

The current output filter is then reset, and all undeleted data of the project file is displayed again.

No No deletion, return to the editor menu

After deletion, the data memory can be reorganized in the same way as by the **OrgP** function:



Yes Data memory reorganization.
Caution! This deletes the data for good!

No No data memory reorganization. Attention! Gaps in the addresses! But the data remains available in the project file!

Data recovery after deletion?

Yes, but be careful when using external editors !

Attention !

Only the reorganization of the data memory will physically delete the selected records in the project file. If this process has not yet been started, you can reactivate the address ranges selected for deletion by using an external editor and replacing the delete identifier "~" in column 119 of the record by a blank. Please note, however, that the record length of 121 bytes (characters) must not be exceeded!

After the deletion of records, you return to the editor menu (brief display).

Further function keys

Proj Project change

You can change the current project without having to quit the editor. When you quit the editor, the project originally selected is reloaded.

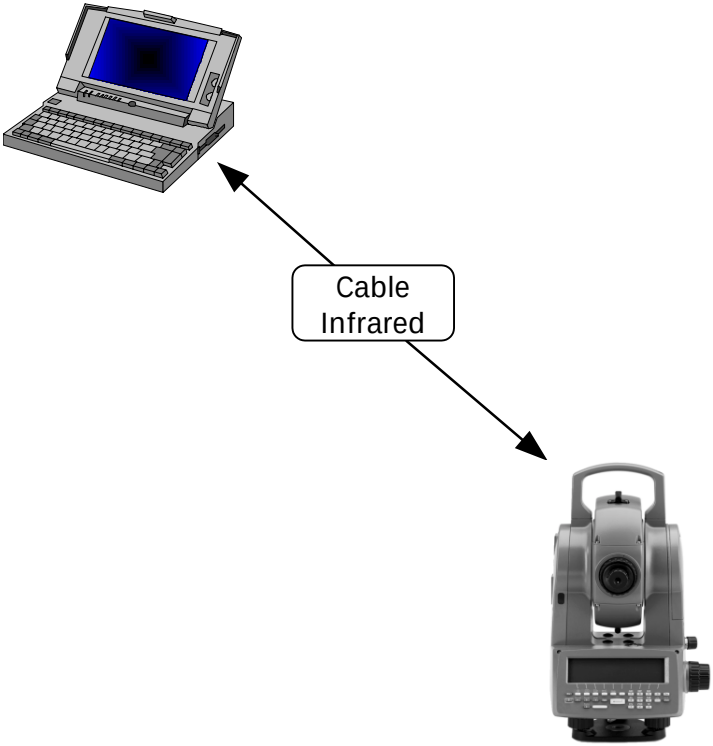
OrgP Data memory reorganization

Reorganizes the data memory in the current project.

This button is available if data has been deleted without subsequent memory reorganization, and if address gaps therefore exist in the project file.

Yes Data memory reorganization.
Caution! This deletes the data for good!

No No data memory reorganization. Attention! Gaps in the addresses! But the data remains available in the project file!



Data transfer can be done between

by

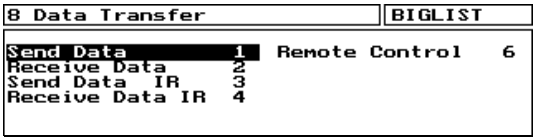
↔ RS232C cable interface

Trimble™ 3600 ↔ PC

Cable
Infrared

This allows comprehensive yet easy data management and exchange. The software functionality for data transfer is the same on the instrument via radio

Data Transfer 8



Cable for data transfer using the Xon/Xoff protocol:

Instrument ↔ PC
Cable:
Cat. No.
708177-9470.000

📖 **Data Transfer**
Zeiss Control Center

Data transfer Trimble 3600 ↔ PC

instrument ↔ **PC**
Connect both devices by a serial interface cable and start the necessary programs for data transfer.

Infrared data transfer at this menu level is not supported. A solution for infrared data transfer is given by the **Zeiss Control Center**.

☞ Tip

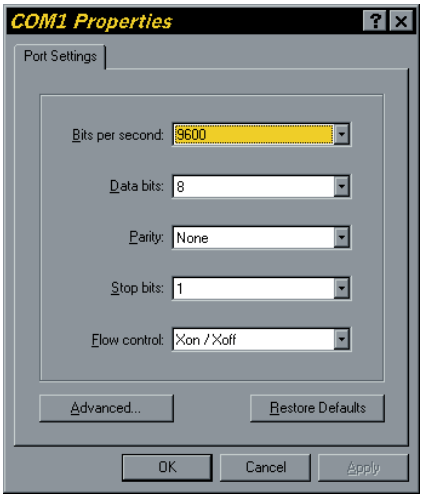
For data tranfer of project files by cable to the PC, you can use e.g. the MS-Windows™ Hyperterminal Program. Connect the Elta® C with your PC station via serial interface cable and define the interface parameters in the Terminal Program as described in the next chapter.

For an easy data transfer via infrared or serial cable interface the PC Program **Zeiss Control Center** for Windows™95/98/NTwill be needed. This optional program can be ordered under Cat.-No.: 708043.0000.000.

Hyperterminal Settings

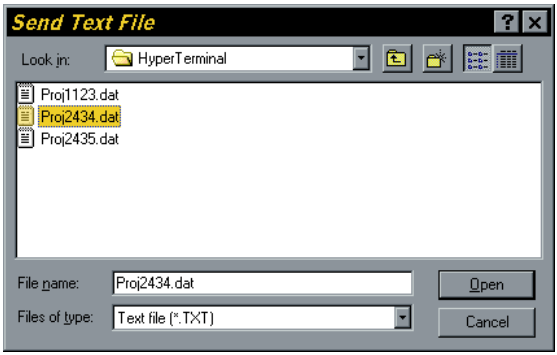
Example Windows™ 95/98 or Windows™ NT Hyper-Terminal Program:

The COM port settings can be switched in the Hyper-Terminal Program of Windows™ 98 or Windows™ NT under *FIle* > *Properties* > *Configuration* as follows:



Tip: for a much faster data transmission switch off the "local echo" in the Hyper-terminal ASCII-Configuration.

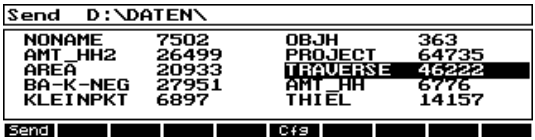
To send or receive a project file, select for transfers "*Send text file*" or "*Receive text file*":



Data transmission

Send Data **1**

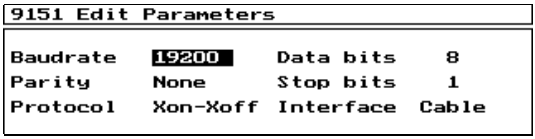
For the transmission of data files.



Send Transmits data file

Use the cursor keys to select the project file required and transmit it with **Send**.

Cfg Configuration of interface parameters



Configuration of interface parameters. The same parameters has to be set on the external device (PC e.g.).

Baudrate:	2400 / 9600 / 19200 (default) 38400 / 57600 / 115200
Parity:	no / odd / even
Protocoll:	Xon-Xoff / Ln-Ctl / Rec500
Data bits:	8 / 7
Stop bits:	1 / 2
Interface:	Cable / Infrared

 to select parameters,

 to accept.

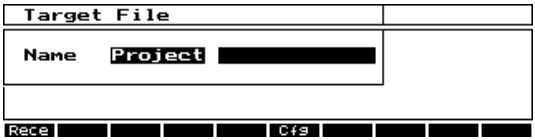
☞ Tip

The instrument or program at the receiving end must be set to the receive mode before you can transmit the project file.

Data reception

Receive Data **2**

For receiving data files.

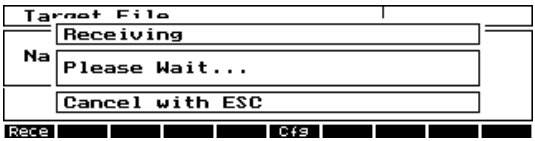


Enter the new file name.

Rece to enter the target file name

↵ to accept sets the instrument in the receiving mode.

The instrument is now waiting for the file from the transmitting end:



Esc to continue after receiving the data.

Target drive on the Instrument: D:\DATEN

Cfg Configuration of interface parameters

Cofiguration of interface parameters is similar to Send Data.

☞ **Tip**

Time-out occurs after 45 seconds without data communication.

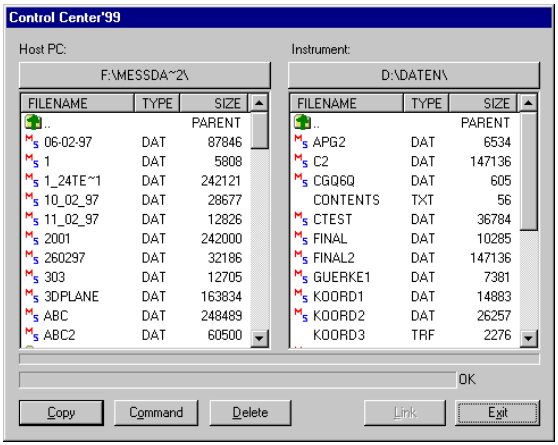
The message "Data format error“ indicates a data error. The program returns to the data transfer menu.

Zeiss Control Center

Runs under Windows™95/98/NT

PC program for data transfer via serial interface. With Trimble 3600 Zeiss Elta software release V1.04 or higher the instrument communicates via infrared interface to the Zeiss Control Center on a PC.

Trimble 3600 System Controller:



Start Remote Service (Cable or Infrared) in the system control menu on the instrument.

Link — Automatic scan of all serial interface ports (cable or infrared) on PC for a connected instrument.

Copy — The files selected on PC or instrument will be copied to the target directory displayed on the other window.

For further information: 🕮 User Manual for Zeiss Control Center.

M5 data format

Project file <NAME>.DAT

<NAME> Project name

When you set up a new project, an ASCII project file is created whose records conform to a predefined format.

M5 record format

The Trimble 3600 uses the Zeiss M5 data format which is the common standard for all current Zeiss surveying systems.

1 Address block

1 information block
3 numerical data blocks

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).

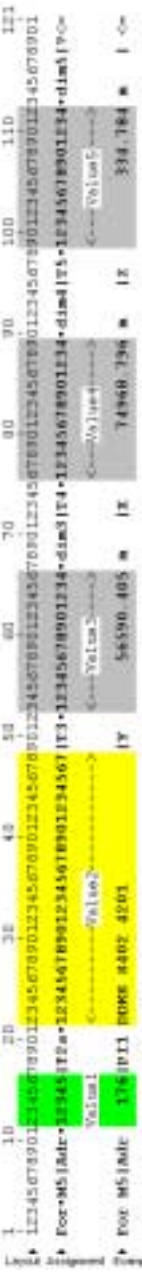
M5 data line

The data line of the M5 format has a length of 121 characters (bytes). The multiplication of this figure by the number of addresses (lines) stored gives you the volume 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: Internal CZ code field or blank
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	Elta® 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 (Pla ,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	CZ code, 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

7 Adjustment

The instrument adjustment defines all corrections and correction values for the Trimble™ 3600 Zeiss Elta, which are required to ensure optimum measuring accuracy.

Adjusting V-Index / Hz-Collimation

Adjusting Compensator

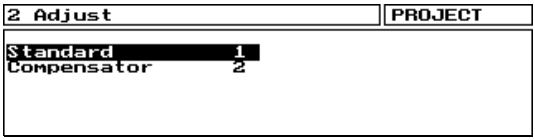
Adjusting DR EDM System

Adjustment methods

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.

Adjustment 2

The menu item *Adjustment* offers the following adjustment programs:



Adjustment menu.

Instrument Corrections Standard

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

Compensator

Determination of the compensator run center.

☝ 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).

Instrument errors and their correction

i Vertical index correction

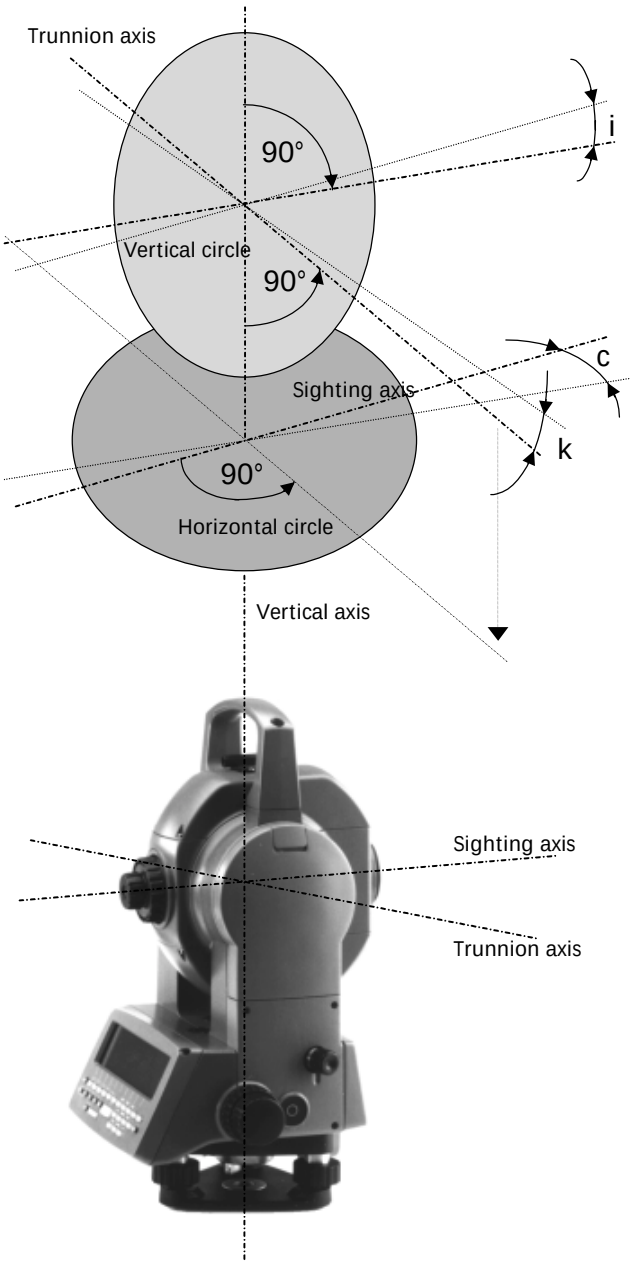
The vertical index error is the zero point error of the vertical circle with respect to the vertical shaft.

c Sighting axis correction

The sighting axis error is the departure from right angles between the trunnion axis and sighting axis.

k Trunnion axis correction

The trunnion axis error is the departure from right angles between the trunnion axis and vertical shaft. It is determined at the works and its correction is stored in the instrument.



Further errors are:

Compensator run center error

Adjusting V-Index / Hz-Collimation

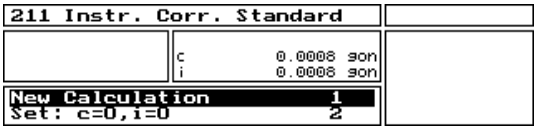
The vertical index and sighting axis corrections should be recomputed after prolonged storage or transportation of the instrument, after major temperature changes and prior to precise height measurements.

> ☞ **Tip**
>
> Before starting this procedure, precisely level the instrument using the electronic 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 = $100^{grads} \pm 10^{grads}$).

Standard 1

Determination of the sighting axis and vertical index corrections, or setting the values c = i = 0.

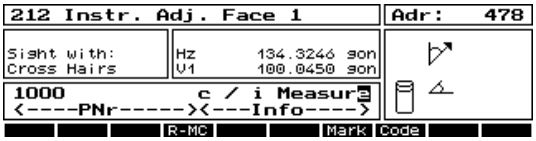


The current **c** and **i** values are displayed in the readings window.

c sighting axis correction
i vertical index correction

New Calculation 1

Determination of the **c** and **i** values by measurement in two faces.

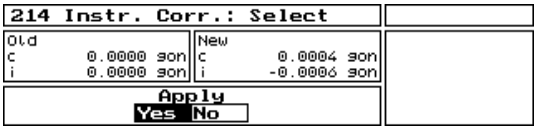


for measurement in face 1.

Then turn the instrument through 180 degrees in Hz and V in face 2. Sight the same point again.

for measurement in face 2.

The new vertical index and sighting axis corrections are computed automatically.



Yes The new values are saved.

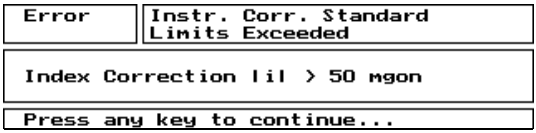
No The old values are retained.

Technical

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

Tolerance exceeded

If either the **c** or **i** value exceeds the admissible range of ± 50 mgrads, the following error message appears:



The values are not saved, and the menu for new calculation is displayed again.

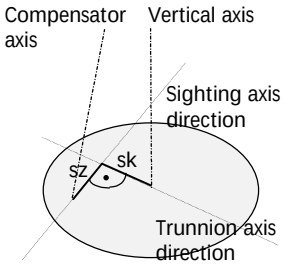
Attention !

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

Set: c=0, i=0 2

Setting the **c** and **i** values to zero.

Adjusting Compensator



The Trimble 3600 features a dual-axis compensator which compensates any vertical shaft inclinations remaining after instrument levelling both in the sighting and trunnion axis directions.

To check the compensator, its run center should be determined at regular intervals and in particular prior to precise height measurements.

Compensator 2

Determination of the compensator run center and checking of the instrument levelling.

```
251 Center point of Comp.
                  sz      0.0021 gon
                  sk      0.0001 gon
New Calculation          1
Check Levelling          2
```

The current run center values for **sk** and **sz** are displayed in the readings window

sk component in trunnion axis direction
sz component in sighting axis direction

New Calculation 1

Determination of the new run center components **sk** and **sz**.

In New Calculation wait for the request to turn the instrument in Hz-direction to 0 degrees.

```
Turn Hz to 0 !
                    200.0000


Then continue with <Return>
```

 to continue displays the results of the automatically computed center point:

```
253 Center point of Comp.
Old                New
sz    0.0021 gon   sz    0.0020 gon
sk    0.0001 gon   sk    0.0009 gon
          Apply
        Yes No
```

Yes The new values are saved.

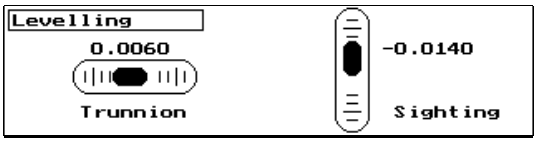
No The old values are retained.

Attention !

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

Check Levelling 2

Calling up the "Electronic level" display for levelling the instrument.



The signs of the inclination values in position 1 have to be interpreted as follows:

Inclination	*Trunnion axis*	*Sighting axis*
positive value:	to the right	to the front
negative value:	to the left	to the back

📖 **First Steps** Before Measurement

Use the tribrach footscrews to set the inclination values roughly to zero. More precise levelling is not required if compensation has been activated. At any rate, the residual inclinations should be within the compensator working range (±0.092 grad).

Tip

Precise levelling is advisable if the compensator needs to be deactivated due to vibrations.

The electronic level can be called up at any point of the program using the hotkey.

DR EDM System

The system

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

☝ Attention !

Before starting adjustment, allow the instrument to adapt to the ambient temperature.

Inspection the Direction of the Beam:

Check the system at regular intervals in order to avoid faulty measurements. A target foil is provided. Set it up between 25 and 50 metres away facing the instrument. Move the telescope to face II. Switch on the red laser beam by activating the laser-point function. Use the telescope crosshair to align the instrument with the centre of the target plate, and then inspect the position of the red laser spot on the target plate. If the spot lies outside the limits of the cross, the direction of the beam needs to be adjusted

☞ Tip

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

Adjusting the Direction of the Beam:

Pull the two plugs out from the adjustment ports on the top and the front side of the telescope housing. To correct the height of the beam, insert the alan key into the front side adjustment port and turn it. To correct the beam laterally, insert the alan key into the top side adjustment port and turn it. Throughout the adjustment procedure, keep the telescope pointing to the target plate..

Technical

At first the adjusting screws are of a high tension as they are selfblocking. The screws will tighten automatically after the adjustment.

Attention !

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

8 Configuration

With the configuration, you can adjust the Instrument to all measurement conditions and requests taking into account an optimum of operator convenience.

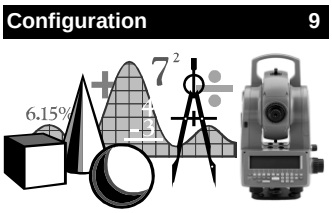
Configuration Instrument

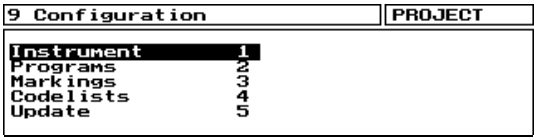
Configuration Programs

Configuration Markings

Configuration Codelists

Configuration Update





↓ and ↵ or with keys 1 to 5 for a directly menu selection.

Generally, the settings of the configuration are stored permanently. Exceptional cases (temporary storage) are indicated in the description.

Operation in the submenus

For the setting of switches or input of information and data, resp., the handling of the menus of the configuration is based on a common concept. The following keys are frequently used:

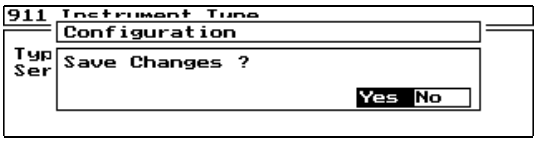
↑ ↓ Tab Cursor positioning

0 - 9 Keys for direct selecting of submenus

Toggling in selection fields

↵ Confirming entrance and quitting

Esc Quitting of submenu;
when settings have been changed, the following question is asked prior to quitting:



Yes Change accepted

No No change of settings

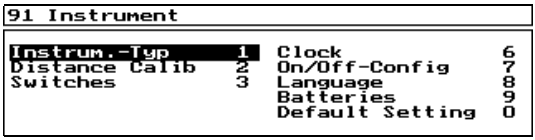
This user information is a pre-requisit for the following descriptions.

📖 **Trimble™ 3600 System** Operation

Configuration 9

Instrument 1

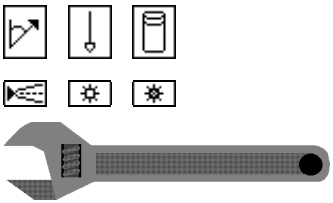
Setting and checking of all switches, parameters and options necessary for best operation of the instrument.



Menu of the instrument configuration.

↓ and ↵ or with keys 0 to 9 for a directly menu selection.

Overview Instrument Configuration

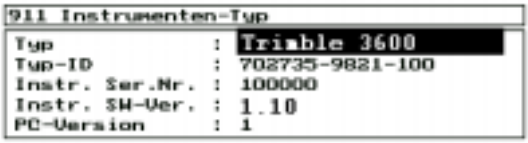


91 Configuration Instrument

- 911 Instrument Type
- 912 External Distance Calibration
- 913 Switches
  - 9131 Illumination
  - 9132 Peripheries
  - 9133 Adjustments
  - 9134 Units / Decimal
  - 9135 Reference
  - 9136 Recording
  - 9137 Error
  - 9138 Operation
- 916 Clock
- 917 On/Off-Configuration
- 918 Language
- 919 Batteries
- 910 Default

Instrum.-Type **1**

Definition, whether measuring with instrument or by manual input.



Type: **Trimble 3600**
Manual Input

Type-ID: Cat. Number

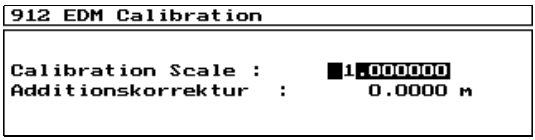
Ser. Number: Instrument serial number

SW Version: Installed Software Release.

PC Version: Display of PC Type
1 = 8086 Processor
2 = 486 Processor

Calibration **2**

Display and input of calibration scale and addition correction for supplementary correction of distance measurement.



Calibration scale: Default = 1.000000
✍ 0.995000 < Km < 1.005000

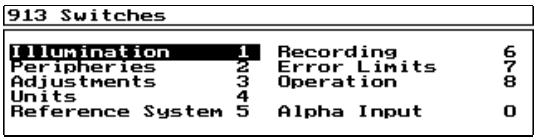
Addition correction: Default = 0.0 mm
✍ -10.0 mm ≤ Ac ≤ 10.0 mm

Attention !

Both values influence the measured distance directly! Therefore, they must have been determined by means of an accurate calibration.

Switches 3

Switching instrument functions and their parameters on and off.

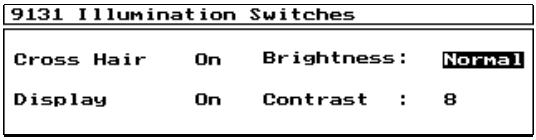


Menu Switches for instrument configuration.

Switches 3

Illumination 1

Switching on and off and adjusting the illumination available in the instrument.



Cross Hair: on / off

and the switches for the display illumination:

Display: on / off

Brightness: low / normal / high

Contrast: 0 (low) to 10 (high)

☞ **Tip**

The illumination can also be switched on and off using the Hotkey ⇧ .

Switches 3

Peripheries 2

Switching sensors and actuators on and off.

PositionLight **on**

Laserpointer ON

Laserpointer OFF:

Once - after each measurement or 2 min

10 min - after 10 min

Off - pointer On always

Toggling all switches **On ↔ Off.**

☞ **Tip**

The PositionLight and the Laserpointer can also be switched on and off using the Hotkey ⇧ and ⇧ .

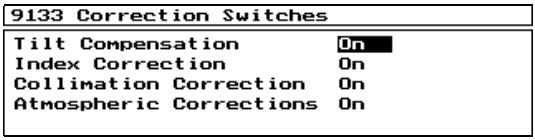
Switches 3

Adjustments 3

Activating and deactivating corrections to the measured bearings and distances.

Compensator **On**

Annex
Glossary



Toggling all switches **On** ↔ **Off**.

Default: all switches **On**.

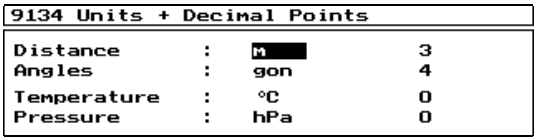
☞ Tip

After instrument startup all switches are again in position **On**.

Switches 3

Units 4

Modification of display of measuring units and number of decimal places.



Distances:	m	ft		
Decimal places:	1-4	1-4		
Angles:	grads	DMS	deg	mil
Decimal places:	1-5	0-1	1-5	1-4
Temperature:	°C	°F		
Decimal places:	0-1	0-1		
Pressure:	hPa	Torr	inHg	
Decimal places:	0-1	0-1	1	

☞ Tip

The number of decimal places is not related to the internal data storage, but only to the appearance of the data on the display.

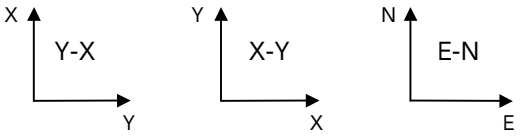
Switches 3

Reference System 5

Modification of display of coordinate systems and definition of angles and bearings.

9135 Switch Reference System	
Axis Definit.	: Y-X
Display	: Y-X
Height	: Z
Hz-Direction	: Orientated
Vert.Orient	: Zenith Angle

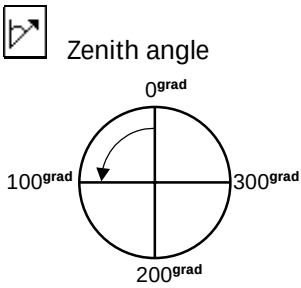
Assignment of coordinates:

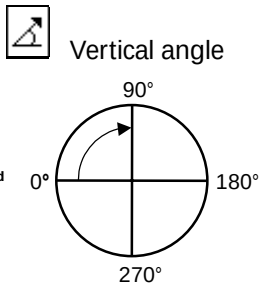


Indication sequence: Y-X /X-Y E-N /N-E

Height: Z El

Vertical reference system:

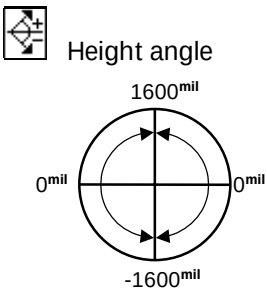


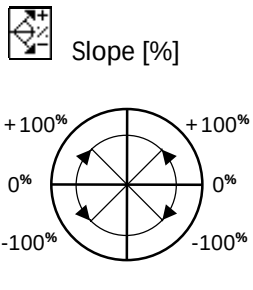


Examples

1: Zenith angle
unit 400 grads

2: Vertical angle
unit 360°





Examples

3: Height angle
unit 6400 mil

4: Slope [%]
unit %

Hz-Direction:

absolute: (default) recording of the absolute (original) Hz circle reading.

orientated: recording of the oriented (by stationing) Hz direction.

Switches 3

Recording 6

Recording **On**

```
9136 Recording Switch
Recording          On
Destination        Internal
Format             Rec E
                   Cfg
```

Switches the data storage **On** or **Off**.

Default value: Recording **On**

Target Drive: **Internal** (A:\ or D:\DATEN)
External (RS232C)

Format: **Rec E** (M5, internal + external)
Rec500 (only external)

Cfg Configuration of interface parameters

```
9151 Edit Parameters
Baudrate   19200     Data bits    8
Parity     None      Stop bits    1
Protocol   Xon-Xoff  Interface    Cable
```

Configuration of interface parameters. The same parameters has to be set on the external device (PC e.g.).

Baudrate: 2400 / 9600 / 19200
38400 / 57600 / 115200

Parity: no / odd / even

Protocol: Xon-Xoff / Ln-Ctl / Rec500

Data bits: 8 / 7

Stop bits: 1 / 2

Interface: Cable / Infrared

Switches 3

Error Limits 7

☐ Error limits **Off**

☐ Error limits **On**

```
9137 Switch Error Limits

Error Limits   On
```

Default value: Error limits **On**

Switches the error limits set in the configuration of the programs **On** or **Off**.

Switches 3

Operation 8

Defines the position of the motion knobs for right-handed or left-handed operation in face 1 in instruments with 2 control units.

```
9138 Switch Operation

Operation in Face 1   : Righthanded
```

Operation in face 1:

righthanded / lefthanded

Switches 3

Alpha-Input 0

Configures the key press frequency for alphanumerical input.

```
9130 Alphanumeric Input

Speed          :        3
(1 is slow, 5 is fast)
```

Selection of a value 1-5. This value defines the time until the cursor goes automatically one position to the right in the alphanumeric input field. During this time the dual assignment swichover for the alpha-letter selection can be done.

(Value 1 = 1.3 sec , ... , Value 5 = 0.7 sec)

Clock **6**

Modification of date and time display.

```
916 Clock Configration

Time Format      :      24 HH:MM
Date Format      :      DD.MM.YY
```

Time format:

24 HH.MM	24 Hours:Minutes
24 HH:MM:SS	24 Hours:Minutes:Seconds
12 HH:MM	12 Hours:Minutes
12 HH:MM:SS	12 Hours:Minutes:Seconds

Date format:

TT.MM.JJ	Day.Month.Year
MM.TT.JJ	Month.Day.Year
JJ.MM.TT	Year.Month.Day

Ctrl T Hotkey for input of time and date in each program level:

Time for time input

Dat for date input

Cfg Configuration display time / date

```
9161  Time and Date

 Time              :      08:31
 Date              :      29.01.98

Time Dat                    Cfg
```

After having pressed the switches **Time** or **Date** the input of time or date can be done in the configured format.

On/Off Config **7**

Configuration of functions to be executed after booting or before loading the application.

```
917 On/Off Configuration

Levelling    :      On
Station Input    :  On
```

Toggling of switches **On ↔ Off**.

Levelling: Display levelling menu after starting the Elta® C.

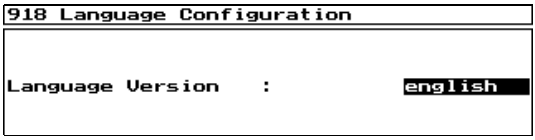
Station Input: Input of station information before start measuring in a local system.

Station Input

Before measuring in a local system a point information and further station parameters (th, ih, Reflector Type etc.) can be entered. This will be stored in the project file as like a header for the following measurement values.

Language 8

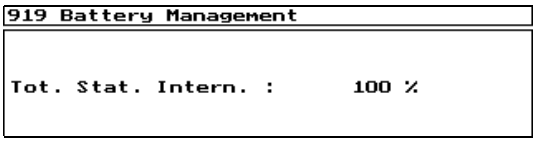
Configuration of the language, in which the software appears on the display.



Here, existing and integrated language versions are offered for activation.

Batteries 9

Management and checking of the batteries connected and their capacities.



Display of the remaining battery capacity of the internal or external battery.

⇧ −+ Hotkey for activating the battery manager (in every menu available).

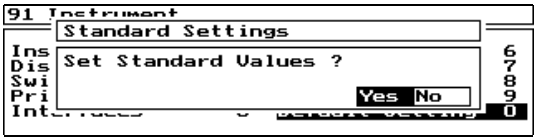
☛ Tip

For switchover between internal and external battery connect the full battery and take the empty battery off from the instrument. The power supply will be stable then.

For changing batteries of the same type, close the application, switch off the instrument and change the battery.

Default Setting **0**

Resets the complete configuration of the instrument to the default values defined in the program.



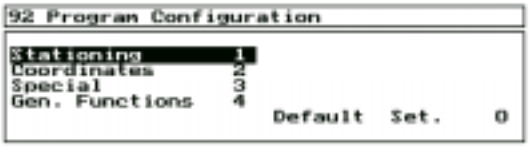
No back without modification.

Yes reset of all parameters of the instrument configuration to their default values.

Configuration 9

Programs 2

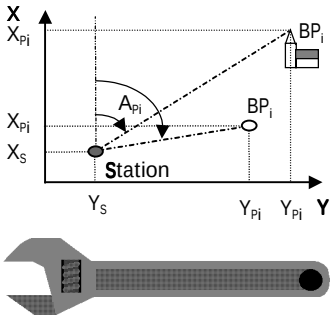
Setting and checking of all switches, parameters and options required for the application programs



Menu of the program configuration.

↓ and ↵ or with keys 0 to 5 for a directly menu selection.

Overview Configuration Stationing



921 Configuration Stationing

- 9211 Free Stationing
  - 92111 Adjustment Type
  - 92112 Standard Deviations
  - 92113 Error Limits
  - 92114 Adjustment
  - 92115 Reductions
  - 92116 Scale Range
- 9212 Stationing on a Known Point
  - 92121 Standard Deviations
  - 92122 Error Limits
  - 92123 Adjustment
  - 92124 Reductions
  - 92125 Scale Range
- 9213 Eccentric Stationing
  - 92131 Standard Deviations
  - 92132 Error Limits
  - 92133 Reductions
- 9214 Heightstationing
  - 92141 Standard Deviations
  - 92142 Error Limits

Stationing 1

Setting and checking of error limits, standard deviations, scale ranges and reduction parameters.

```
921 Stationings

Free Stationing  1
Stat. Knwn. Pnt  2
Ecc. Station     3
Heightstation.   4
```

Menu for the configuration of the stationing.

Free Stationing 1

in analogy to that

Stat. Knwn. Pnt 2

Eccentric Station 3

```
9211 Free Stationing

Adjustment Type  1   Scale Range      6
Stand. Deviation 2
Error Limits     3
Adjustment       4
Reductions       5
```

Configuration menu free stationing.

The configuration of free stationing includes all possible settings of the configuration of stationing on a known point and eccentric station.

Free Stationing 1

Adjustment Type 1

Definition, if and how the type of computation and the scale are set as standard in the free stationing.

```
92111 Free Station. Adjustment Type

Calculations : Single Point Adjustment
Change       : On

Scale        : free
Change       : On
```

The setting entered correspondes to the type of computation displayed first in the program.

Computation: **Single point adjustment / Helmert transformation**

Scale: **free / fixed**

Change: **On**
Type of computation and scale can be changed during the free stationing.

Off
Given type of computation and scale setting cannot be changed.

Free Stationing **1**

Stand. Deviation **2**

Definition of standard deviations of observations and centering for the weighting in the single point adjustment.

✍ $0.0001 \le sr < 1$ grad

$0.001 \le sdc < 1$ m

$0 \le sdl < 1000$ ppm

$0.000 \le sz < 1$ m

```
92112 Single Point Adjust.
Orientation        :      0.0003 gon
Distances constant:       0.003 m
Distances linear   :           0 ppm
Levelling          :       0.000 m
```

Input of values in given measuring units.

	Default values:
Bearings:	**sr = 0.0003 grad**
Distances constant: (constant part)	**sdc = 0.001 m**
Distances linear: (linear part)	**sdl = 0 ppm**
Target centering: (centering accuracy reflector above target)	**sz = 0.000 m**

☞ Tip

A specification of 0.0 results in remaining this parameter without influence on the weighting.

Free Stationing **1**

Error Limits **3**

Definition of error limits for the results of the free stationing.

✍ $0.000 \le va < 1$ grad

$0.000 \le vr/vq/vl < 1$ m

```
92113 Free Stat. Error Limits
                  s=fix     s=free
Linear Dev.   vr   0.040      0.030  m
Angle Dev.    va   0.0050     0.0050 gon
Orthog. Dev.  vq   0.030      0.020  m
Lateral Dev.  vl   0.030      0.020  m
```

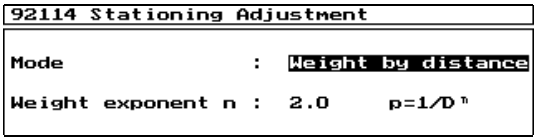
Input of values in given measuring units.

Default values:	s=**fix**	s=**free**
Linear dev. **vr**:	**0.040**	**0.030 m**
Bearing dev. **va**:	**0.0050**	**0.0050 grad**
Transv. dev. **vq**:	**0.030**	**0.020 m**
Long. dev. **vl**:	**0.030**	**0.020 m**

Free Stationing 1

Adjustment 4

Activation and deactivation or weight definition, resp., of best-fit adjustment.



Mode: Distances / Off

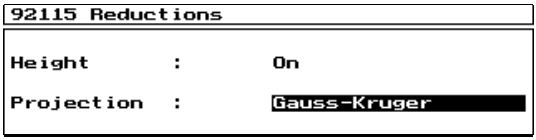
Weight exponent: 0.5 / 1 / 1.5 / 2
For distributing the residuals according to distances by means of the arithmetic mean.

Default Mode: **Off**

Free Stationing 1

Reductions 5

Activation and deactivation of projection reductions.



Height reduction: On / Off
Projection: Gauss-Krueger / UTM / Off

Default reduction: **Off**

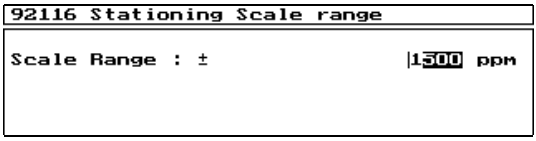
The reductions act (when activated) parallel to the existing scale factor **s** on the distances measured.

Free Stationing 1

Scale Range 6

Definition of the admissible scale range.

✍ $-9999 \leq SR \leq 9999$



Scale range: Input in [ppm]

Default value: ± 1500 ppm

☞ Tip

With a value of 0 ppm, the scale range will not be checked.

Heightstationing 4

Definition of standard deviations and error limits of the height stationing.

```
9214 Heightstationing
Stand. Deviation 1
Error Limits     2
```

Menu of the configuration height stationing.

Heightstationing 4

Stand. Deviation 1

Definition of the distance section, for which p = 1 is applied.

✍ $0 \leq c \leq 9999$ m

```
92141 Heightstationing Stand. Deviation
c : 30 m     Distance for Weight 1
Weight for D >  c : p = c²/D²
Weight for D <= c : p = 1
If c = 0          : p = 1/D²
```

Input distance **c** in [m].

Default: **c = 30 m**

Example:

up to 30 m distance	→ p = 1
from 30 m distance onwards	→ p = c² / D²
c = 0	→ p = 1 / D²

Heightstationing 4

Error Limits 2

Definition of the max. admissible height deviation.

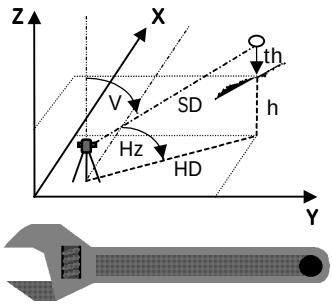
✍ $0 \leq vz \leq 1$ m

```
92142 Height Station Error Limits
Height Dev.   vz :      0.030 m
```

Input height deviation **vz** in [m].

Default: **vz = 0.030 m**

Overview Configuration Coordinates

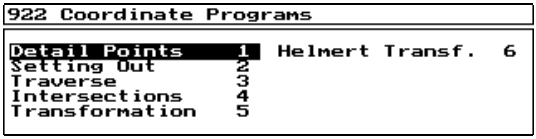


922 Configuration Coordinates

- 9221 Detail Points
  - 92211 Verification Points
- 9222 Setting Out
  - 92221 Error Limits
  - 92222 Recording
- 9223 Traverse
- 9224 Intersections
- 9225 Transformation
  - 92251 Distance Deviation
  - 92252 Scale Range
- 9226 Helmert-Transformation
  - 92261 Error Limits
  - 92262 Adjustment
  - 92263 Scale Range

Coordinates 2

Setting and checking of error limits, admissible differences and ranges in the coordinate programs.



Menu configuration coordinate programs.

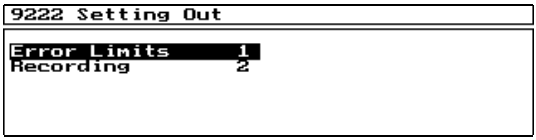
📖 Trimble® 3600 Manual Special/Professional

The Verification Point Configuration for Detail Point Measurement will be described Manual Part for the program packages *Special* and *Professional.*

Coordinates 2

Setting Out 2

Setting out configuration

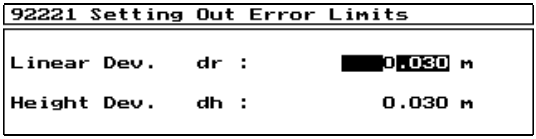


Menu of the setting out configuration.

Setting Out 2

Error Limits 1

Admissible deviations for the definitive coordinates of the setting-out point.



Default value:

Linear deviation dr: **0.020 m**

Height deviation dh: **0.020 m**

✍ $0 \leq dr/dh < 1$ m

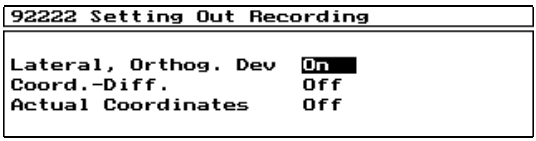
☞ **Tip**

If one value is set to 0, this error limit will not be checked.

Setting Out 2

Storage 2

Activation or deactivation of the storage of setting out results.

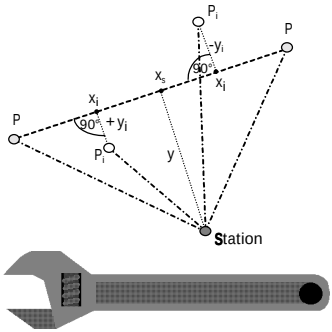


Toggling of switches **On ↔ Off**.

☞ **Tip**

The description of further coordinate program configuration (Traverse etc.) will be done in the part of the manual *Special and Professional* .

Overview Configuration Special




```
923 Special Programs
Point to Line     1
Multiple Rounds   3
```

Menu Configuration of Special Programs.

This manual describes the Point-to-Line Distances configuration. All the other special programs and their configuration will be explained in the part of the manual Special/Professional.

Special 3

Point to Line 1

Configuration of the Point-to-Line Distances program.

```
9231 Config. Point to Line Dist.
Dist. Deviation  1
Scale Range      2
Recording        3
```

↑ ↓ + ↵ to select.

Distance Deviation 1

```
92311 Point to Line - Deviation in dist
Max. distance ds = a + b*s² + c*s
   a  :  0.040                 s[m]
   b  :  0.0080               ds[m]
   c  :  0.00030
```

Input of parameters for computation of the maximum distance deviation.

Scale Range 2

Definition of the admissible scale range.

✍ -9999 ≤ SR ≤ 9999

```
92312 Point to Line Scale Range
Scale Range : ±              1500 ppm
```

Scale Range: Input in [ppm]

Default Value: ± 1500 ppm

Recording 3

To activate recording Grid Coordinates

```
92313 Point to Line Recording
Grid Coordinates :   Off
```

Overwiev Configuration General Functions

924 Configuration General Functions

- 9241 Constants
- 9242 2-Face Measuring
  - 92421 Recording
  - 92422 Error Limits
- 9243 Control Point
- 9244 Distance Measuring
- 9245 Point Identification

General Functions 4

Configuration of general funcions and constants.

```
924 General Functions
Constants          1
2-Face Measuring   2
Control Point      3
Distance Meas.     4
Identical Point    5
```

Menu of the configuration of general functions.

General Functions 4

Constants 1

Modification of the constant parameters earth radius and refraction coefficient relevant to reductions and corrections.

```
9241 Constants
Earth Curvature          :  6370000 m
Refractions Coefficient:        0.13
```

Input in the predefined measuring units of

Earth radius R: Default value 6370000 m

✍ **6300000 m ≤ R ≤ 6400000 m**

Refraction coefficient k: Default value 0.13

✍ **-1.00 ≤ k ≤ 1.00**

General Functions 4

2-Face Measuring 2

Configuration of the recording and error limits for points measured in two faces.

```
9242 2-Face Measurement
Recording          1
Error Limits       2
```

Menu of the configuration measurement in 2 faces.

2-Face Measuring 2

Recording 1

```
92421 2-Face Measurement Recording
Single Values  Off
Middle         On
Differences    Off
```

Toggling of switches **On ↔ Off**.

Default switch: as shown in the screen shot.

Single values: Recording the single values from both faces.

Mean: Recording the mean from both faces.

Differences: Recording the differences between both faces measurements

☞ **Tip**

For various recording modes the following is applied:

R-M Recording of the original measurements or the mean, resp., and/or the differences between them.

R-C Recording of the respective computation values in the same way.

R-MC Recording of measurement and computation values in the same way.

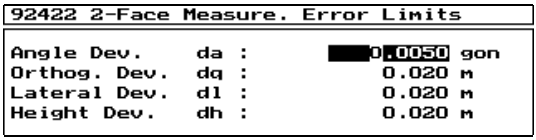
2-Face Measuring 2

Error Limits 2

Input of the error limits for the measurement in 2 faces.

✍ 0.0000 ≤ da ≤ 1 grad

0.000 ≤ dq/dl/dh ≤ 1 m



Input in the predefined measuring units of	Default value:
Bearing deviation da:	**0.0050 grad**
Transverse deviation dq:	**0.020 m**
Longitudinal dev. dl:	**0.020 m**
Height deviation dh:	**0.020 m**

☞ **Tip**

If one value is set to **0**, this error limit will not be checked.

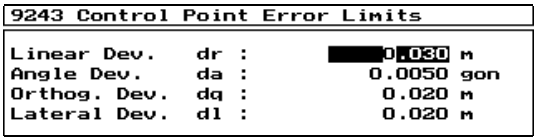
General Functions 4

Control Point 3

Input of the error limits for the control point measurement.

✍ 0.0000 ≤ da ≤ 1 grad

0.000 ≤ dr/dq/dl ≤ 1 m



Input in the predefined measuring units of	Default value:
Linear deviation dr:	**0.030 m**
Bearing deviation da:	**0.0050 grad**
Transverse deviation dq:	**0.020 m**
Longitudinal dev. dl:	**0.020 m**

☞ **Tip**

If one value is set to **0**, this error limit will not be checked.

General Functions 4

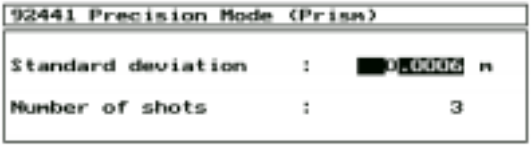
Distance Measurement 4

Configuration measurement functions for Distance

Distance Measurement 4

Precision Mode (Prism) 1

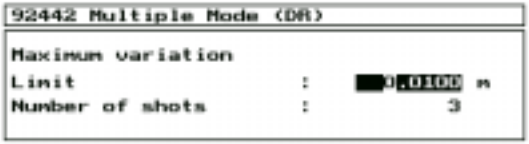
Configuration multiple measurements for distance meter mode N



Setting the standard deviation and/or a number of shots

Multible Mode (DR) 2

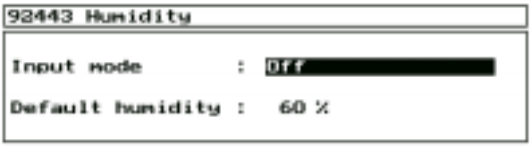
Configuration multiple measurements for distance meter mode N



Setting a limit between the shots and/or a number of shots

Humidity 3

Humidity - configuration and correction



Input Mode:

OFF (Default with 60%) — the key in default value is used as standard.

Wet Temperature — Input of the Wet Tem pe rature with **Inpt**

Rel.Humidity (%) — Input of the rel. Humidity with **Inpt**

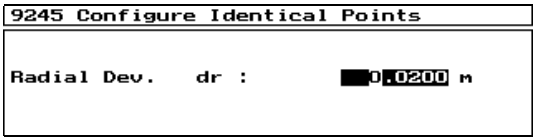
Default humididy: — Input the value in %

General Functions **4**

Identical Points **5**

Input of a linear deviation for decision of identical points.

✍ $0 \leq dr \leq 1$ m



Input in the predefined measuring unit of — Default value:

Linear deviation dr: **0.020 m**

☞ Tip

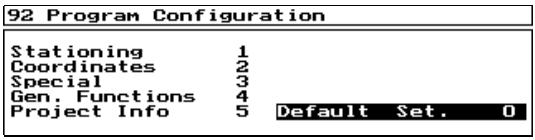
When setting the value for **dr** to **0**, then the default value is used internally.

Configuration Standard Settings

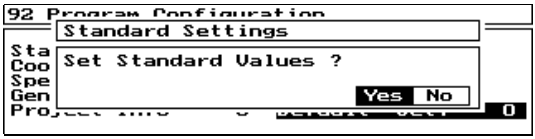
Programs **2**

Default Settings **0**

Setting of standard values for all program configurations..



Select with ↵ or 0.



Yes For setting default (standard) values.

No No default settings, back to menu Configuration Programs.

Configuration 9

Markings 3

```
123456789-123456789-1234567
<----PNr-----><---Info---->
C             T
<ppppppppppp><eeeeeeeeeee>
```

Generating and processing markings for the point identification.

The 27-digit point identification (PI) can be occupied with different blocks:

- Point number block `<ppp...>` `<nnn...>`
- Text block `<eee...>` `<###...>`
- Code block `<ccc...>`
- Time block `<ttt...>`
- Spaces block `>---...<`

A multiple definition of text and code blocks is possible.

Only one point number block and one time block can be defined at a time.

✍ 1 ≤ number ≤ 10

A maximum of 10 markings can be entered.

Marking No. 1 is the standard marking.

☞ Tip

The instrument is delivered with a standard setting of marking No. 1 which can be overwritten by another marking.

As pre-requisit for the storage of a marking, at least one point number block must be set.

Esc for escaping the *Configuration Markings.*

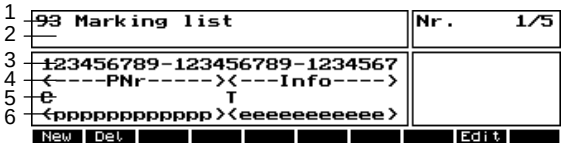
📖 Store marking

Processing of set markings

Legend of the lines:

1 Action
2 Operation
3 Ruler
4 Field label
5 Control character
6 Block marking

After calling up the *Configuration markings,* the first marking which has been set is shown in the display:



Nr. 1/5 indicates the consecutive number **(1)** of the displayed marking out of all defined markings **(5)**.

↑ ↓ Scrolling in the marking list (endless)

Home Display of the first marking

End Display of the last marking set

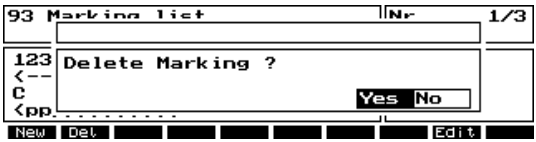
Esc Back to menu *Configuration*

New generate new marking

Del delete displayed marking

Edit edit displayed marking

Delete marking



Yes Marking is deleted, renumbering of the remaining markings.

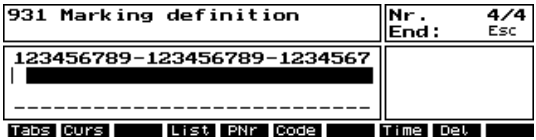
No Back, without deletion of marking.

Esc similar to **No**.

Edit marking in analogy to *Marking New*

Generating new Markings

New Select in the display of the marking list



Menu for generating new markings. The cursor is placed in column 1 of the field label (line 4).

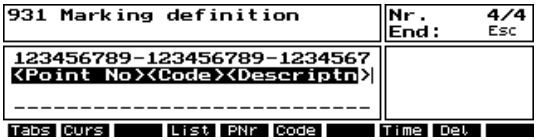
← → go to input position

Home cursor jump to column 1
End cursor jump to column 27

The field label is an information which can be entered in addition to the blocks set.

Input of the field label

For the input, all alphanumeric characters, including special characters, are available. Special characters (like <, >, _ , & etc.) will be displayed by multiple pressing (scrolling) of the decimal point key.



⇦ usable for deleting signs.

The code field is stored with the marking.

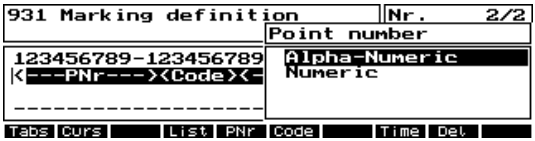
☞ Tip

In a measuring program, the field label is used as orientation for the blocks set. Consequently, it should be entered in that way.

Setting the point number block

Go with the cursor control keys to the inicial position of the point number block.

PNr Set point number block



Selection type of point number (numeric or alpha-numeric point number).

For entering a point number in the measurement menu then will be defined:

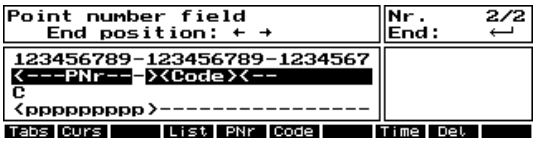
Numeric only numbers in the block ,

Alpha-Numeric all signs allowed.

+ to select.

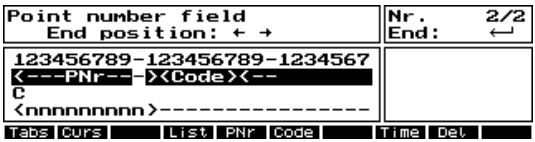
<p> alpha-numeric

Via **alpha-numeric** selection the block is marked with **<p>** in line 6 (block marking), beginning at the current cursor position.



<n> numeric

Via **numeric** selection the block is marked with **<n>** in line 6 (block marking), beginning at the current cursor position.



☞ Tip

The characters **< >** belong to the block, therefore, the minimum size **<p>** or **<n>** comprehends 3 characters.

As proposal, the default cursor position (**C** in line 5) is set on the first place within the PNr block, but that can be changed any time with **Curs**.

go to final position of the PNr block.

✍ $3 \leq$ PNr block ≤ 14

A maximum of 14 characters can be set for the PNr block.

Accept point number block.

☞ Tip

When pressing PNr then at another place of the PI, the old entry in the block marking is deleted and set again at the new position.

Setting a text or code block

A maximum of 5 blocks can be defined as text or code blocks. There is as well a numerical or an alphanumerical selection possible.

📖 **Configuration**
Codelists

When entering the PI, a *codelist* can be accessed within the code blocks.

Go with the cursor control keys to the inicial position of the text or code block.

Code Set text or code block

Via **Code**, the block is marked with **< >** in line 6 (block marking), beginning at the current cursor position. This is the minimum size of a text or code block. Each alphanumerical code block is being marked as block <eeeee...>, each numerical as block <#####...>.

> ☞ **Tip**
>
> As proposal, the default tabulator position (**T** in line 5) is set on the first place within the text or code block, but that can be changed any time with **Tabs**.

← → go to final position of the text or code block.

✍ 2 ≤ text block ≤ 24 A maximum of 24 characters can be set for a text or code block.

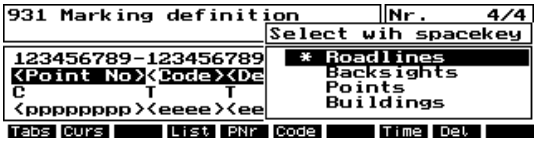
↵ Accept text or code block.

Allocating a codelist

It is possible to allocate a codelist to a text block set, converting thus the text block into a code block.

Set the cursor on the text block destined to become the code block.

List Allocating a codelist



With **List,** all selectable codelists are offered. If no codelist has been defined yet, the softkey **List** has no effect.

 for selection (also various codelists).

 Allocation of all marked codelists and back to the menu.

The block marking <eee...> has now been replaced by the block marking <ccc...>.

> **☞ Tip**
>
> It is also possible to allocate a codelist subsequently in a marking that has already been generated.

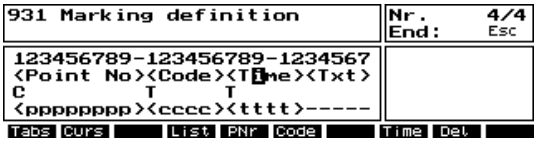
Setting a time block

📖 **Configuration**
Instrument / Clock

In this field, the system time is automatically stored in the time format specified.
A time block cannot be set within another block.

Select with the cursor control keys the inicial position of the time block.

Time Set time block



Via **Time,** the block is marked with **<ttt>** in line 6 (block marking), beginning at the current cursor position.

> ☞ **Tip**
>
> If the space available between the inicial position and the marking end or the next block is not sufficient for the configurated time format, the softkey **Time** has no effect.

<pppp>----<ccccccc>
space block

Setting a space block

At the beginning of a marking definition all places of the marking are occupied by forced blanks (**- - - - - - -** in the block marking, line 6). By specifying blocks, these blanks are occupied accordingly.

With the inicial positioning of blocks, blanks can be set between the blocks which are then locked when entering the PI and for tab stops.

Further function keys

Del Deleting blocks

Set the cursor into the block range and delete the block with **Del** (attention, without enquiry!).

> ☞ **Tip**
>
> For changing inicial positions, the blocks are first to be deleted.

Tabs Setting tab stops

Tab stops can be set at any position (exception: forced blanks). A tab stop can be set in each defined input block. When entering the PI, the cursor jumps to this position by means of the

Tab key.

Go to the target position using the cursor control keys and set a tab stop with **Tabs**. A **T** will appear in line 5 (control characters). The tab stop can be deleted again with the **Del** softkey.

Curs Setting a default cursor position

The default cursor position can be set at any position (exception: forced blanks). For each marking, only one default cursor position can be set. The cursor jumps automatically to this position after a measurement for entering or editing the PI.

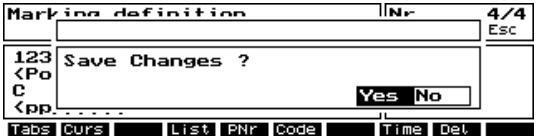
Go to the target position using the cursor control keys and set the position with **Curs.** A **C** will appear in line 5 (control characters). If a tab stop **T** has been set at the same place, this will be overwritten by **C**. The cursor position is of equal importance to the tabulator.

☞ Tip

When setting **Curs** at another place, the old **C** is being deleted.

Store marking

Esc for quit in the menu of the *Configuration markings* leads to the enquiry:



Yes Acceptance of the marking with consecutive number, continues with display of the renumbered markings.

No Marking is not accepted, the old status of the marking list is being re- established. Back to the display of the markings.

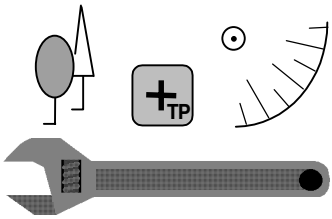
Esc Back to the definition of the new marking.

Technical Info

The markings will be stored in file Marko.txt in the directory D:\ELTAC\INIT.

Configuration 9

Codelists 4



For objects of everyday surveying, coded point infomation can be managed in the form of codelists.

Thus, they can be allocated quickly and simply to a code block of the marking and, consequently, to the PI during the measurement.

After being called up from the configuration menu, the codelists already generated are displayed:

New Creating a new codelist

A maximum of 16 lists can be stored. Having reached this number, the functions **New** and **Copy** are no longer available.

The number of codes per list depends on the available memory.

Processing codelists

Del Delete a codelist

Yes Deletion of selected codelist.

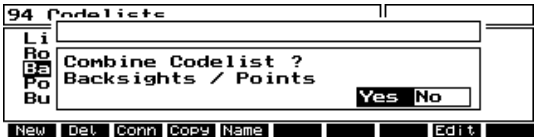
No (or **Esc**) Back, without deletion.

Conn Connecting two codelists

Select the first codelist with the cursor control keys, then, select **Conn** in order to connect the first with a second list out of the remaining codelists.

Confirm the selection of the second codelist with

 .



Example:
First codelist: ***Backsights***
Second codelist: ***Points***

Yes List *Points* is added to the list *Backsights.* The added list *Points* is deleted and does no longer appear.

No Esc Back to menu *codelists.*

Copy Copying the selected codelist

Name Renaming the selected codelist

Select codelist with the cursor control keys, select then **Copy** oder **Name** in order to copy or rename the list.

Name: Data string with a maximum of 18 alphanumeric characters.

↵ List is copied with new name or renamed.

Esc Back to menu *Codelists.*

☞ **Tip**

Codelists cannot be copied or renamed using the same name with the same ASCII characters.

But a difference is made between upper-case and lower-case letters, i.e. names like *LIST* and *List* are different.

Generating new codelist

New Creating a new codelist

Name: Data string with a maximum of 18 alphanumeric characters.

↵ List is generated with the name, at the same time a check is carried out with regard to names of the same ASCII strings already assigned.

Esc Back to menu *Codelists.*

Editing codelist

Edit Editing an existing codelist

Set the cursor at the codelist to be edited and select **Edit**:

Example: Editing the codelist *point type*.

Code: A maximum of 10 alphanumeric characters.

Meaning: Description of the code with a maximum of 20 alphanumeric characters.

> ☞ **Tip**
>
> In the application program, the **Code** is transferred into the code block allocated to the list.

Admissible keys for editing codelist

↑ ↓ PgUP PgDn Scrolling in the codelist.

Home End Jump to the first or last position of the input field.

Tab Changing the input field between code and meaning.

↵ Accepting code input in list.

Esc Escape editing of codelist.

New Entering a new code

Entering a code and its meaning.

Del Delete code

Set curser onto the code line and delete code with **Del** (attention, no enquiry!).
By this function, the selected code line is deleted inmediately and copied in a buffer memory.

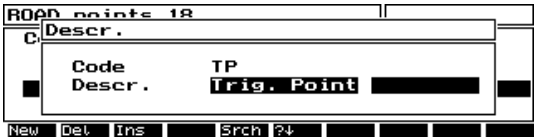
Ins Inserting a code line

Inserts the code line saved in the buffer memory, in front of the marked code line.

☞ **Tip**

Consequently, with the functions **Del** and **Ins,** also code lines can be copied and relocated.

Srch Searching a code line



Search for code **or** meaning, also of partial strings. No attention is payed to upper-case or lower-case letters.

↵ Search is carried out from the cursor position downwards. If the search is successful, the cursor jumps to the respective code position.

Esc Without search back to the editing menu.

?↓ Continuing search for a code line

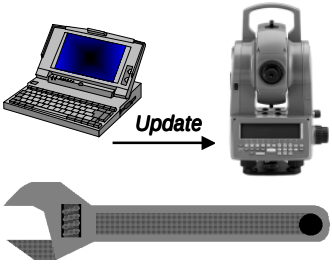
If the code line found is not the one searched for, the search downwards can be continued inmediately by means of this function.

Technical Info

The codelist will be stored in file Koco.txt in the directory D:\ELTAC\INIT.

Configuration 9

Update 5



For activation of the software-packages it is necessary, to enter a code generated by Trimble for the instrument.

There is one authorisation code for each software package. After input you get access to the software.

```
95 Update
Input Authorisation Code                1
```

Menu Update Configuration.

Input Authorisation Code 1

Code Input for each software package.

```
951 Configuration Auth.-Code
Package                 Auth.-Code
Basic                   291192
Expert                  996972
Professional            125372
Special                 182315
                                    Edit
```

Select the software-package by cursor-keys.

Edit For code input / change

```
951 Configuration Auth.-Code
EDIT
  Package                Professional
  Auth.-Code                 125372
                                    Edit
```

Input of the authorisation code.

↵ to confirm the code input.

Esc abort input.

Attention !

The authorisation code is the same for the Trimble 3600 as for the RecLink and has to be entered on the Trimble 3600 instrument.

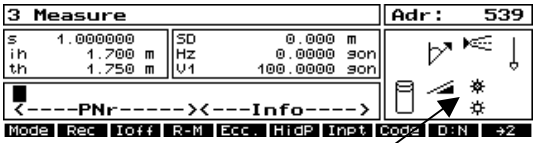
9 Annex

The annex contains a compilation of symbols, keys, formulae and constants as well as explanations of concepts used for the Trimble™ 3600.

Furthermore, it gives an overview of the technical data and instructions for maintenance and care of the instrument. Important certificates are also attached.

Status Symbols

The instrument displays status symbols to show internal instrument settings.



Symbols for Measure Mode

SD Hz V HD Hz h Y X Z Hz V

EDM Mode

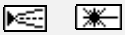
Direct Reflex* Prisma Prisma Direct Reflex*

Vertical Reference System

Zenith Vertical Height Slope [%]

Error Limits

switched off switched on



PositionLight*

PositionLight on

Illumination

Display on Cross hairs on

Recording switched on

Compensator switched on

* Opttion

Keys and Function

Escape	Esc	Quitting program levels
Shift	⇧	Dual assignment switchover
Tabulator	Tab	Selector and tab key
Caps	⇩	Upper-case and lower-case letters
Softkey Activation	Fcn	Control and hotkeys
Softkeys		Softkeys 1-6 and instrument control
Space key		Space and selector key
Cursor keys	↑ ↓	Positioning the Cursor up/down
Cursor keys	← →	Positioning the Cursor to the left/right
Numeric block	0 9	Numeric input function and Softkeys 7-10
Enter key	↵	Confirmation + measurement triggering
Power key	PWR	Switching the instrument on
Page Up	PgUp	Scrolling up
Page Down	PgDn	Scrolling down
Home	Home	Cursor at the start of line or list
End	End	Cursor at the end of line or list

Backspace		Delete a sign to the left
Additional trigger key		Trigger key located on the right-hand side of the instrument, particularly useful when measuring in the reverse position.

Instrument Control

The yellow signed symbols above the function keys 1-6 are used for controlling of significant instrument switches and parameters and can be activated pressing Shift + function key:

 Illumination Crosshair + Display On / Off

 Instrument Levelling

 Battery Control

 PositionLight On / Off

Help Online-Help

 EDM Mode

 Laser Pointer

A

Addition correction	Correction of the addition value (''additive constant'') of the distance measuring instrument

B

Backsight point	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 lists	Reference number for the point description, characterizes certain point types, compilation and explanation in *code lists*
Compensation	Mathematical consideration of the *vertical axis inclinations* measured with the *compensator,* in Hz and V angle measurements
Compensator run center	electronic center of the clinometer in sighting and trunnion axis directions
Configuration	Basic settings of the instrument (e.g. measuring units, coordinate system etc.). Proceeding from the respective measuring program, it is possible to access locally the relevant configuration. The configuration can be transmitted to other instruments/computers.
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 any time for checking.
Coordinates, global	higher-order coordinate system (e.g. Gauss-Krüger)
Coordinates, local	Zero of this coordinate system is the station point of the instrument with the coordinates (0,0,0). The *orientation* is determined by the zero direction of the Hz circle
	D
Distance measuring method	Variable measuring time (and with it measuring accuracy) in accordance with the purpose of application: Normal **D:N**, Tracking **D:T**
Dual Control	Sighting process in the instrument and measurement from the target;
	E
Eccentricity = eccentric target measurement	The reflector is not set up right in the target point, but in a defined position to it.
Eccentricity mode	Switch for toggling *eccentric target point measurement*
Eccentric station	Program for an *eccentric stationing,* if the position of the center is unfavourable for the backsight measurement or for the following survey or setting out
Error limits	Limit values which can be set by the user for certain measuring values or results

F

Free Stationing	Free choice of the station. The measurements to known *backsight points* are taken as starting point for computing the station coordinates, the *scale* and the orientation of the graduated circle by *single point adjustment* or *Helmert transformation*

H

Height stationing	The height of the station point is derived from measurements to known height points
Helmert transformation	*Transformation* (similarity transformation) named after Helmert, between two rectangular coordinate systems, *free stationing*
Hidden point reflector rod	Reflector rod with 2 reflectors arranged in a fixed distance to each other; for the position and height determination of inaccessible points such as channels, shafts, room corners; can be held also in oblique position to the point to be measured
Hz collimation correction	(also correction of collimation or sighting axis) Correction of the deviation of the sighting axis from its required position at right angles to the trunnion axis. Determination by measurement in two positions, automatic correction in measurements in one position

I

Incrementing	Input of an interval (increment), by which the point number is automatically counted
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

	L
L1 Norm	Adjustment in which the sum of the absolute corrections is turned into the minimum, for recognizing outliers with special accuracy. In all adjustments, an L1 adjustment can be additionally calculated.
L2 Norm	Adjustment in which the sum of the correction squares is turned into the minimum (adjustment according to the method of least squares)
	O
Object height	Determination of the height of points to which a direct distance measurement is impossible, by means of a pure angle measurement
Orientation	When orientating the instrument, the *bearing angle* of the zero of the graduated circle Omega (Om) is calculated. For this, measurements to one or various *backsight points* can be made or the *bearing angle* of a known point can be entered.
	P
Point Identification	Identification of the measuring point by a maximum of 27 characters for the point number and up to 5 code fields; data record format M5
Point number	Numerical or alphanumerical part of the point identification
PositionLight	Quick optical sighting aid for setting out; visualization of the sighting line for the reflector porter so that he can orientate himself independently and quickly with reference to the sighting line
Project	Quantity of data sets, which are combined under one name into an independent unit within the database
Projection reduction	Reduction into the projection plane

R

Radio data transmission module	Radio communication between station and target for transmitting data and information, Observe announcement.
RecLink	Alphanumeric computer with radio data transmission module for controlling the measuring process from the target point
Recording mode	Switch in all measuring programs for controlling, which data are to be recorded: measuring values, computing values or both types
Reference Point	used here as reflector station for the indirect height determination
Refraction coefficient	Measure for the light-beam refraction in the atmosphere; can be set by the user
Residual	Difference between nominal and transformed coordinates
Run center	see *Compensator run centers*

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*, *weather correction*, *projection reduction*, height reduction, reticle scale
Single point adjustment	Method for computing a *free stationing* by adjustment of all distance and bearing observations addording to the method of least squares.
Softkey	Function key which has different functions in dependence on the program
Standard deviation	Statistical value for the accuracy of a computed value

Standard project	Project implemented by the manufacturer (project name: NONAME), which can be used without project definition
Standard settings	Values set by the manufacturer, for all configuration parameters
Stationing	Station point determination and/or calculation of the orientation of the graduated circle: stationing on a known point, free stationing and off-center station, 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

Time	The time can be displayed and recorded together with the measuring values in the *point identification*
Tracking	Continuous measurement of the angles and distances. Generally, Hz and V values are always measured and displayed; set permanent measurement for distance measurements
Transformation	Computing program for converting point coordinates between different coordinate systems. At least 2 identical points have to be known in both systems.

V

Vertical axis inclination	The inclinations of the vertical axis of the instrument in sighting axis direction and trunnion axis direction are measured with the *compensator*. Digital and analog representation of the inclinations on the display.

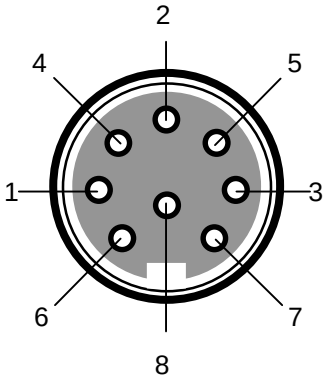
W

Weather correction	Correction of the distance measurement by values for temperature and air pressure which deviate from the standard values
Weighting specifications	For the adjustment, a certain influence (direct or indirectly by specifying *standard deviations*) on the total result can be assigned to the measuring values (stationing programs)

External Interface Port

The external interface port is a 8-pin plug (female) refering DIN 41524.

This port is used for data transfer and power supply by external battery. The port is fixed on the slip ring of the instrument.



PIN Location
(seen from the outside)

PINs

Pin	Signal	In/Out	Function
1	RTS	Output	Ready To Send
2	GND		Ground
3	CTS	Input	Clear To Send
4	TD	Output	Send
5	RD	Input	Receive
6	VCC	Input	Power Supply
7	VCC	Input	Power Supply
8	GND		Ground

Cable Connection

For data transfer via cable the serial interface cable with ordering number 708177-9460 or 708177-9470 can be used.

For external power supply and data transfer a special cable („Y-cable“) with ordering number 701520-9186-000 must be connected to the instrument.

Computations formulae for angle measurement

V angle measurement

$V_k = V_0 + V_1 + V_2 + i + nz$

V_0 = uncorrected V circle reading

V_1 = correction due to V circle eccentricity

$V_1 = A_V \cdot \sin (V_0 - \varphi_V)$

A_V = amplitude

φ_V = phase

V_2 = V circle orientation

i = index correction

$i = \frac{1}{2}(400 - V_I - V_{II})$

nz = current vertical axis inclination in the sighting direction

Hz bearing measurement

$Hz = Hz_0 + Hz_1 + Hz_2 + Hz_3 + Hz_4 + A$

Hz_0 = uncorr. Hz circle reading-(absolut)

Hz_1 = corr. due to Hz circle eccentricity

$Hz_1 = A_{Hz} \cdot \sin (Hz_0 - \varphi_{Hz})$

A_{hz} = amplitude

φ_{Hz} = phase

Hz_2 = due to collimation correction

$Hz_2 = c / \sin V_k$

$c = -\sin (V_{II}) \cdot \frac{dHz}{2}$

$dHz = (Hz_{II} - Hz_I + 200)$

Hz_{II}, Hz_I = Hz in Lage 1,2

c = collimation error

Hz_3 = due to current nk vertical axis inclination in the tilting axis direction

$Hz_3 = nk / \tan V_k$

Hz_4 = corr. due to tilting axis error k

$Hz_4 = k / \tan V_k$

A = circle orientation, e. g. Hz setting (necessary for computations of coordinates)

Computations formulae for distance measurement

Internal correction formulae (with correction from external calibration)

$D_{c1} = D_u \cdot m_{cal} + Ak_{cal}$

D_u = uncorrected measured distance
m_{cal} = scale from external calibration
Ak_{cal} = addition constant from external calibration

Weather correction formulae with additional constants.

$D_{c2} = D_{c1}(1 + K_W 10^{-6}) + A_c + T_r$

carrier wavelength 0.66 µm
precision scale 0,5 m

D_{c1} = corrected distance
A_c = addition constant
K_W = weather correction
T_r = threedimensional eccentricity (value input in menu 912)

The weather correction K_W is computed as follows:

$$K_W = 278.8 - \left[\frac{0.29527}{1+\alpha t} P - \frac{4.126 \cdot 10^{-4} \cdot h}{1+\alpha t} E \right]$$

p = air pressure in hPa
t = temperature in degrees Celsius
h = relative humidity in %
α = coefficient of vapour pressure correction 1/273,16
E = saturation aire presure to Magnus Tetens

$$E = 10^{\frac{7,5 \cdot t}{t+237,3} + 0.7857}$$

In case of standard atmospheric conditions with p = 1013,25 hPa, t = 20 °C und h = 60% the correktion K_W disappears. The basic value of h = 60% for the relative humidity is fixed. When the conditons are very extremly (humid and hot) the deviation of weather correction is maximal 2 ppm.

Reduction formulae

V angle measurement

Refraktion correction of the V angle measurement

$$V' = V_k + \frac{\delta}{2} = \frac{D_{k2}}{2R} \cdot k_L \cdot \rho$$

Distance measurement

Horizontal distance in the instrument horizont

$$E = \frac{R}{\rho} \cdot \arctan \frac{D_{k2} \cdot \sin V'}{R + D_{k2} \cdot \cos V'} \qquad \rho = \frac{200}{\pi}$$

Height difference

included are corretions of refraction, earth curvature, instrument- and reflector height

$$dh = D_{k2} \cdot \cos V_k + \frac{1 - k_L}{2R} \cdot E^2 + ih - th$$

V_k = corrected V circle reading
k_L = influence of refraction,
Default: 0.13
R = mean earth radius in the field,
Default: 6 370 000 m
ih = instrument height
th = reflector height

Horizontal distance with scale correction

$E_m = E \cdot m$

E = horizontal distance in the instrument horizon
E_m = horizontal distance with scale corr. m
= scale (e.g. from Free Stationing)

Height reduction

Reduction of horizontal distances from instrument horizon into the used projection horizon (e.g. NN)

$$E_o = E_m \cdot \frac{R}{R + H}$$

E_m = distance in the instrument horizo [m]
E_o = distance in the used projection horizon[m] R = mean earth radius in the project [m]
H = mean height in the project [m]

Reduction into the projection plane

The distance is reduced into the projection plan with the mean distance from the main meridian.

1. Gauß - Krüger -Projection

$$E_{GK} = E + k_{GK} \qquad k_{GK} = E \cdot \frac{Y_m^2}{2R^2}$$

$$E_{GK} = E \left(1 + \frac{Y_m^2}{2R^2} \right) = E + E \cdot \frac{Y_m^2}{2R^2}$$

with:

E = Distance between two points
E_{GK} = distance in the Gauß-Krüger-Plane
Y_m = mean distance from the main meridian
R = earth radius

2. UTM - Projection

$$E_{UTM} = E \cdot 0{,}9996 \left(1 + \frac{Y_m^2}{2R^2} \right)$$

Note:

Distances used in stationing and e.g. in a subsequent polar survey must be treated identically. If, for example, no height and projection reductions have been applied in stationing, this must also not be done in the polar survey. In this case, the corresponding reduction is incorporated in the randomly selected scale or in the stationing corrections, if a given scale is used. In the latter case, it is always advisable to perform a best-fit adjustment if major corrections are involved.

Verifying on Calibration Distances

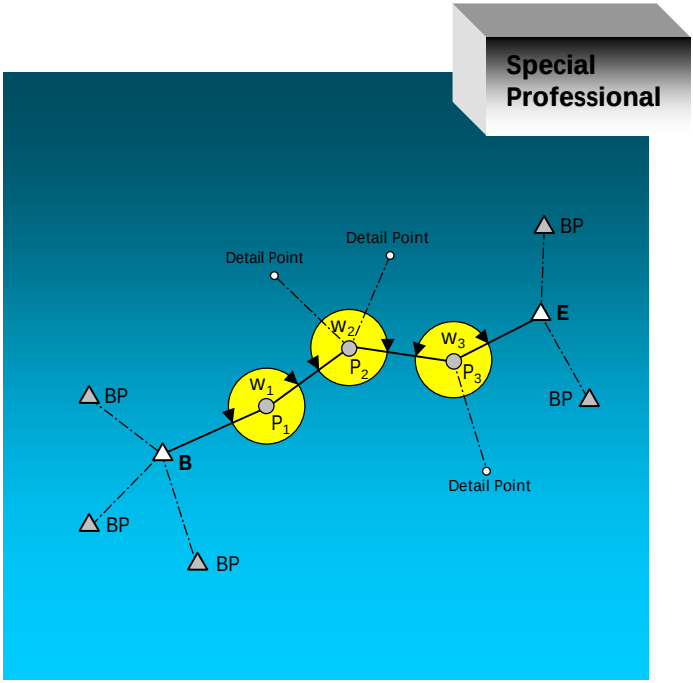
Basically, all measured distances are corrected with reference to:
the entered scale
the entered additive constant
the influence of pressure and temperature
internal influencing variables.

Attention!

Prior to the practical realization of the calibration measurement, the current values of the parameters additive constant, pressure and temperature are to be entered. Projection reduction and height reduction are to be deactivated and the scale is to be set to default: 1.000000, as the test distances normally are not referred to sea level. This is to secure that all corrections are made completely and perfectly. Furthermore, this allows a direct comparison of nominal and actual values.

If a weather correction is to be carried out externally, the temperature must be set to 20°C and the air pressure to 1013.25 hPa. Then, the internal correction goes to zero.

Total Station
Trimble 3600 Zeiss Elta



User Manual Trimble 3600 Zeiss Elta,

Part 2 for program packages

Special and Professional

Cat-No.: 1073.496
(702722-7044-004)

Total Station
Trimble 3600 Zeiss Elta

API

Application Programming Interface

Programming Manual for the
Trimble 3600 Zeiss Elta TS.

The Trimble 3600 Zeiss Elta is programmable in several program-ming languages. This Manual describes the programming interfaces and functions at the hand of many source code examples. A diskette with the necessary programming tools and source codes is given with the programming manual.

Order.-Code.: CAPI_E.DOC V1.10

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

Phone: +49 3641 64-3200
Fax: + 49 3641 64-3229
email: surveying@zspjena.de
www.trimble.com