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1 Introduction

Dear Customer

By purchasing a Zeiss Elta® CU from Trimble AB you have opted for a leading-edge product in the field of surveying instruments.
We congratulate you on your choice and would like to thank you for the trust placed in our company.

The system philosophy

Surveying today is no longer confined to the measurement of angles and distances. A demand now exists for complex measuring systems which not only meet the increasing requirements for automatization, digital data processing and last but not least efficiency in everyday surveying, but which also set new standards in technology and operating convenience.

The Zeiss Elta® CU is part of a complete range of surveying instruments from Trimble. Data interchange between all the instruments is ensured by a common data format and by the use of the PCMCIA memory card.
The operating convenience that is offered by the Zeiss Elta® CU hardware is unique. The large graphic display and the appropriately adapted PC keyboard give the user a high degree of flexibility for the processing of the wide information variety in the measurement dialog.

The modular software structure meets all requirements from "Basic" to "Special".

Use of this manual

The manual is divided into 10 main chapters.

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

4 Stationing

Free Stationing

Adjustment methods

The pages are divided into two columns:

Functional text for:

Program calls

Stationing 4

Free station. 1

Mode Softkeys and their functions

Cross-references to other chapters

Ranges for values to be entered or pre-set

Status symbols in the Zeiss Elta® CU display

Keys / Hotkeys

Small graphics

principal text including

- Descriptions of measuring processes / methods
- instrument operation and keys
- Zeiss Elta® CU display graphics
- drawings and large graphics
- tips, warnings and technical information

☛ Tip

For hints, special aspects and tricks

Attention!

For risks or potential problems

Technical

For technical background information

Measuring tasks are defined by symbols:

⇨ : given values
⌖ : measured values
: required/computed values

You will find a list of terms and an index in the annex (Geodetic Glossary, Index).

Important notes

Attention!

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

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

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

This warranty does not cover defects caused by operator errors or improper handling.

Any further liabilities, e.g. for indirect damages, cannot be accepted.

Zeiss Elta ®CU
User Manual Part1st
Program Packages *Basic* and *Expert*

Edition 1:	**04.06.2001**
Software Release:	**V1.40**
Part.no:	571 702 031

Subject to change.

☛ Tip

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

Instrument:

☐ Trimble 5600 Series

☐ Zeiss Elta®Control Unit (Elta CU)

Serial numbers:

If you have any software-related questions, please also state the version of the relevant software package installed in your instrument:

Software version: Package:

☐ Basic

☐ Expert

☐ Profess.

☐ Special

Please note your autohorisation code for the software packages::

Basic

Expert

Professional

Special

Professional Plus!

We would like to wish you every success in your work with your Zeiss Elta® CU. If you need any help, we will be glad to be of assistance.

Yours

Trimble AB
P.O. Box 64
S-182 11 Danderyd
Phone: +46 8 622 10 00
Telefax: +46 8 753 24 64
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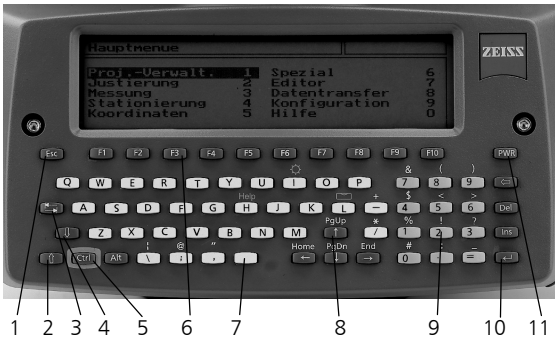
http://www.trimble.com

2 Zeiss Elta Control Unit

This chapter gives you an overview of the hardware and software.

It describes the operation and controls of the Elta CU as well as the sensors and peripheries which are a special feature of the Trimble 5600 Series total stations.

QWERTY keyboard



The key assignment and symbols are mostly identical to a normal PC keyboard.

Dual assignments have been implemented in the numeric block (9) and cursor keys (8) and can be activated with the shift key (2).

Keys and their functions

Esc 1 Escape

Quitting program levels

⇧ 2 Shift
Dual assignment switchover

⇥ 3 Tabulator
Selector and tab key

⇩ 4 Caps
Upper-case and lower-case letters

Ctrl 5 Control

Control and hotkeys

F10 6 Function keys
Softkeys activation (in the display above)

7 Space key
Space and selector key

8 Cursor keys

Cursors positioning

9 Numeric block

Numeric entries and dual assignment

10 Enter key

Confirmation and triggering of measurement

11 Power key
Switching the instrument on

Hotkeys

In addition, hotkeys are provided which permit you to directly activate a function at any point in the program. For activation press

Ctrl + the appropriate character:

Ctrl B	Battery display
Ctrl H	Help
Ctrl I	Illumination
Ctrl L	Levelling (compensator)
Ctrl P	Tracklight® on / off
Ctrl R	Direct Reflex Mode ON / OFF*
Ctrl O	Laser Pointer ON / OFF*

- - Only active with Trimble 5600 DR200+!

Further keys and hotkeys:

📖 **Annex**
Symbols and keys

PWR Additional trigger key

Additional trigger key

The power key can be used as an additional trigger.

Graphic display

The display is a LCD screen with 320 x 80 pixels in the display window. To control the full display area, use

Ctrl Alt + ↑ ↓ ← →

This allows you to see the full virtual screen area e.g. in the MS-DOS® mode.

> ☞ Tip
>
> If the cursor appears in the MS-DOS® mode, press
>
> Ctrl Alt + ↓
>
> To scroll down the display until the cursor will be seen blinking.

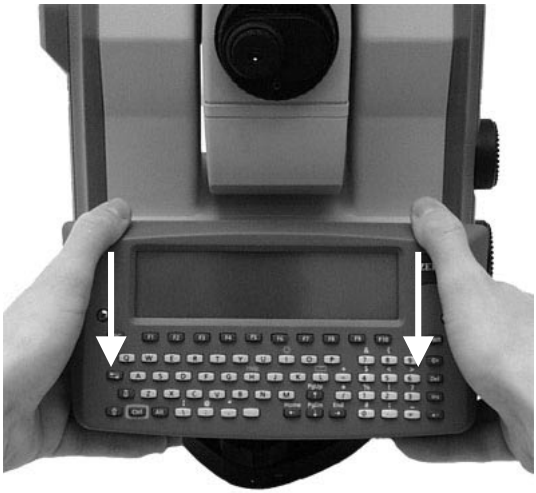
📖 **Configuration** Instrument Switches

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

Ctrl I

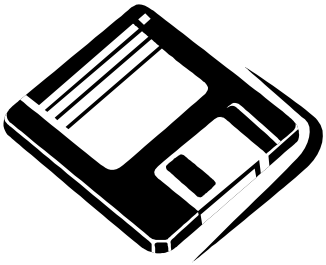
Contrast variation is also possible. Therefore select the configuration of the instrument.

Attaching/Detaching the Control unit



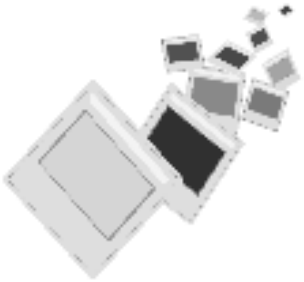
Attaching/Deattaching the Elta CU to the Trimble 5600 Series total station.

Software overview



- **Main Menu**
  - **1 Project Management**
  - **2 Adjustment**
    - 21 Standard
    - 23 Tracker
    - 25 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**
  - **9 Configuration**
    - 91 Instrument
    - 92 Programs
    - 93 Marking
    - 94 Codelists
    - 95 Update
  - **0 Remote Control**

Modular structure of the system software



The Zeiss Elta® CU modular software comprises four packages. Thanks to the full MS-DOS® compatibility of the Zeiss Elta® CU 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

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 making 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

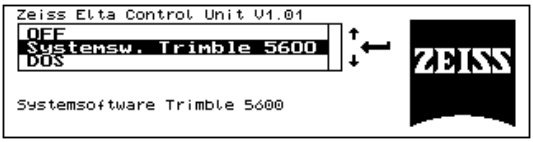
- Coordinates
  - RoadLine Lite
- Special
  - Multiple Rounds
  - 3D Plane

Switching the instrument on and off

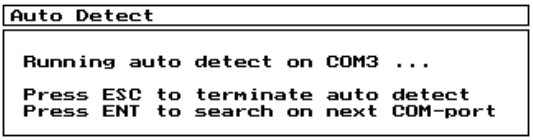
Switching the instrument on

Press the PWR key and the start menu is displayed unless any other application in the start menu is configured and activated.

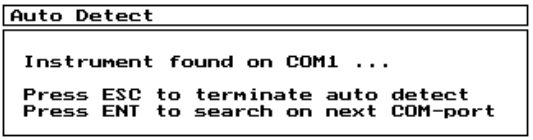
Select "Systemsw. Trimble 5600"



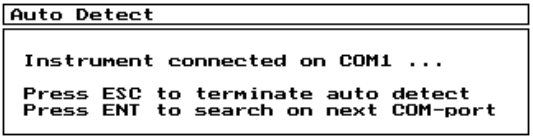
-Display Search for active COM-Port3



-Display Instrument found at COM-Port3

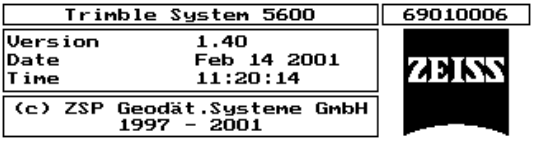


-Display Instrument connected at COM3



Display of startup logo with

- Instrument type
- Serial no. Zeiss Elta® CU
- Software release data

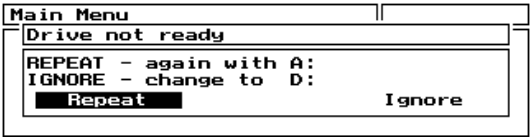


Configuration
Instrument

The instrument configuration permits you to define which functions should be executed after the PC is booted or which menu the program should directly access.

If no PCMCIA card was inserted, the following message appears:

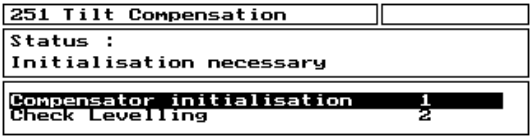
The PCMCIA drive is the expected drive starting the Elta®CU.



Repeat Insert the PCMCIA card and get access to the PCMCIA drive A:\

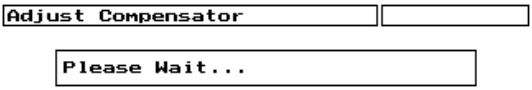
Ignore Data storing on the internal drive D:\DATEN of the Elta® CU

Display
.-Initialisation compensator
and check levelling

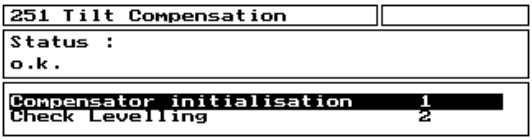


↵ Adjustment of compensator.

Display
- Adjustment of
compensator is running

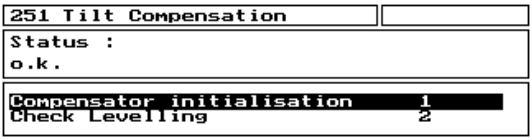


Display
-Compensator adjusted

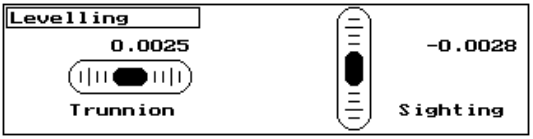


2 or

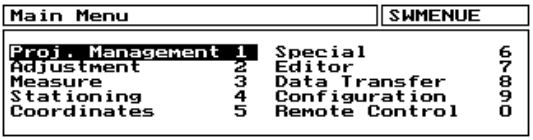
↓ , ↵ „Check Levelling“



Display
– instrument is levelled

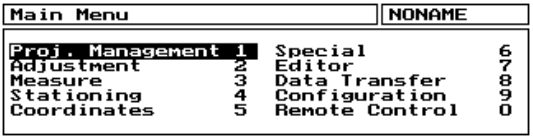


Display
- Main menu of the Elta® CU software
- The project last processed is loaded.

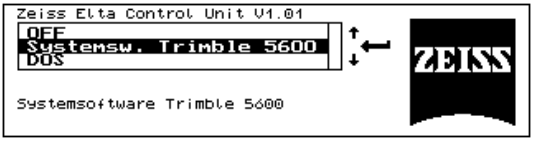


If there is no project stored on the actual drive, a project "NONAME" will be automatically opened.

Display
- The project "NONAME" is loaded.

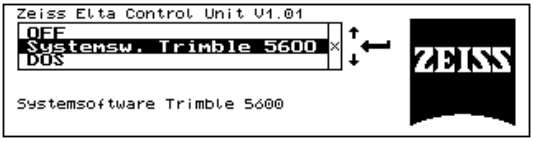


Configure Start menu select "Sytemsw. Trimble 5600"



Activate Auto Start

Display
- "X" marks application for Auto Start.



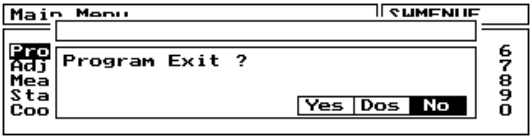
Hard- and Software Scan

Starting the program checks automatically for all necessary Hard- and Software Components are rightly installed and set. If not, a message 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 to the start menu. Select MS-DOS® prompt and press ↵.
At D:\> type "off" and press ↵ to shut off the instrument.

No Return to the main menu.

☞ Tip

To get back to the application enter **START** from the MS-DOS®prompt D:\>.

Servo Controls

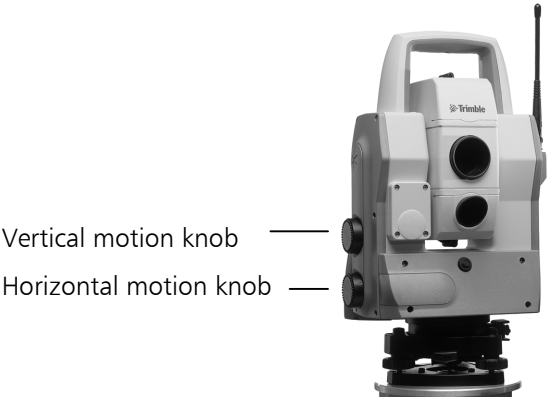
The servo is manually controlled by the two motion knobs for Hz and V located at the side of the instrument.

Motorized coarse drive

The motion knobs are sensitive in four steps so that the more you turn the knob the faster the servo will rotate the instrument.

Motorised slow-motion drive

If you want to switch to fine mode adjustment when operating a motion knob, turn the knob in the opposite direction and fine adjust.



Manual motion

Although the servos are always active the instrument can turned manually.
Therefore touch the body of the instrument or the telescope anywhere and just turn it.

Friction clamp

In turned on state, with the motors active a friction system assumes clamp function in Hz and V.

Autolock™(only for servo instruments)

The AutoLock™ functionality is based on the Tracker unit in combination with the RMT (Remote Target). This enables the instrument automatically to lock on to the center of the RMT and to automatically follow it as it moves.

📖 **Measure in a local System**

The following AutoLock™ Switches are possible for each measurement in all application programs using the softkey **Srch** (F9):

Srch

Off AutoLock™ OFF.

On AutoLock™ ON: Target search and automatic target aim.

Tracking AutoLock™ Tracking: Instrument is following the RMT while it is moving.

AutoLock™ tracking is optimized for fast and efficient operation.

📖 **Configuration**
Instrument / Prism
Sensors /
AutoLock™

If you pass the prism behind an object the instrument will loose the target. Now the TrackLight® will be switched on, is flashing slow (this helps realignment with the Tracker) and the tracking lost symbol will flash.

If you are stationary and an object passes in front of the prism, then the total station will remain stationary until the prism is reacquired.

Tracker (only for servo instruments)

Trimble 5600 series can be equipped with a Tracker unit, which is needed when using the system for robotic surveying or when performing conventional surveying with Autolock™.
The Tracker has control over the instrument's servos and aims the instrument correctly towards the target, which in these cases must be an RMT

The RMT is sent out a signal, and when captured from the Tracker the instrument is orientated in vertical and horizontal axis to the target.

Calling Tracker operation

Srch

Find

Calling the instrument search is available in all measure programs via the **Srch** softkey and is activated with Softkey **Find.**
This method is identical on both the operations at the instrument and the RCU.

All measure programs

Srch

The Tracker can operate in different search modes. Setting and activating the modes press the Softkeys **Cent** and **Win**.

Tracker Range

✍ Tracker < 1000m

The maximum range of Tracker is an circular area around the station of about < 3 000 000 m^2

Tracker and Prism Tracking

Using the Tracker in combination with AutoLock™-Tracking provides the user with a very comfortable one-man operation. If the prism is lost during Prism Tracking, using the comfortable search
functionality will quickly allow the instrument to snap back onto the prism, ready for further tracking.

TrackLight®

TrackLight® is the optical aid for aligning the prism in setting out, which enables the staffman to position the prism on the correct bearing. It is standard equipment for all the Trimble 5600 instruments with Tracker. TrackLight® helps to find the setting out position by optical illumination signals.

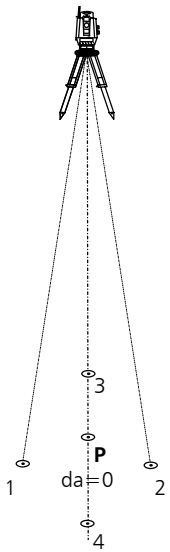
Seen the TrackLight from the prism pole means:

green flashing: left from the point

red flashing: right from the point

If the setting out direction (**da=0**) is reached, the green light and the red light are merging.

If the setting out direction (**da=0**) is reached, it means the RMT is in the sight line of the instrument, the TrackLight® goes off.
The TrackLight® is white flashing with the doubled frequency when only the prism is to be seen.



In the left figure the setting out positions 1-4 will be shown on the prism pole as follows:

1 green light

2 red light

3 in sight line in front of the point, no light

4 in sight line behind the point, no light

P set out point plus prism, no light

Basics

This chapter will describe the different ways of working with Trimble 5600 series. First of all you can work conventionally with the system. Since the instrument is equipped with servo drive, you'll find that the system is very easy to handle, when setting out you can with a touch of a single key aim the instrument towards the set out point.

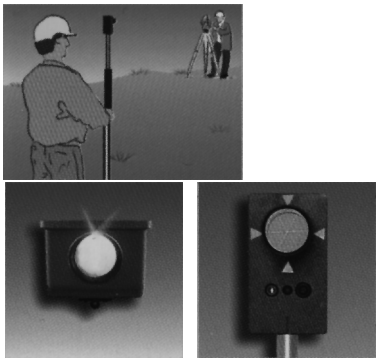
Conventional surveying with servo

If your instrument is equipped with servo drive, this means a lot of advantages:
In e.g. setting out you only need to give the point number. The instrument will calculate and aim automatically towards the pre-calculated direction.

During manual aiming, the servo assists the horizontal and vertical adjustments. All that's needed is a light circular movement of the adjustment screw with your fingertip.

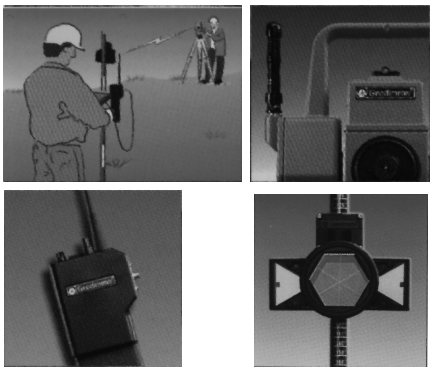
Thanks to servo-drive, adjustment screws have no end positions. That means no unnecessary interruptions, when aiming.

Autolock™ (only servo)



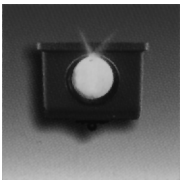
Secondly you can equip your instrument with a tracker unit and take full advantage of the feature we call Autolock™, this enables the instrument to lock on to a RMT and automatically follow it as it moves. This means that there is no need for fine adjustment or focusing.

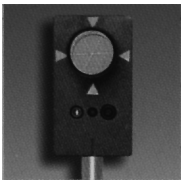
Remote Surveying



With an instrument, a telemetric link and an ordinary prism you can work with remote surveying which enables you to have the control over the measured data from the point.

Robotic Surveying (only servo)




With a tracker unit and a telemetric link plus an RMT you can work with robotic surveying. This means that you can take over the control of the whole measurement from the point, i.e. you have a one-person system. On the following pages we will describe the different measuring techniques with Trimble 5600 series.

Conventional surveying with Autolock™ (only servo)

With the feature Autolock™, you do no longer have to fine adjust or focus, since this is taken care of by the system.

- To upgrade a base unit to Autolock™, you'll only need to add a Tracker unit and a RMT target. It is also possible to measure in a conventional way without Autolock™ using an ordinary reflector.
- When setting out, you'll only need to supply a pre-stored point and the system will calculate the necessary data for setting out. Then, position the instrument with the positioning key. When the staffman, guided by the built-in (2.5m/100m), the instrument locks onto the RMT automatically. You're now able to fully concentrate on the information in the display (radial/right angle offset) and direct the
  staffman to the setting out point.

Important information when measuring with high accuracy (and using the instrument's Tracker)

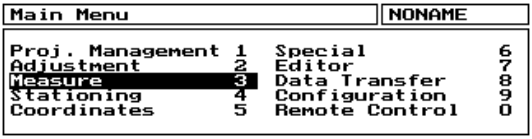
To achieve the highest accuracy when measuring distances shorter than 200 meters and using the Tracker unit you need to be aware of the following:

Always use the Miniature Prism (Part no. 571 126 060) mounted on your RMT. If you use a large reflector like the Super Prism (Part no. 571 125 021), reflections from the Tracker unit may have influence on the measured distance. The error can vary from 0 to 3 mm. This error doesn't occur using the Miniature Prism.

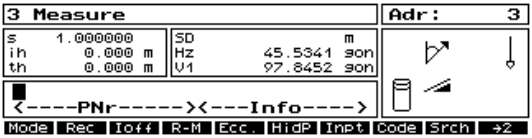
How to work with Autolock™

First switch on your instrument activate compensator, check levelling and set all the required parameters like PPM-factor etc.

3 4 5 6
Select any application, e.g. measure



Srch Select AutoLock™



Display
– menu AutoLock™

Press spacebar to activate AutoLock™.

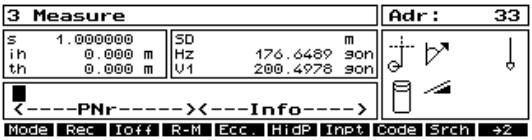
Activate AutoLock™

Display
- Autolock™ activated

Confirm setting

Jump back to selected application

Display
-AutoLock™ active,
Status symbol
 shown

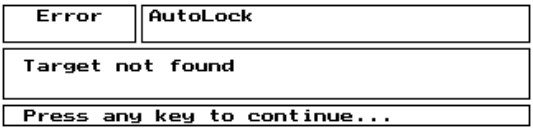


The instrument is now set-up for Autolock™. A search function can be added as an option. With this option both sector control and search control can be used. For more information, follow this chapter.

Measuring towards an ordinary prism

If you aim towards an ordinary prism with the Autolock™ option on and press the

Enter key, you will be prompted:



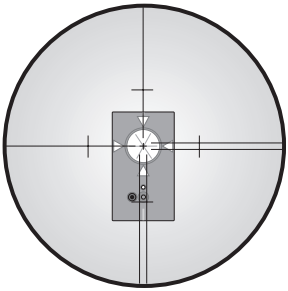
Now please switch off Autolock ™ and start measurement again!

Aiming

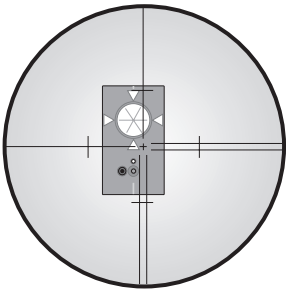
The adjustment between the two optical axes, i.e. the Telescope and the Tracker, may differ. The difference will make it seem like the instrument does not point towards the centre of the prism, when using Autolock™ (see fig. below). This is not a problem since the two axes have their own collimation data. It is however important to make collimation test for both axis.

Without Autolock™.

Manual aiming



With Autolock™



How to check

You can check how good the instrument is calibrated yourself, by measuring towards the same prism with and without Autolock™ and compare the displayed angles:

Without Autolock™:	The instrument shows the angles for the tube.
With Autolock™:	The instrument shows the angles for the tracker.

If the angle deviations are large you should calibrate both the tube (Menu 2 Standard Adjustment and Tracker Unit Adjustment),
see chapter 8.

Remote surveying

Remote surveying means the instrument operator's job is to aim the instrument toward the reflector. The most experienced member of the survey crew is out at the measuring point taking care of the qualified work of checking, coding, registering etc.

Remote surveying gives you the ability to access the information where it's most needed. Because it's out at the measuring point itself you most often discover how to achieve the best results.

Important information when measuring with high accuracy

To achieve the highest accuracy when measuring distances shorter than 200 meters and having the Tracker unit installed on your instrument you need to be aware of the following:

If you use a large reflector like the Super Prism (Part no. 571 125 021) or the Tiltable Reflector (Part No. 571 126 110) you need to cover the tracker aperture before you measure the distance. Otherwise reflections from the Tracker unit may have influence on the measured distance. The error can vary from 0 to 3 mm. If you use a Miniature Prism (Part no. 571 126 060 or 571 126 100) this error doesn't occur.

Equipment:

To be able to work with remote surveying you'll need a control unit at the point. You will also need to equip your instrument with a radio side cover (see chapter 1.1) and to connect an external radio to the Elta® CU. The control unit, the prism and the external radio will hereafter be called RPU.

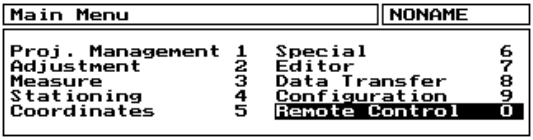
Radio communication:

In order for the instrument and the RPU to be able to communicate you will have to set the same radio channel at the instrument and at the RPU. Select a channel with regard to other radio systems that might be in operation in your immediate area. If radio disturbances occur, e.g. if Info 103 is displayed, try another channel.

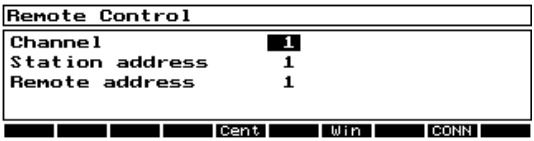
How to work with remote surveying

First switch on your instrument activate compensator, check levelling and set all the required parameters like PPM-factor etc.

0 Activate Remote Control



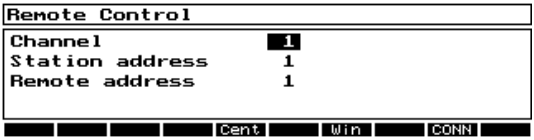
↑, ↓ Select (Radio) Channel, Station address, Remote address



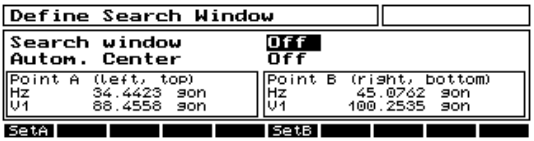
Toggle Channel

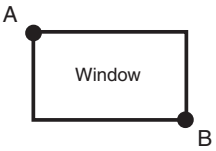
Key in the selected station and remote addresses

Win Define Search Window Activate Autom. Center



Display – Define Search Window



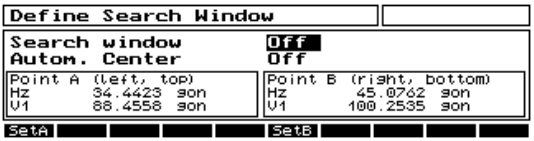


For setting a Search Window select one of two variants.

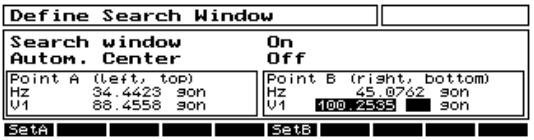
Variant A:
Turn the instrument and the telescope one after another.

SetA Aim to upper/lower left corner

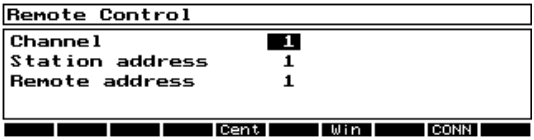
SetB Aim to lower/upper right corner



Activate Search Window

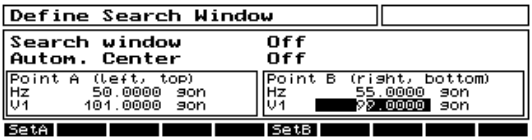


Jump back to menu Remote Control

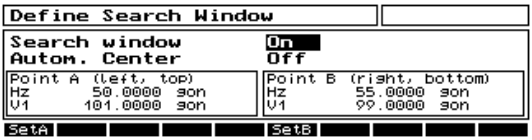


Variant B:

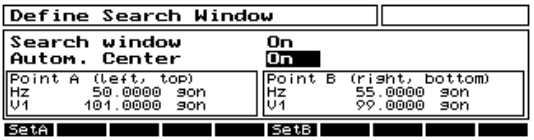
Select Point A (left, top) type Hz/V-angle; Point B (right, bottom) type Hz/V-angle



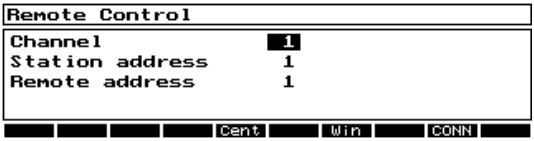
Activate Search Window



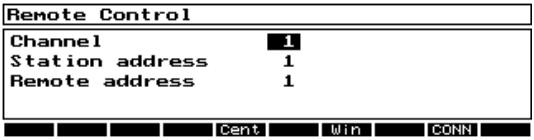
Select Autom. Center Activate Autom. Center



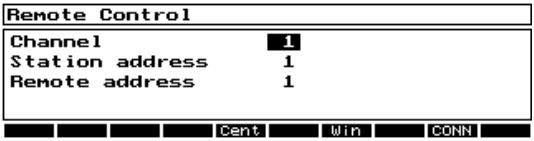
Jump back to menu Remote Control



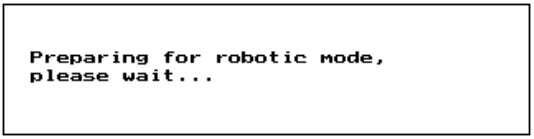
Cent Turn instrument to new Window Centre and Set new direction



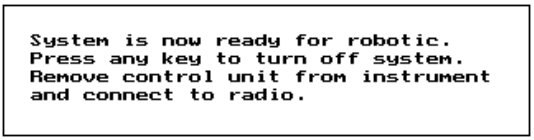
Conn Activate RCU mode



Display
-Preparation RCU mode



Display
.-Press any key to turn off



Detach Elta® CU from instrument

Instrument prepared for Remote Control Mode

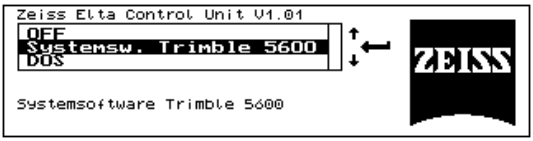
Activation of the RPU

Attach the Elta® CU at the prism pole holder. Connect Elta® CU with radio via serial cable when using control unit holder (Artikel-Nr. 571 224 030).

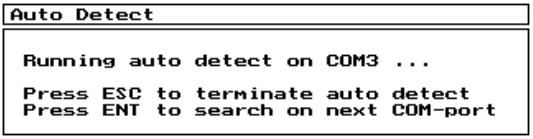
Switch on Elta® CU.

PWR Power On

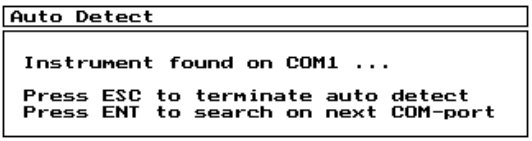
Select "Systems. Trimble 5600"



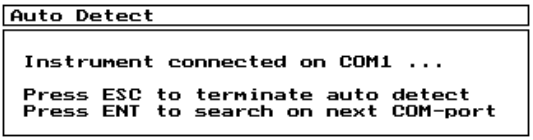
Display — Search for active COM-Port?



-Display — Instrument found at COM-Port1



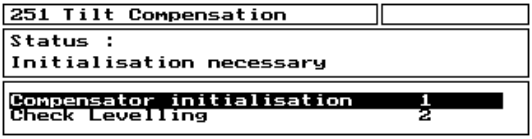
-Display — Elta® CU connected at COM1



☞ Tip :

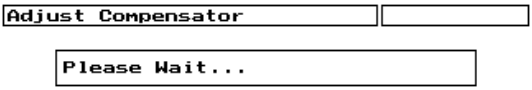
Depending on used holder the Elta® CU can be connected with radio via COM1/3/4!

Display
.-Initialisation Compensator
-Check Levelling

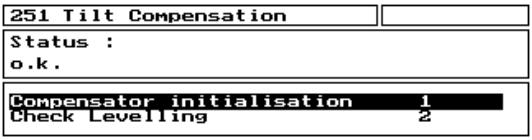



Adjustment of compensator.

Display
- Adjustment of compensator is running

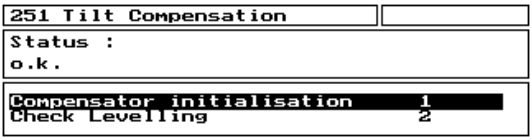


Display
-Compensator adjusted

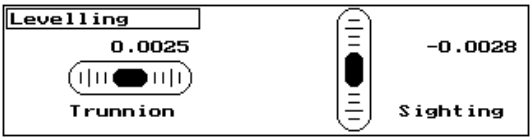


2 or

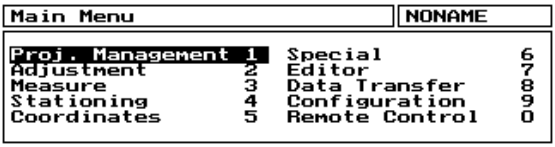
„Check Levelling“



Display
– Instrument is levelled



Esc 2x Return to main menu

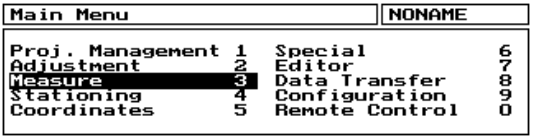


Aim, Measure, Register

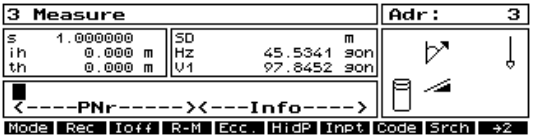
PWR Power On

Switch on Elta® CU, activate compensator, check levelling and set all the required parameters like PPM-factor etc.

3 4 5 6
Select any application, e.g. measure



Srch Select AutoLock™



Display
– menu AutoLock™

Activate AutoLock™

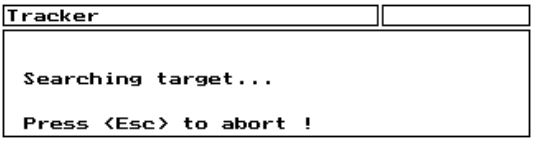
Press spacebar to activate AutoLock™.

Display
- Autolock™ activated

Find Search RMT

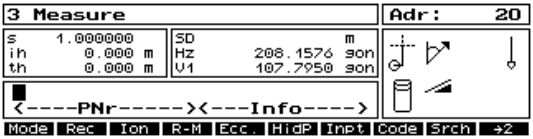
Display

- Instrument searches RMT

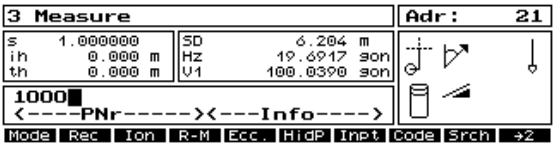


Display

-Instrument found RMT



Enter PI, aim, measure and record



☞ Tip:

After recording the memory address is incremented by one.

Robotic Surveying (only servo)

By equipping the instrument with a tracker unit, even aiming can be done from the measuring point. The entire measurement is performed from the point, with the same access to all functions of the total station as if you were standing beside it.

Robotic surveying means higher production capacity. During setting-out, it's best with two people: one to handle the measuring with the RPU, and one to mark the points. Of course, one person can perform the entire job.

The unique search function makes robotic surveying extremely efficient 24 hours a day.

Important information when measuring with high accuracy

Important information when measuring with high accuracy (and using the instrument's Tracker):

To achieve the highest accuracy when measuring distances shorter than 200 meters and using the Tracker unit you need to be aware of the following:

If you use a large reflector like the Super Prism (Part no. 571 125 021) on your RMT, reflections from the Tracker unit may have influence on the measured distance. The error can vary from 0 to 3 mm. If you use the Miniature Prism (Part no. 571 126 060) instead this error doesn't occur.

Equipment:

To be able to work with robotic surveying you'll only need one control unit, which you after station establishment etc. disconnect from the instrument and bring to the point. You will also need to equip your instrument with a radio side cover a tracker unit, a RMT (Remote Target) and an external radio connected to the Elta® CU. The Elta® CU, the RMT and the external radio will hereafter be called RPU.

Radio communication:

In order for the instrument and the RPU to be able to communicate you will have to set the same radio channel at the instrument and at the RPU. Select a channel with regards to other radio systems that might be in operation in your immediate area. If radio disturbances occur, e.g. if Info 103 is displayed, try another channel.

How to work with robotic surveying

PWR Power On

Switch on Elta® CU, activate compensator, check levelling and set all the required parameters like PPM-factor etc.

0 Activate Remote Control

```
Main Menu                          NONAME

Proj. Management  1   Special          6
Adjustment        2   Editor           7
Measure           3   Data Transfer    8
Stationing        4   Configuration    9
Coordinates       5   Remote Control   0
```

↑, ↓ Select (Radio) Channel, Station address, Remote address

```
Remote Control
Channel                1
Station address        1
Remote address         1

                  Cent      Win      CONN
```

Toggle Channel, addresses

```
Main Menu                          NONAME

Proj. Management  1   Special          6
Adjustment        2   Editor           7
Measure           3   Data Transfer    8
Stationing        4   Configuration    9
Coordinates       5   Remote Control   0
```

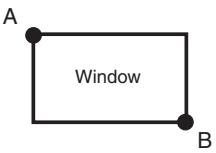
Win Define Search Window Activate Autom. Center

```
Remote Control
Channel                1
Station address        1
Remote address         1

                  Cent      Win      CONN
```

Display – Define Search Window

```
Define Search Window
Search window          Off
Autom. Center          Off
Point A (left, top)          Point B (right, bottom)
Hz      34.4423 gon          Hz      45.0762 gon
V1      88.4558 gon          V1     100.2535 gon
SetA                         SetB
```

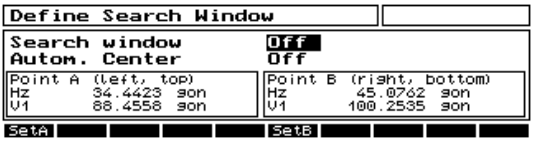


For setting a Search Window select one of two variants.

Variant A:
Turn the instrument and the telescope one after another.

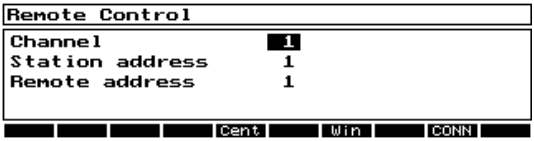
SetA Aim to upper/lower left corner

SetB Aim to lower/upper right corner



Activate Search Window

Jump back to menu Remote Control



Variant B:

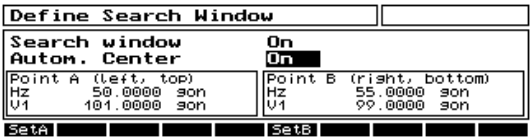
↑, ↓

Select Point A (left,top) type Hz/V-angle; Point B (right, bottom) type Hz/V-angle

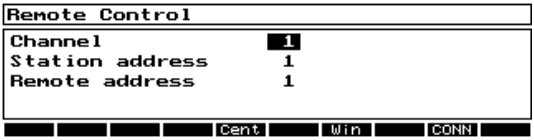
Activate
Search Window

,

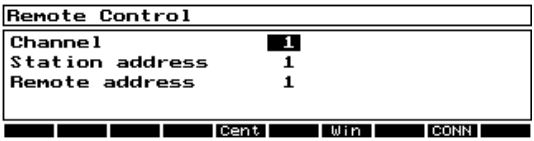
Select
Autom. Center
Activate
Autom. Center



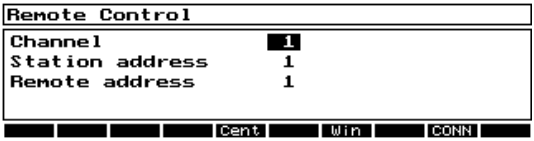
Jump back to
menu
Remote Control



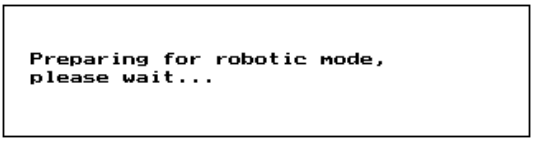
Cent Turn instrument
to new
Window Centre
and
Set
new direction



Conn Activate RCU mode



Display
-Preparation RCU mode



Display
.-Press any key to turn off

```
System is now ready for robotic.
Press any key to turn off system.
Remove control unit from instrument
and connect to radio.
```

Detach Elta® CU
from instrument

Instrument prepared for Remote Control Mode

Search Window

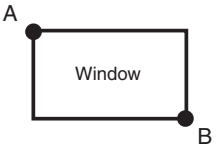
Win

Define
Search Window
Activate
Autom. Centre

```
Remote Control
Channel              1
Station address      1
Remote address       1
                  Cent  Win  CONN
```

Display
– Define Search Window

```
Define Search Window
Search window        Off
Autom. Center        Off
Point A (left, top)        Point B (right, bottom)
Hz      34.4423 gon        Hz      45.0762 gon
V1      88.4558 gon        V1     100.2535 gon
SetA                       SetB
```



For setting a Search Window select one of two variants.

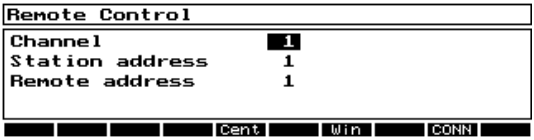
Variant A:
Turn the instrument and the telescope one after another.

SetA Aim to upper/lower left corner

SetB Aim to lower/upper right corner

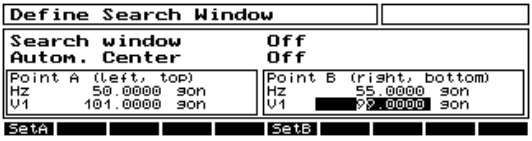
Activate Search Window

Jump back to menu Remote Control

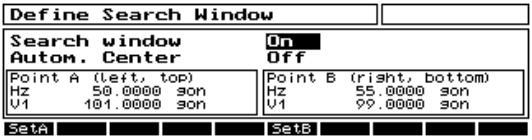


Variant B:

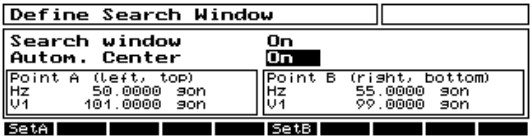
↑, ↓ Select Point A (left,top) type Hz/V-angle; Point B (right, bottom) type Hz/V-angle



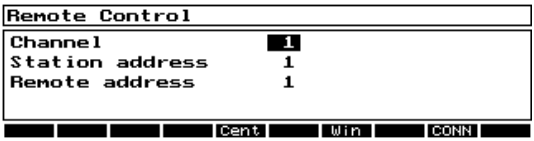
Activate Search Window



Select
Autom. Center
Activate
Autom. Center

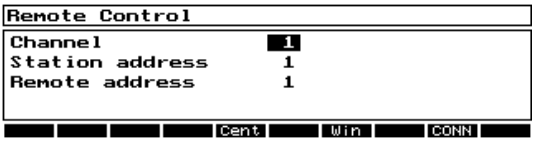


Jump back to
menu
Remote Control



Cent

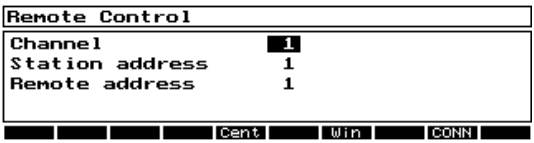
Turn instrument
to new
Window Centre
and
Set
new direction



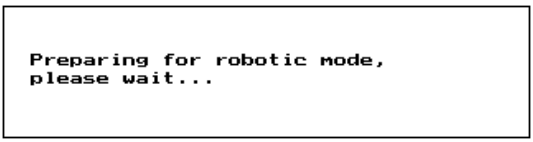
Activation of the RCU

Conn

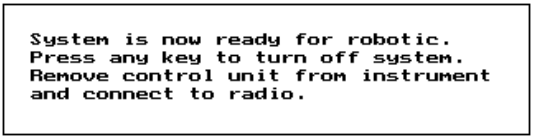
Activate RCU mode



Display
-Preparation RCU mode



Display
.-Press any key to turn off



Detach Elta® CU
from instrument

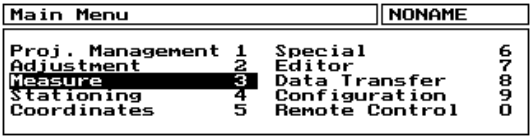
Instrument prepared for Remote Control Mode

Aim, Measure, Register

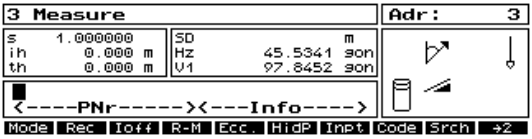
PWR Power On

Switch on Elta® CU, activate compensator, check levelling and set all the required parameters like PPM-factor etc.

3 4 5 6
Select any application, e.g. measure



Srch Select AutoLock™



Display
– menu AutoLock™

Activate AutoLock™

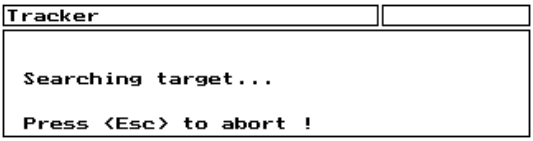
Press spacebar to activate AutoLock™.

Display
- Autolock™ activated

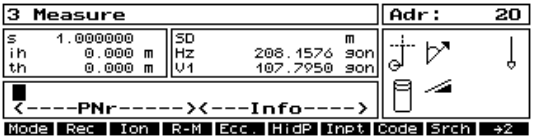
Find Search RMT

Display

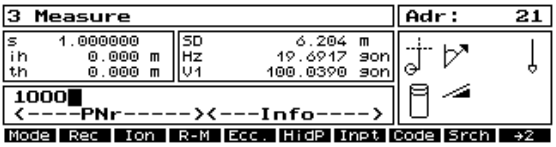
- Instrument searches RMT



Display
.-Instrument found RMT



Enter PI, aim, measure and record



☞ **Tip**:

After recording the memory address is incremented by one.

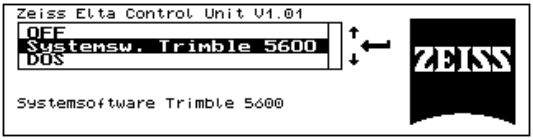
Establishing contact from a detached control unit (Activation of the RPU)

Attach the Elta® CU at the prism pole holder. Connect Elta® CU with radio via serial cable when using control unit holder (Artikel-Nr. 571 224 030).

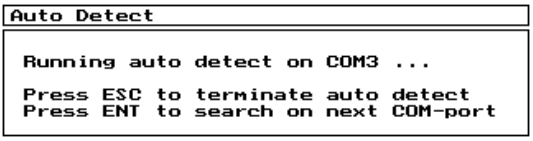
PWR Power On

Switch on Elta® CU.

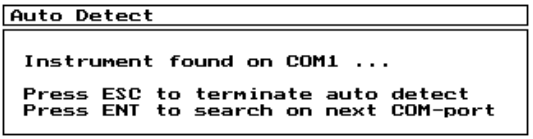
Select "Systemsw. Trimble 5600"



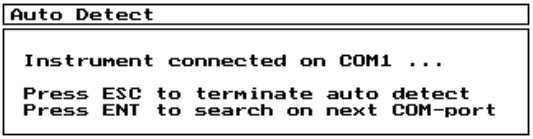
Display — Search for active COM-Port?



-Display — Instrument found at COM-Port1



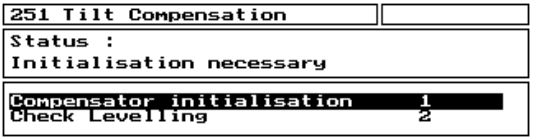
-Display Elta® CU connected at COM1



☞ Tip :

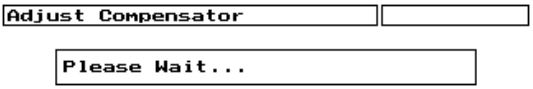
Depending on used holder Elta® CU can be connected with radio via COM1 or COM3!

Display
.-Initialisation Compensator
-Check Levelling

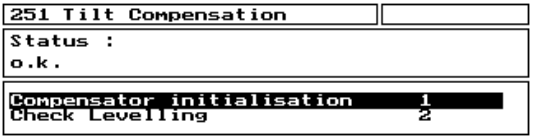


Adjustment of compensator.

Display
- Adjustment of compensator is running



Display
-Compensator adjusted

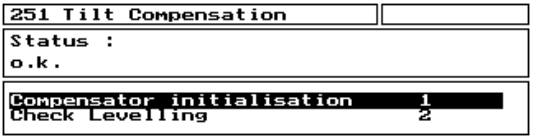


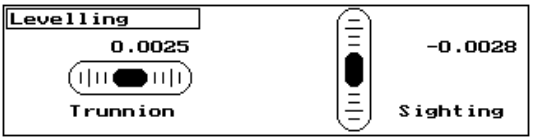
2 or

↓ , ↵

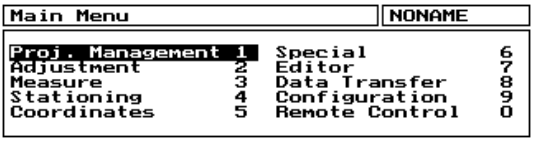
„Check Levelling“

Display
– Instrument is levelled





Esc 2x Return to main menu



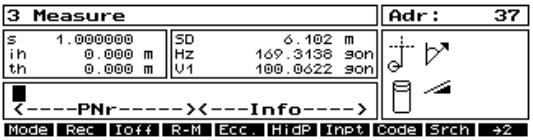
Switch to measurement towards an ordinary prism

If you, during a robotic measurement wish to measure towards an ordinary prism (e.g. when you wish to measure outside the range of the tracker), you can deactivate the function AutoLock™ at the RCU in any application menu.

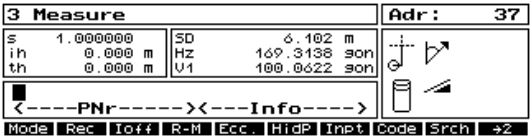
Measure 3

Display
-AutoLock™ active,
Status symbol

shown



Srch Select AutoLock™



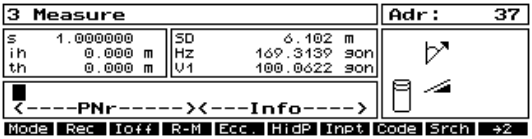
Display
– menu AutoLock™ active

Press spacebar to deactivate AutoLock™.

Deactivate AutoLock™

Display
– AutoLock™ deactivated

↵, **Esc** Jump back to menu Measure

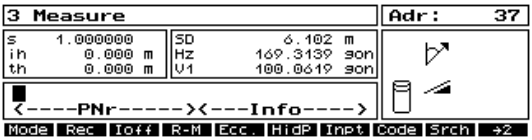


Switch back to robotic surveying

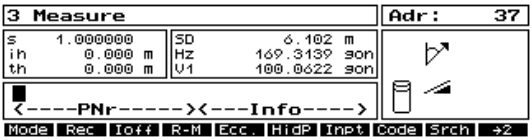
If you wish to switch back to robotic surveying from measuring towards an ordinary prism, you can activate the function AutoLock™ at the RCU in any application menu.

Measure 3

Display
-AutoLock™ inactive



Srch Select AutoLock™



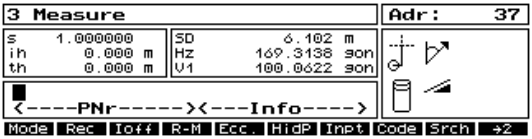
Display
– AutoLock™ deactivated

Press spacebar to activate AutoLock™.

Activate AutoLock™

Display
– AutoLock™ activated

↵, Esc — Jump back to menu Measure



AutoLock™ active, Status symbol  shown.

Search functions in robotic surveying

Find, **Cent**, **Win**
AutoLock™
Search Window
Autom. Centre

When you are surveying with Trimble 5600 series in robotic mode there is a number of search functions that can be very useful depending on actual application. These functions are described below.

Search Window: OFF
Autom. Centre: OFF
Find Start search

Instrument searches 360 degrees.

Search Window: OFF
Autom. Centre: On
Find Start search

Instrument searches in the area the RMT were lost.
Instrument searches 360 degrees if the RMT couldn't be find in the area the RMT were lost.

Search Window: On
Autom. Centre: OFF
Find Start search

Instrument searches in the pre-selected window.

Search Window: On
Autom. Centre: On
Find Start search

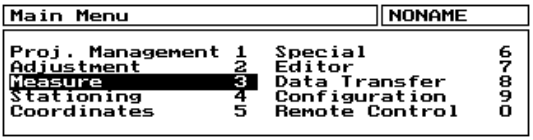
Instrument searches in the area the RMT were lost.

☞ Tip : If the instrument in Tracking mode looses lock of the target (RMT) it automatically locks on to the target as soon as it is visible again. This function is useful if you, for example, are measuring in heavy traffic with cars temporarily blocking the measuring beam.

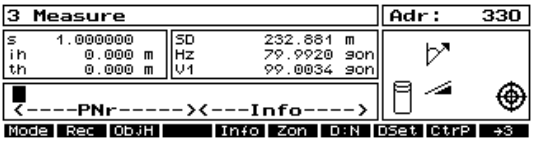
Distance Mode Direct Reflex (Option)

First switch on your instrument activate compensator, check levelling and set all the required parameters like PPM-factor etc.

3 4 5 6
Select any application, e.g. Measurement



Ctrl , R
Direct Reflex Mode



Switch ON / OFF Distance Mode „Direct Reflex".

Direct Reflex mode.
The „reflectorless" mode.

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

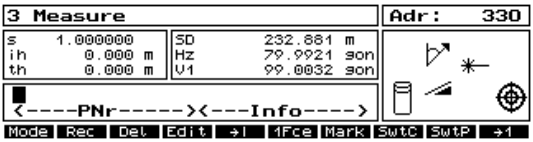
The following EDM modes are possible:

Direct Reflex mode.
The „reflectorless“ mode.

Direct Reflex mode.
The reflector “Weak signal” mode.
This means lower accuracy.

Prism mode.
The reflector mode.

Ctrl , O
Laserpointer



Switch ON / OFF Laser Pointer.

Activate Laser Pointer

> ☞ Note
>
> Laser Pointer and EDM mode switches via Hotkey is only possible in the measurement menus.

Default EDM Mode:
Prism Mode

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

Dset Configuration-Instrument-EDM-Setting

SwtP Configuration-Instrument-Periphery-Switches.

Standard Deviation

Set accuracy

EDM Mode:

DR = Direct Reflex Mode
PR = Prism Mode

Dist interval max.

Set sightdistance to max.

Dist interval min

Set sightdistance to min

Pointer

Laser Pointer ON / OFF

Weak Signal

Set for weak reflected signal

Laserp.OFF (switch off time)

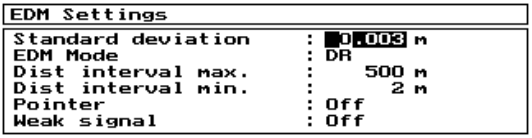
OFF=Pointer always ON
Once=Pointer OFF after trigger instrument

10 min=Pointer OFF after 10 minutes

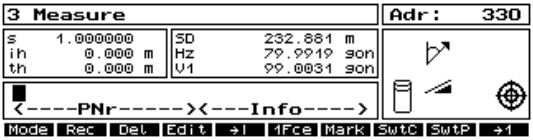
Switches

In the Configuration Menu the EDM functions can also be switched ON or OFF. Enter to configuration menu 915 or **9132** or use the softkey Dset or **SwtP** in the measurement menus:

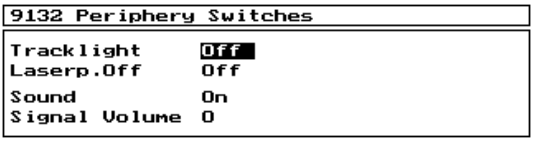
plus



or



plus



Use space key to toggle

Press ↵ to save settings.

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

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

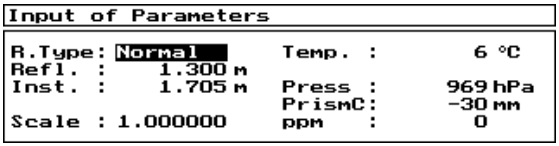
In measurement menus the **EDM Mode** can be switched using the hotkey
⇧ + . R .

The **Laser Pointer** can be switched ON/OFF using the hotkey
⇧ + 0 .

EDM Mode and reflector type

The EDM modes are combined with reflector types set in the **Input Menu** of the measurement program. To enter this menu, press **Functionkey** F7 to activate **Inpt**:

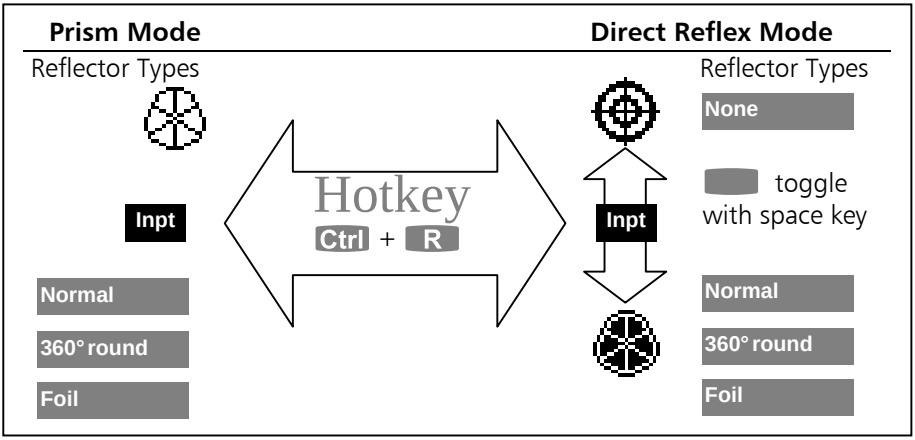
Inpt Input Menu



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: Kodak grey 200m

Kodak white >600m

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: 2- 5500 m (for one prism)

2 – 800 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 Mode (weak signal)

When measuring in direct reflex mode you may need to activate the weak signal if it isn't possible to measure the object.

Direct Reflex Distance Measurement

📖 Appendix
Technical Data

EDM Modes: 

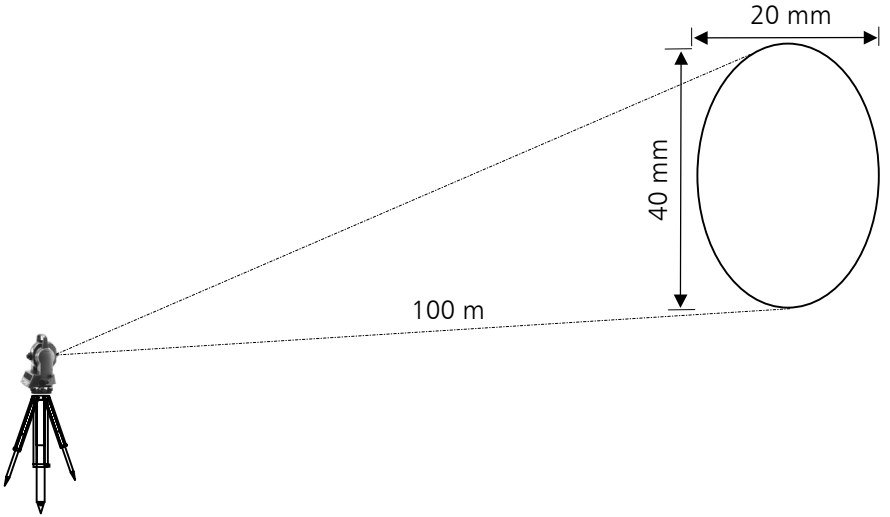
The values given in the technischen Datenblatt concerning accuracy, range and measurement time depend on the following effects:

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

The range of unambiguity of an indicated measurement covers up to 5,5 km using Prism Mode.

When measuring in Direct Reflex Mode the following measuring range at the target is significant for a measured distance of 100 meters.

DR & **PM Mode, 100m**

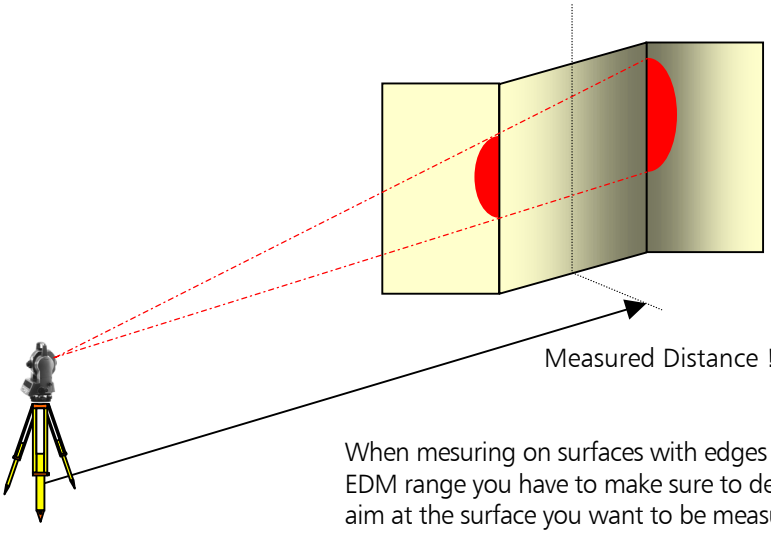


Attention !

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 Distance intervall max., min.

You can avoid incorrect distance measurement by activating Distance interval (max., min.) e.g. in the measurement program. This is especially advisable when measuring across roads with havy traffic.



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.

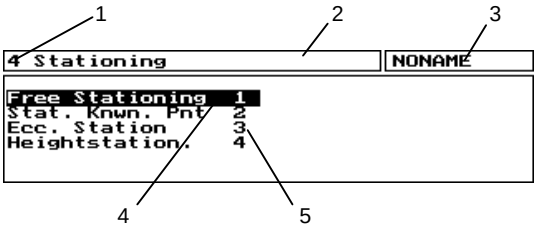
☛ Tip

Using Direct Reflex Mode be aware of a minimum distance of 2 m. If there are unfavourable conditions you cannot fall short of this minimum distance.

Menu guidance

Menus support the user at any stage of the program.

Options menu

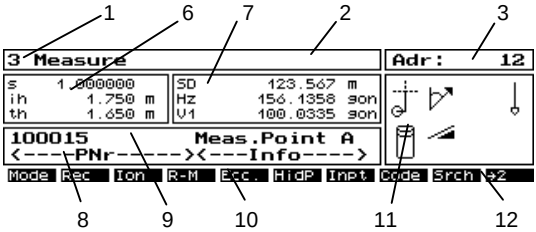


Key:

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



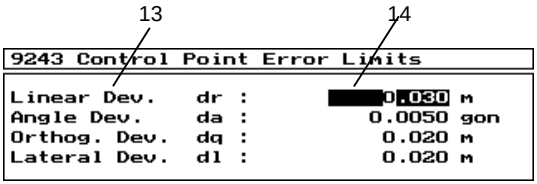
F1 to F10 for function keys.

In the measurement menu, you can navigate between the input fields for point identification and reflector height using

⇆ and ↑.

↵ or the special trigger key PWR to start the measurement.

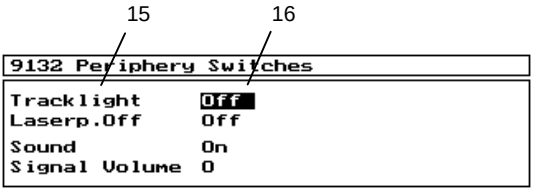
Input menu



⇦ Del Ins can be used in the input field.

↵ ends the entry.

Switch menu



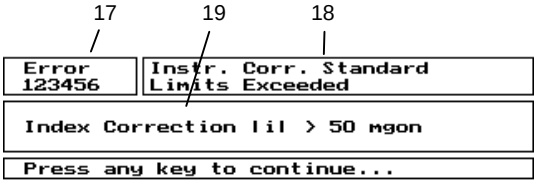
For toggling, use the ▭ (space bar) key in the switch field.

Key:

13 Input option
14 Input field cursor
15 Switch
16 Switch field

17 Error number
18 Error type
19 Error information

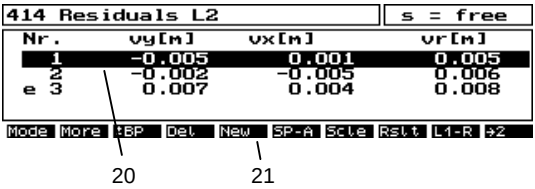
Error messages in the display



Lists

Key:

20 List cursor
21 Function keys



↑ ↓ PgU^{p} PgD$_{n}$ for scrolling.

F1 to F10 for function keys.

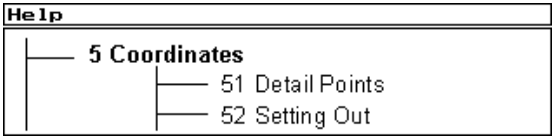
Quitting the menu

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.

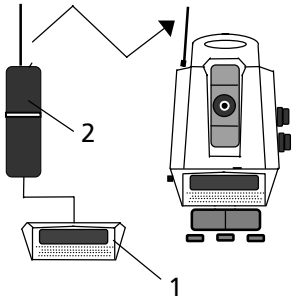
Help function

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

Ctrl H at any point of the program.



Zeiss Elta® CU and Radio



RCU is the unit for radio remote control of the Trimble 5600 series.

RCU comprises the components:

- Zeiss Elta® CU (1)
  (486 compatible processor), 33 MHz, 8MB Flash)
- Georadio (2)
  (radio module, λ/4-λ/2 antenna)
- Elta® CU holder,
  (Option: data cable)

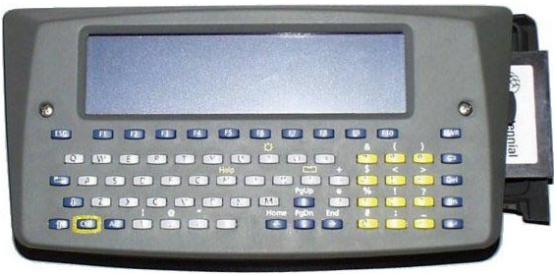
Attention!

Be careful opening the lid for removing the PCMCIA card!

Zeiss Elta® CU

PWR Power on trigger a measurement

Esc Escape



📖 **Zeiss Elta® CU Operation**

The unit can be used with or without a PC card.

Tip

For a more comfortable triggering of the measurement use the PWR key.

Special Notes for Elta® CU

Elta® CU is normally meant to be used whilst connected to the Georadio – and takes its power from Georadio battery (operation time on one battery is between 6-10 hours depending on temperature and use of display illumination etc.).

The unit has an internal backup battery, which will allow a stand-alone operation for up to 2 hours. At low radio battery a warning comes up. Now the user can safely shout down the Elta® CU.

The Elta®CU module can also be connected to a 220V office power unit or to a Cigarette lighter outlet 12V car adapter.

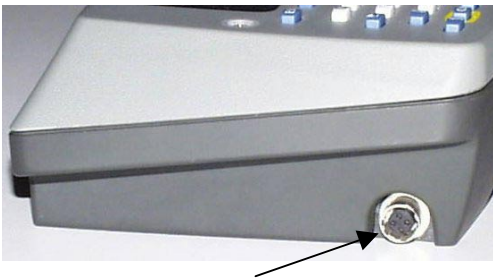
Elta® CU on-line and off-line mode

on-line (Radio) Full software functionality via radio link to the Trimble 5600 instrument.

On-line (Instrument) Full software functionality when Zeiss Elta® CU is attached on the Trimble 5600 instrument.

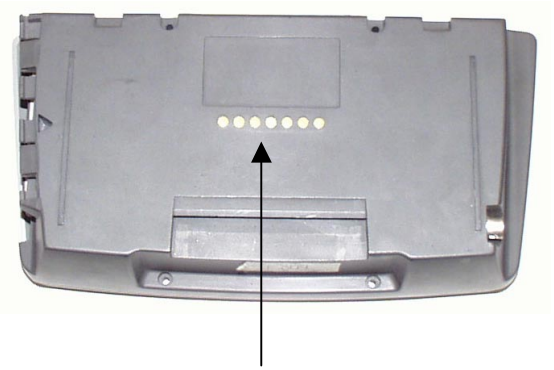
off-line Power from an external battery (3,5Ah or 6,6Ah).
Access to all menus in off-line mode.
Measurement value entering manually.
Data transfer via PCMCIA-card or RS232C cable.

Interface ports



Serial interface COM1.

Connect the Georadio for remote mode or PC for data transfer to the serial interface of the Elta® CU.



Serial interface COM3 and COM4.

Connect the Elta® CU via COM3 or COM4 with the holder for keyboard unit.

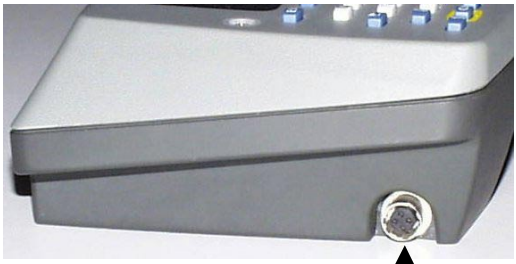
🕮 **Data Transfer**
PCMCIA Card Data Memory

Using a PC card

Zeiss Elta®CU card slot

The Elta® CU provides 8 MB of internal storage capacity. However, a PC card can also be used, and allows the easy transportation of data from the instrument to the Elta® CU.

Battery ports



Connector for charger

📖 **Annex**
Technical Data
Zeiss Elta® CU- Information for first use

Charging the backup battery

(1) Connect the power supply.

(2) Charging time is about 70 minutes.

Radio

The Trimble 5600 has the Georadio that can work with the system. The Georadio has a removable battery and the ability to select channels should the radio signal be disturbed.

Attention

Please be sure that you have the appropriate license for using the Georadio before using the data radio. It is the responsibility of the user to ensure that this license is arranged.

Attention

If there should arise questions with reference to the application of the radio data transmission module please contact the trader in your country.

Tip

Set the Data Radio as high as possible on the prism pole. Radios that are set too low will limit the range over which the instrument is operable.

Risks in use

Instruments and original accessories from Trimble AB must only be used for the intended purpose. Carefully read the manual before the first use and be sure to comply with the safety notes.

Attention!

- Don't make any changes or repairs on the instrument and accessories. This must be done only by a service team or by authorised technical staff.
- Do not point the telescope directly at the sun.
- The instrument is equipped with servomotors. Operate the instrument as described in this manual to avoid your fingers being caught between the handle and the telescope body or between the telescope and the uprights. The forces occurring lie below the threshold for potential injury. The motors can be immediately stopped in a hazardous situation by separating the batteries from the instrument (loss of data!).
- Do not operate the battery charger and PC card reader in humid conditions (risk of electrical shock). Do not use instruments while they are wet.

Attention!

- The magnetic PC card cover should always be closed to stop environment damage (water, dust).
- Check that the instrument has been correctly set up and the accessories are properly secured.
- Take the necessary precautions at your measuring site in the field; note the relevant traffic rules.
- Check your instrument at regular intervals in order to avoid faulty measurements, especially after it has been subjected to shock or heavy punishment.
- The instrument and accessories must only be opened by a service team or by authorised technical staff.
- Remove the batteries in case of unloading or a longer time without using the instrument.
- Properly dispose of the batteries and equipment taking into account the applicable national regulations.
- Do not use destroyed plugs and cables for accessories with the instrument.
- Do not use the instrument and accessories in rooms with danger of explosion.

3 First Steps

The first steps cover the set-up and check of the instrument. The data is stored project wise, and is controlled via the ***Project Management***.

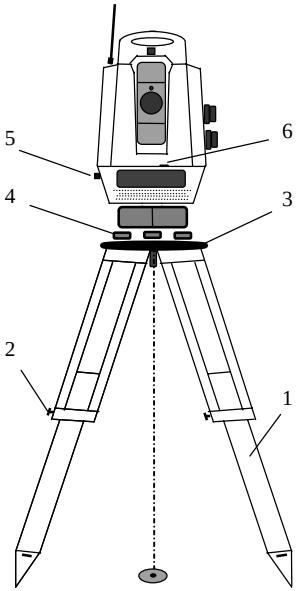
In the Program ***Measuring in a Local System***, one can measure using all functions of the Trimble 5600 series Total Station.

Before Measurement

Project Management

Measuring in a Local System

Set Up and Centring



Attention!

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

Set-up:

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

Centring:

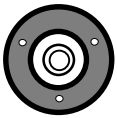
With the tripod set over the station point, look through the optical plummet (5) and position the centre over the station point using the tribrach screws (4).

Attention!

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

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

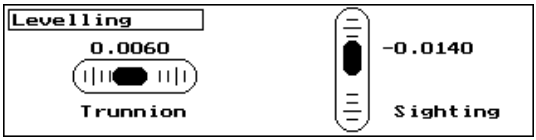
Levelling and Fine Centring



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

Fine Levelling:
The digital fine levelling is accessed using the

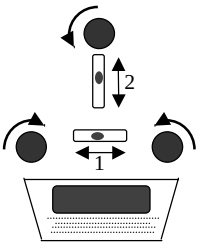
Ctrl L hotkey:



📖 **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 levelling error should be within the working range of the compensator.

After adjustment press Esc to return to the program screen.

Fine Centring:
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 through 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 CheckList:

1. Set Up ok. ?

- Levelling, Centring

2. Adjustment ok. ?

- V-Index- and Hz-Collimation
- Compensator run centre point
- FineLock

3. Data ok. ?

- PC Card is in?
- Control RCU)  ok. ?

4. Switches ok. ?

Configuration / Instrument / Switches /

- Compensation activated  ?
- Units / Decimal Points are set?
- Measure system  ok?
- Recording  on?

5. Battery ok. ?

- Battery Strength  , use Ctrl B

6. Project ok ?

- Is the current Project ok. ?

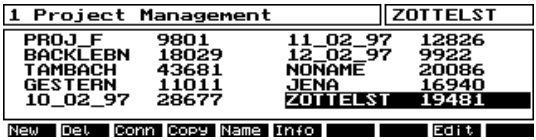
Create a New Project

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 screen (121 Byte per Data Line).

Select an existing Project

↓ Select the Project with the cursor keys.

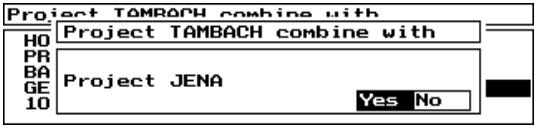
↵ to confirm as the current Project.

☞ Tip

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

Connect Projects

Conn to connect one Project with another.



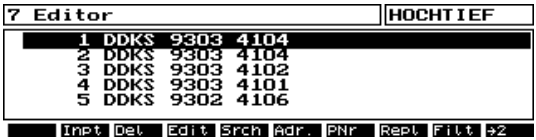
☝ Attention!

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!

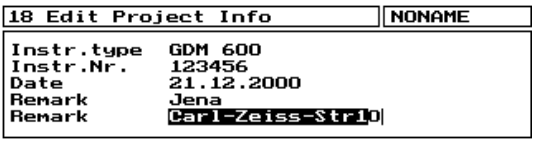
It is not possible to rename or copy a Project if the same name exists.

Project Information

Info Input the Project Information.

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

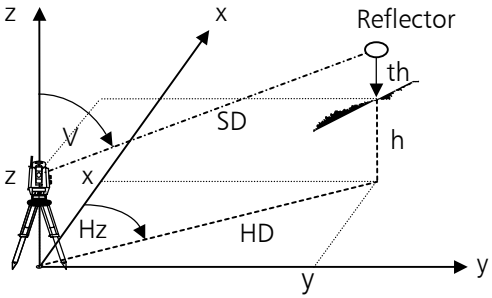
PgUp PgDn to select the other page.



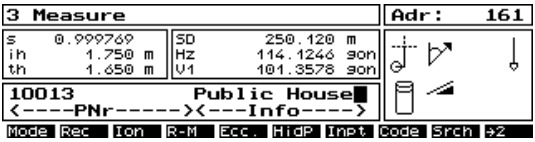
Measure **3**

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.



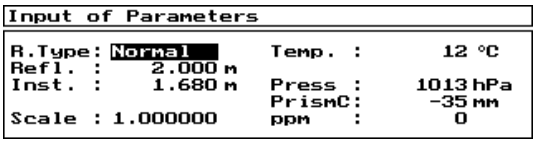
↵ or PWR to start measuring,
↑ to directly input the target height.

> **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 / ppm
(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.

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

A selection of one of the recording modes is possible only if the right measuring mode is selected. Selection of the Record mode is only possible when the recording Configuration is switch to On.

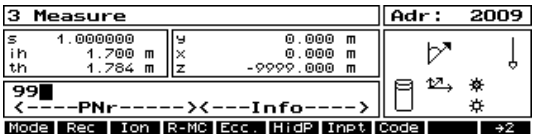
Ioff Incrementation of the point number **On / Off**

✍ -9999 ≤ Inc ≤ 9999

Set the increment step.

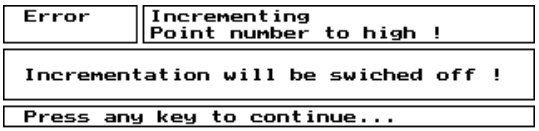
↵ to accept.

> ☛ 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.

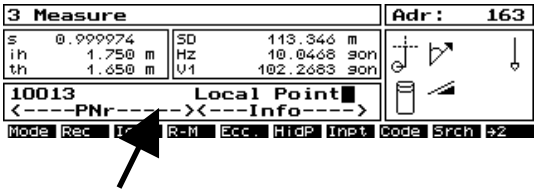
Input of the Point Identification PI

Use the cursors to navigate the input field.

Switch between code fields using .

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.

Prism Search and Prism Tracking (RMT)

Srch Call AutoLock™

Find Start searching RMT

Cent Set centre for window

Win Set dimension of window

SwtP Select menu TrackLight®

Use the Spacebar to select AutoLock™ OFF ON or Tracking.

FineLock: **On** / **Off** / **Tracking /**

📖 Trimble 5600– Operation AutoLock™

Status-Symbols:

AutoLock™**On**

Tracking **On**

Tracking lost

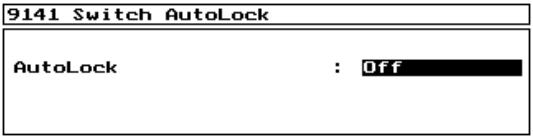
☞ Tip

Use the AutoLock™ function of the Trimble 5600 for more practical one man operation of the instrument.

Cfg Configuration of Prism Search

SwtP Periphery Switches

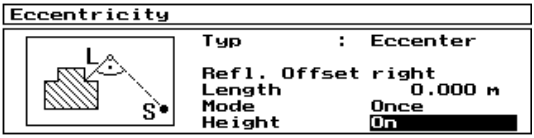
📖 **Configuration** Instrument Switches / Prism Sensors

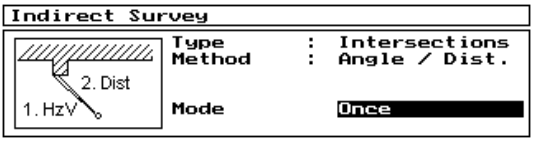


Configuration Menu for the AutoLock™ function.

Eccentric Measuring / Intersection

Ecc. Eccentricity
Intersection





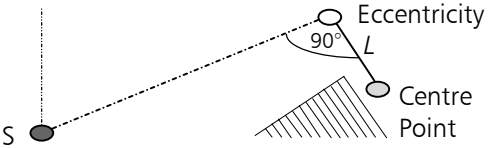
toggling between options.

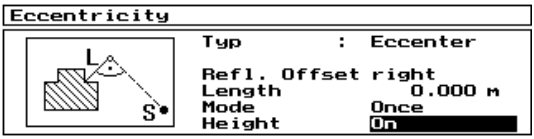
Type: Eccentricity

Type: Intersection

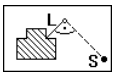
Eccentricity

Length L < 100 m

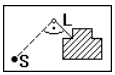




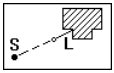
Reflector Offset:



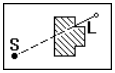
right of



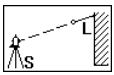
left of



front of



behind



slope (in sighting axis)

to the Centre.

toggling between options.

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

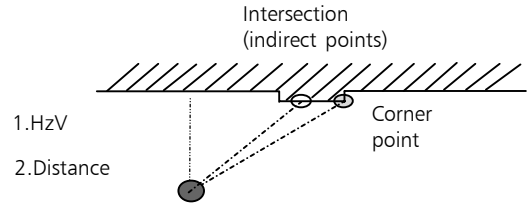
Mode **Perm** for a permanent eccentricity,

Mode **Off** to cancel.

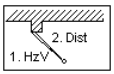
Height **On** To use the height of the eccentric point in position left, right, front of or behind to the centre. The centre height is calculated for a slope eccentre.

Off no height coordinate.

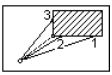
Ecc. Intersection



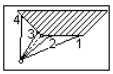
Method of measurement:



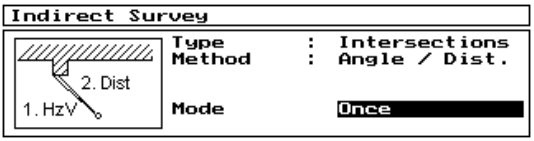
Angle/Dist.



perpend.



general



toggling between options.

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

Mode **Perm** for a permanent eccentricity,

Mode **Off** to cancel.

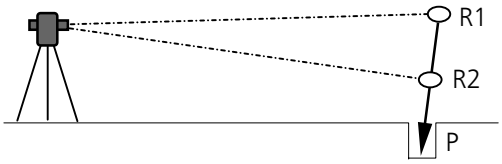
Attention!

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

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

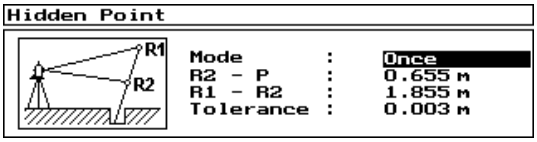
Hidden Point Measurement

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.

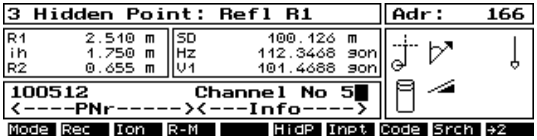


Modes: see Eccentric Measurement

Tolerance: Error limit used to check the accuracy of the measurement of R1 - R2.
Default Value: 0.003 m

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.

Attention!

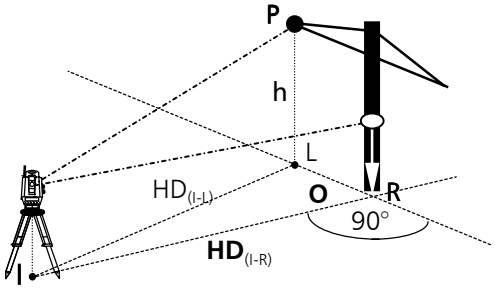
Using a AutoLock™ measurement can be problematic, as the AutoLock™ will lock to the strongest Signal of two prisms inside the telescope suncircle. Please make a test measurement before using!

Object Height Measurement

ObjH After measuring to a reference point in Mode:

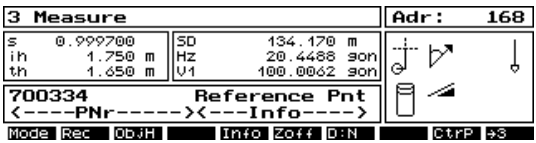
SD Hz V
HD Hz h
y x z

is this softkey accessible.



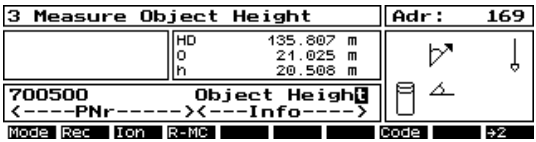
The Reference Point defines the line of the Instrument - Reflector (I-R) and the vertical plane normal to I-R. It is then possible using only the angle measurement  **HzV** to define heights and offsets in the plane:

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.

AutoLock™ is automatically cancelled



 to measure Object Height + Offset in  HzV measure mode.

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

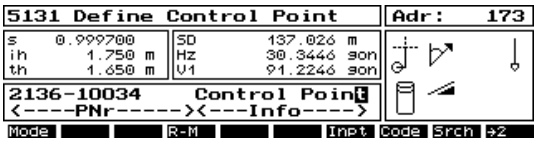
HD Horizontal Distance I-L
h Object Height from Station I

Control Point Measuring

CtrP Control Point

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

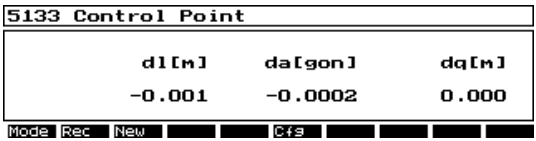
Define **2**



Sight CtrP, Measure with ↵ or PWR.

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** Program

Results of CtrP Measuring with :

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

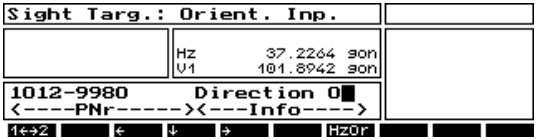
Motorised Directions and Hz-Circle Orientation

→| Call-up

1 ↔ 2 Motorised turn Face 1 / 2

HzOr Input of Hz circle orientation

→ Hz turn to a defined value:



↑ Input the direction and press **Enter** to turn the instrument using the motors.

→ Hz - 90[deg] to the right

← Hz - 90[deg] to the left

↓ Hz - 180[deg]

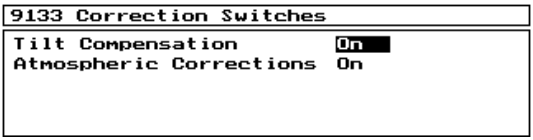
Corrections of the Measured Values

The measured values will be subjected to the following corrections:

- Influence of Temperature and Pressure (SD)
- Prism / Addition Constant (SD)
- Inclination of the Vertical Axis (HzV)
- Horizontal Collimation + Vertical Index (HzV)
- Trunnion axis (Hz)
- Circle Eccentricity (HzV)
- AutoLock™ Corrections (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**.



Toggle with , Confirm with .

Compensator **On**

After switching on the instrument and adjustment of the compensator all corrections are switched to **On.**

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

Attention!

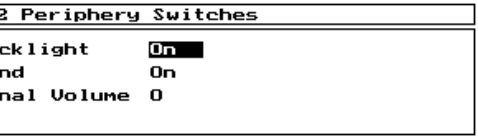
In order to improve the accuracy of the keyed in temperature, the instrument should not be subject to direct sunlight.

Technical Tips in Further switches and Technical Matters

Further Switches and Technical Matters

SwtP Periphery Switches **Trimble 5600**

TrackLight®**On**

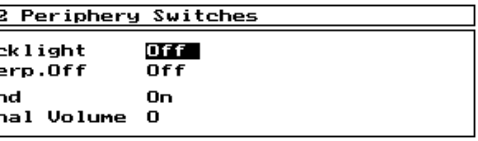


Trimble 5600 DR200+

TrackLight®**On**

EDM mode DR **ON**

Laserpointer **ON**



Error Limits **On**

Error Limits **Off**

Configuration Instrument Switches

☞ Tip

To activate the Error Limits in **HidP**, **ObjH**, **CtrP** and **2Fce ,** switch **On** in the Configuration of Instruments.

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

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

Info Input info line up to 27 characters.

1Fce Measurement in 1

2Fce or 2 faces.

Mark Change the actual Marking.

Del Delete the last record

Dset Setting for Distance Meter Type **DR**

Technical Tips

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

$\Delta t \pm 1$ °C ±1 ppm (parts per million)
$\Delta p \pm 4$ hPa ±1 ppm

Important Hotkeys:

Ctrl I Illumination Display + Crosshair
Ctlr L Levelling Menu
Ctlr B Battery Management
Ctlr H Help
Ctrl P Track Light (on/off)
Ctrl R Distance Meter Type **DR** (on/off)*
Ctrl O Laser Pointer (on/off)*

* For instruments type Trimble 5600 DR200+

4 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

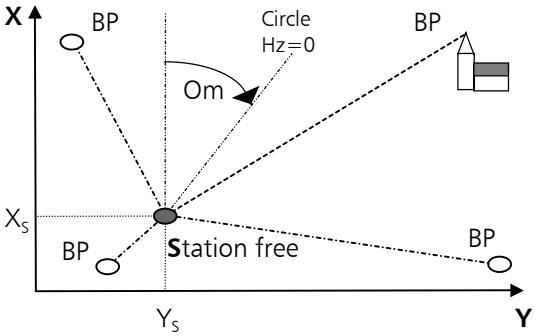
Heightstationing

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.



⇨ : $BP_{YX(Z)}$

⌖ : $SDHzV_{S\text{-}BP}$ or $HzV_{S\text{-}BP}$

💻 : $S_{YX(Z)}$, 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.

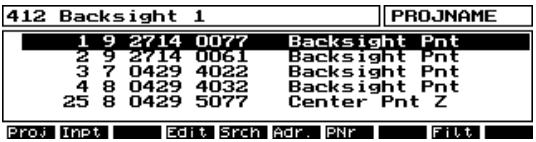
↑ to input the instrument height **ih**.

↵ to confirm input of the station name.

Proj Change projects to recall BP's from another.

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

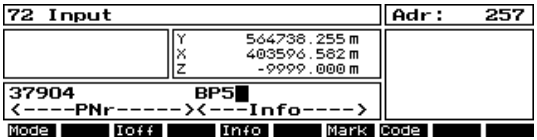
After the coordinate filter, select the required BP



↑ ↵ 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 ↑.

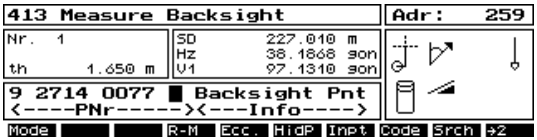
Record with ↵. End Input with Esc.

Free Stationing Measurement

Mode Toggle measure mode **SDHzV** / **HzV**

BP with distance measurement

BP without distance measurement



Start BP measurement with ↵ or PWR .

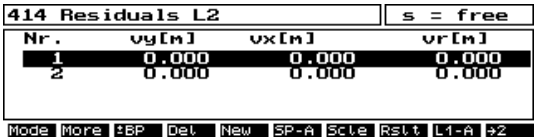
> ☞ Tip
>
> With Cursor ↑ it is possible to edit the target height **th**.

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

↑ Select the second BP and measure.

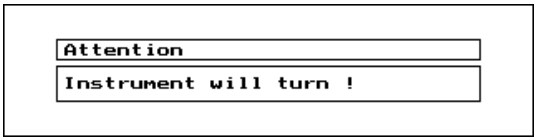
You will then see the first adjustment screen:

More to measure further BPs



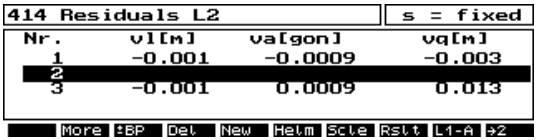
The residuals here are zero, as this kind of selected adjustment method requires a third point for the residual computation.

The direction to the third BP will be driven automatically by the instrument.



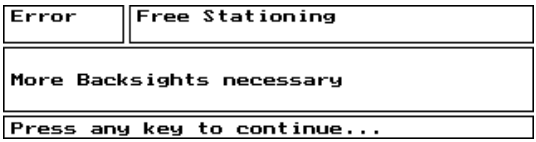
± BP Off/On to skip the BP measurement

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:

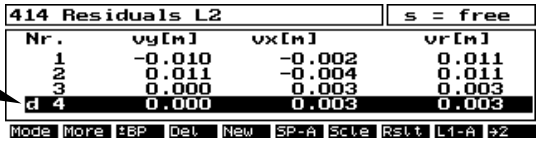


The program will automatically allow the measurement of further BPs as an adjustment.

> ☞ 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.

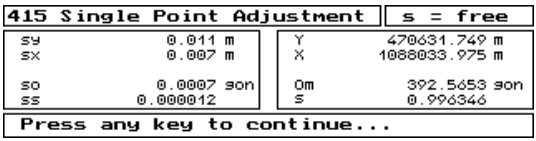
Rslt Results Display

Coordinate Position
Y, X (sy, sx)

Circle shift
Om (so)

Scale Factor
s (ss)

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



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

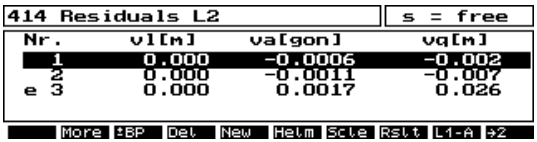
Measured distances will always be adjusted with a scale factor **s = 1.000 000**.

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

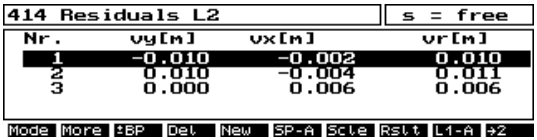
Helmert Transformation

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 radial



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**

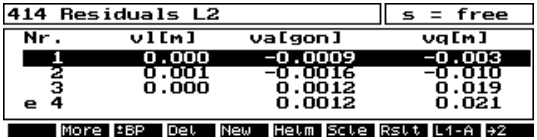
☞ Tip

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.

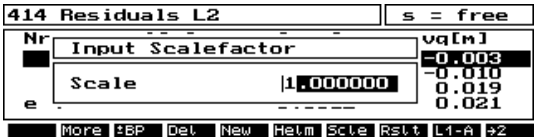


Residuals of the SPA:

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



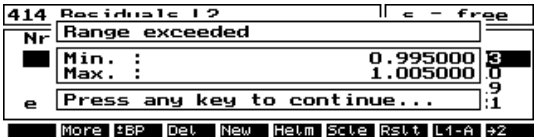
after input.

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 centring 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 centring:

Centring 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.

```
92111 Free Station. Adjustment Type
Calculations : Single Point Adjustment
Change       : On

Scale        : free
Change       : On
```

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.

```
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
```

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.

```
92116 Stationing Scale range
Scale Range : ±                 1500 ppm
```

✍ $-9999 \leq SR \leq 9999$

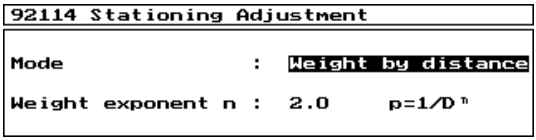
Example: ±1500 ppm would accept scale factors of $0.998500 < s < 1.001500$ as a result of the stationing. So for distances of 100 m you would accept deviations of ±0.15 m.

Neighbourhood principle and Distance Reductions

Cfg Configuration
Free Stationing

Adjustment 4

The residuals 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.



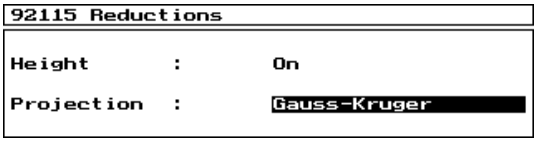
Mode: **Off** / **Distance weights**
n: **0.5** / **1** / **1.5** / **2**

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.



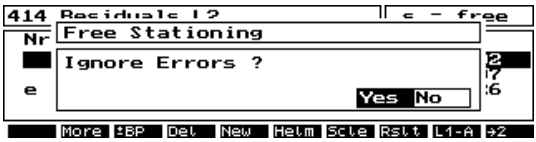
Height : **On** / **Off**
Projection: **Gauss-Krueger** / **UTM** / **Off**

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

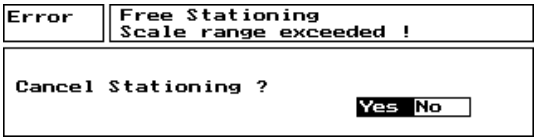
If at the end of your stationing error limits are exceeded for any BP, you will find that BP marked by **e** in column 1 and see the message:



Yes Accept stationing despite the errors.

No Back to displaying the residuals.

If the pre-set 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!

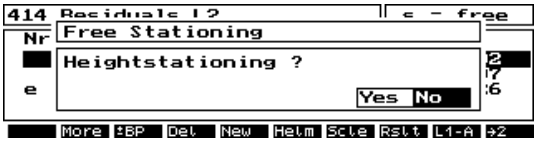
If stand point and 3 BP´s are on a circle and only directions are measured, there is a warning.

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 separate 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 possible 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:

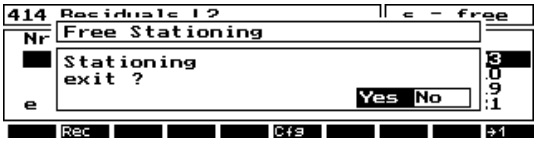
Attention!

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:



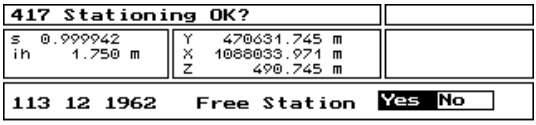
No Remain in the adjustment menu.

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.

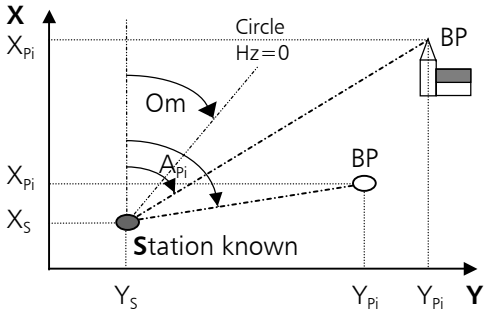
Stationing on a Known Point

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}

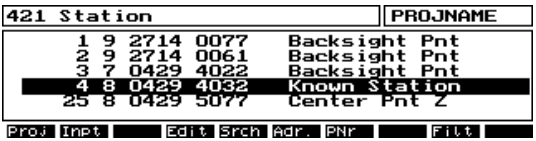
💻 : Om , s

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

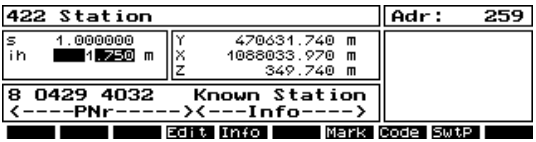
Coordinate points are filtered into the editor ready for selection:



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 ↵ .



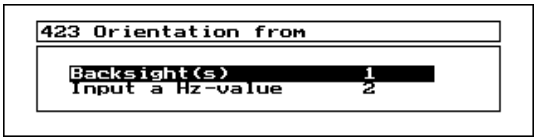
📖 see ***Editor*** for other functions

↑ 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



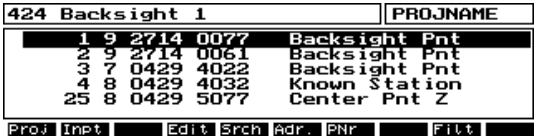
Select with ↓ and press ↵ .

Orientation through Backsight Measurement

Backsight(s) 1

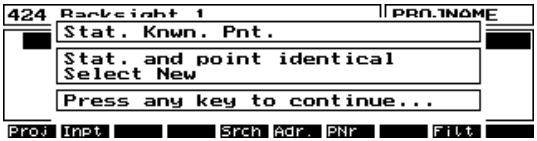
📖 **Free Stationing** Measurement and Adjustment

Select and measure up to 20 BPs from the Project:



Select with ↑ ↓ and press ↵.

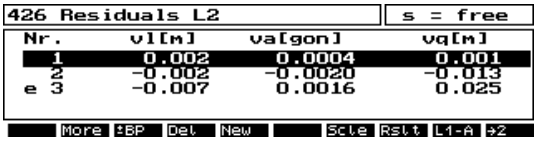
If BP = Station, comes the message:



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

More Measure further Backsights

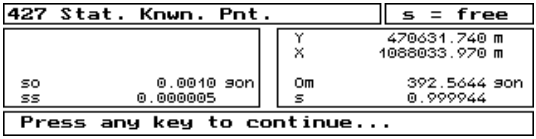
The instrument will automatically turn to further BPs.



Residual Screen. Softkeys similar Free Stationing.

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

Rslt Results display

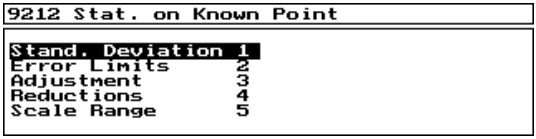


The display screen will show the results of the Stationing and the standard deviations:

Circle shift **Om** (so)

Scale factor **s** (ss)

Cfg Configuration of Stationing on a known point



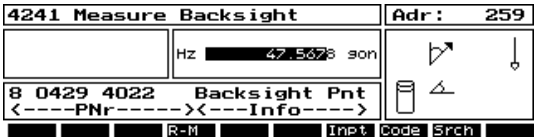
📖 **Configuration** Programs

The Configuration is the same as that for Free Stationing.

Orientation through input and measurement of a bearing

Input a Hz - Value 2

Input a bearing angle A_{Pi}.



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

After orientation, the results of the stationing are displayed.

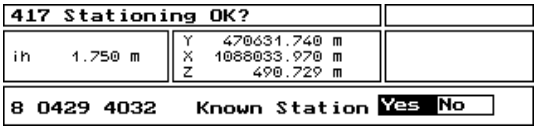
Results of Stationing on a Known Point

📖 **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 orientation and exit the program.

No Leave the Stationing without saving the results.

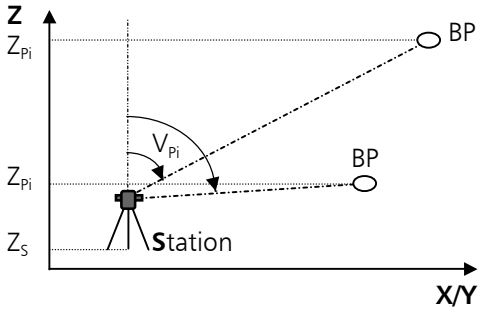
Heightstationing

Stationing **4**

Heightstation. **4**

The heightstationing is used in conjunction with a 2D stationing or as a separate 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.

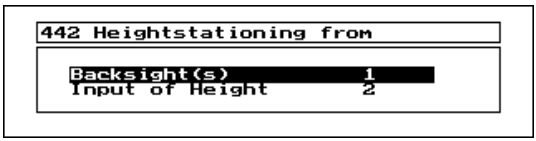
All measurements are performed in the **SDHzV** mode, with scale factor s=1. After heightstationing the previously used scale factor is reactivated.

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

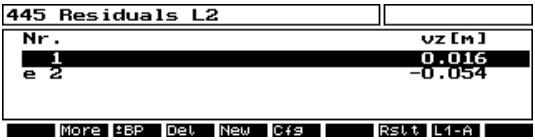
Backsight(s) 1

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.

Selection 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

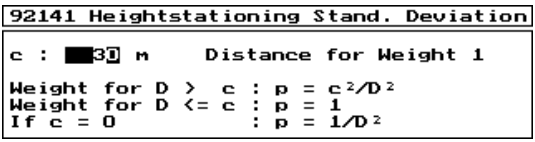
Standard deviation 1

Define 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).

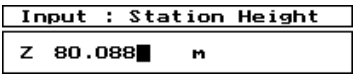


Exam.: up to 30 m distance → p = 1
from 30 m distance on → p = c^2 / D^2
c = 0 → p = $1 / D^2$

Entering a height value

Input of Height 2

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

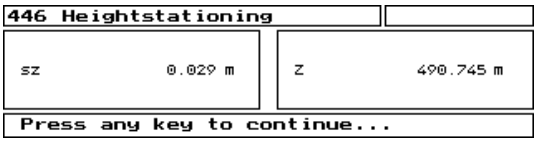


After the height entry, Heightstationing is done.

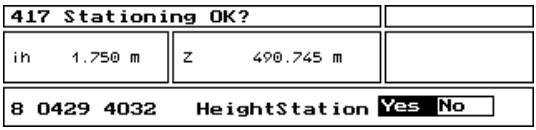
Results of the Heightstationing

Rslt Show result of Heightstationing

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



Esc When pressed in the display of the residuals: Heightstationing is finished and the result is checked in accordance with the pre-set 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.

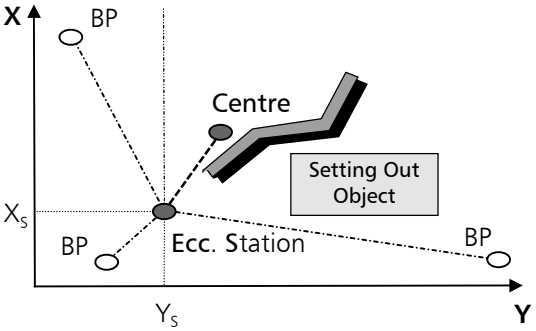
No Leave the Heightstationing without saving the results.

If Heightstationiong was previously called from a stationing 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 an unknown point close to the known point (the so-called centre point).



⇨ : $BY_{PASS(Z)}$, $Centre_{YX(Z)}$

⌖ : $SDHzV_{Exz.-Z}$, $HzV_{Exz.-BP}$

💻 : $Ecc._{YX(Z)}$, Om

📖 $2 \leq BP+CP \leq 20$

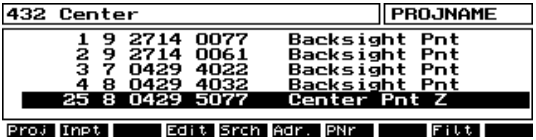
Measure directions to the BP´s and combined distances and directions to the centre point: With these data the coordinates of your station and the orientation **Om** of the horizontal circle are determined. Up to 20 BP´s (including the centre point) can be measured.

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

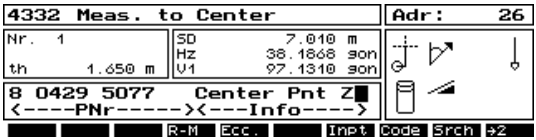
Then you can display the coordinates of the centre point in the editor:

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



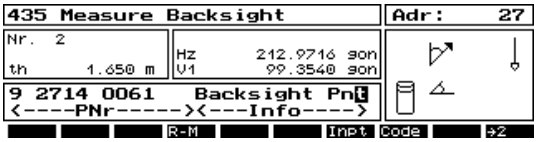
Select the centre point and press **Enter**.

Measurement Eccentric Station



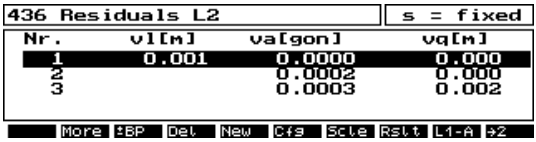
Measure SDHzV (Centre) by or PWR.

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



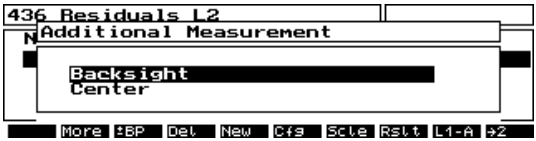
📖 **Free Stationing**
Measurement Free Stationing

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 pt.: Measure another BP

Centre: Re-measure centre 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***

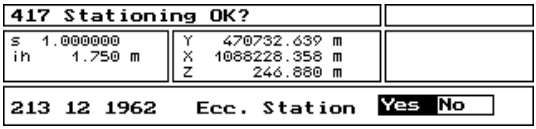
☛ Tip

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

For greater distances it is better to choose the regular Free Stationing, the centre 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.

5 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

Detail Points

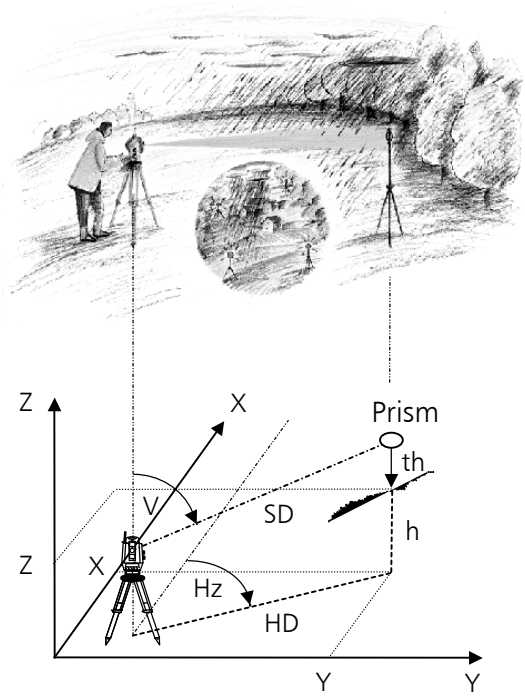
Coordinates 5

Detail Points 1

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

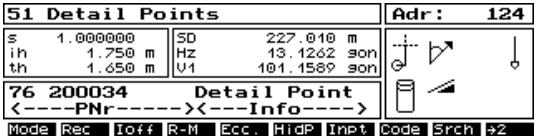
The actual stationing will be used by the *Detail Point* program (including the scale factor).

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 PWR 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

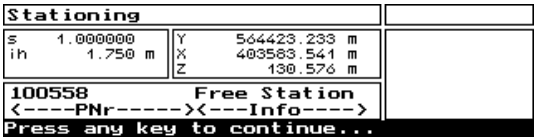
R-C for computed data

R-MC includes R-M and R-C

Configuration
Instrument
Switches

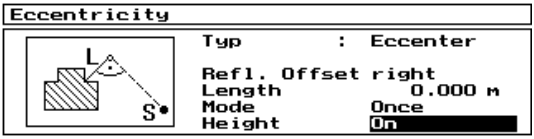
It is possible to record oriented (by stationing, see figure) or not-oriented Hz-directions. For coordinate computation oriented Hz-directions will be used.

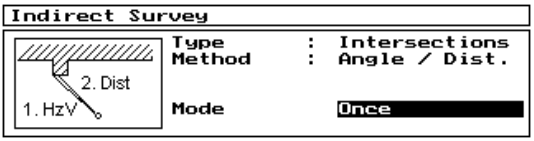
StCk Stationing Check, displays the actual Stationing.



Eccentric Measuring / Intersection

Ecc. Eccentricity Intersection





toggling between options.

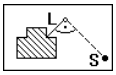
Type: Eccentricity

Type: Intersection

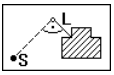
Eccentricity

Length L < 100 m

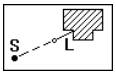
Reflector Offset:



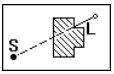
right of



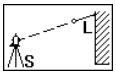
left of



front of

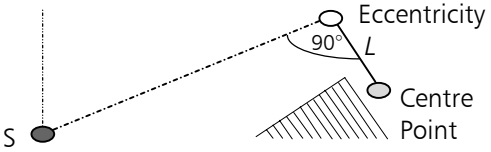


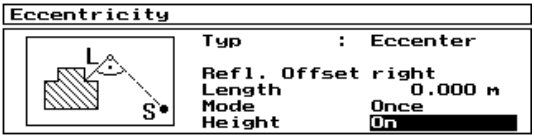
behind



slope (in sighting axis)

to the Centre.





toggling between options.

Mode **Once** for one eccentric measurement,

Mode **Perm** for a permanent eccentricity,

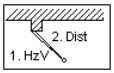
Mode **Off** to cancel.

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

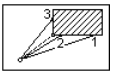
Off no height coordinate.

Ecc. Intersection

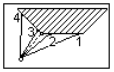
Method of measurement:



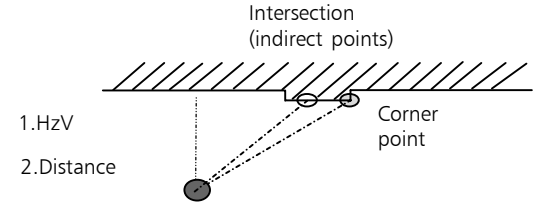
Angle/Dist.

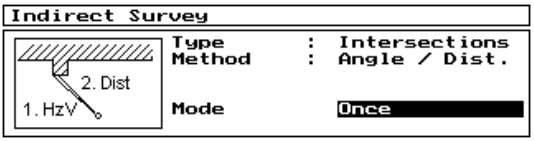


perpend.



general





 toggling between options.

Mode **Once** for one eccentric measurement,

Mode **Perm** for a permanent eccentricity,

Mode **Off** to cancel.

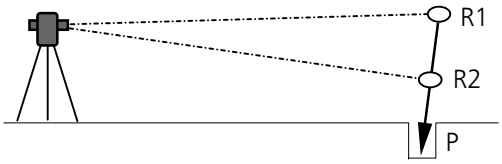
Attention!

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

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

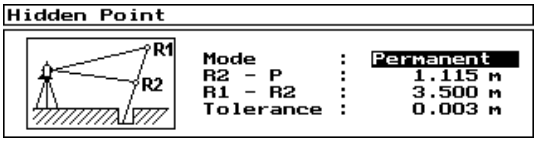
Hidden Point Measurement

HidP Call Hidden Point



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

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



Mode: similar to eccentric measure

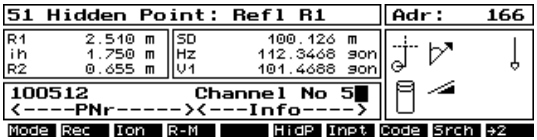
Tolerance: permitted maximum value for accuracy of the R1-R2 distance.

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.

Attention!

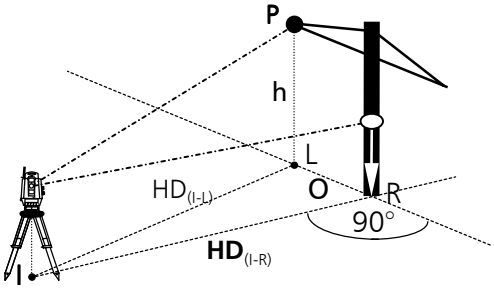
Be careful using AutoLock for hidden point measurement. Test first.

Object Height Measurement

ObjH After measurement to a reference point with modes

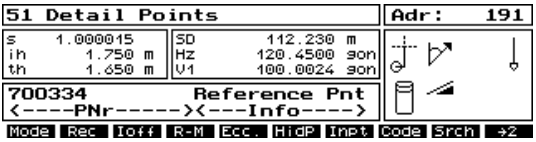
SD Hz V
HD Hz h
Y X Z

this function key is available.



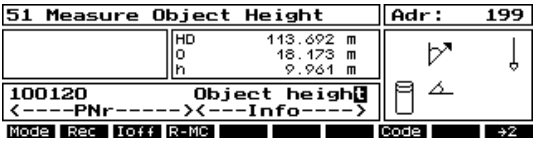
The reference point defines the line Instrument-Reflector (I-R) and the vertical plane normal to I-R. Now it is possible, to measure object heights to points in that plane only by **HzV** angle measurement:

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.

AutoLock will be automatically switched off



to measure object height + orthogonal deviation with .

Mode Switches the display of HD O h, Hz V , SD Hz V HD Hz h , Y X Z

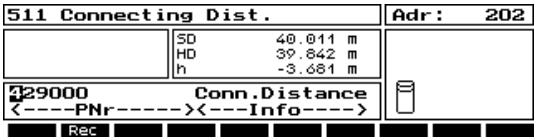
Mode is a switch between the display of **HD O h** and **HD Hz h**. Recording with **Rec**.

HD Horizontal distance Instrument - L
h Object height to I (instrument)

Connecting Distances

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

Rec To record the connecting distance

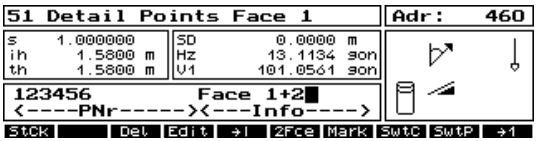


Press **Rec** to record the connecting distance.

↵ or Esc back to the measuring menu without recording.

2 Face Measurement

1Lg toggles between face 1 and face 2.
2Lg



After measurement in face 1 the instrument turns automatically in face 2. After measuring in face 2 the instrument turns back to face 1.

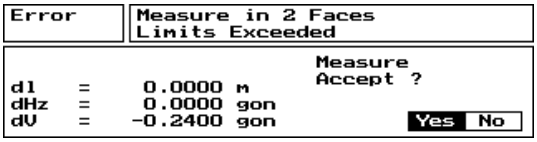
Attention!

Using AutoLock is not possible.

📖 **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.

Distance and AutoLock with Tracking

When in Measure or Detail Points use the following technique for faster topographic surveying:

Srch

D:T

Rec

1. Turn on AutoLock to Tracking
2. Turn on Distance Tracking to **D:T**
3. Use the **Rec** softkey to record the current displayed position

If the prism is lost, the symbol for "Prism lost" appears in the display and the TrackLight turns on automatically helping to rebuilt the connection. The **Rec** softkey is locked for this time.

Setting the Search Window to Automatic Center ON the instrument aims close to the target direction after loosing contact.

Attention!

If distance tracking is switched off by pressing **Esc** or **D:N**, the measure buffer will not be filled with new values and the **Rec** softkey stores the same (the last tracked) value again and again.

in this mode does a precise measurement using the FineLock function. After then it comes back to the distance and FineLock tracking mode.

Value Corrections

📖 **Configuration**
Instrument

The measured values will be subjected to the following corrections:

- Influence of Temperature and Pressure (SD)

  manual setting
- Prism / Addition Constant (SD)
- Inclination of the Vertical Axis (HzV)
- Horizontal Collimation + Vertical Index (HzV)
- Trunnion axis (Hz)
- Circle Eccentricity (HzV)
- AutoLock / Tracker Corrections (HzV)

📖 **Configuration**
Programs

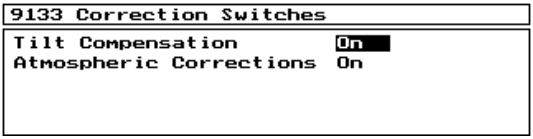
The calculated values (HD, h, X, Y, Z) will be computed from the corrected measured values and are corrected by the following (selectable) influences:

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

📖 **Annex**
Formulae

The exact formulas are given in the annex.

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



Toggle with , Confirm with .

Compensator **On**

After switching on the instrument and adjustment of the compensator all corrections are switched to **On.**

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

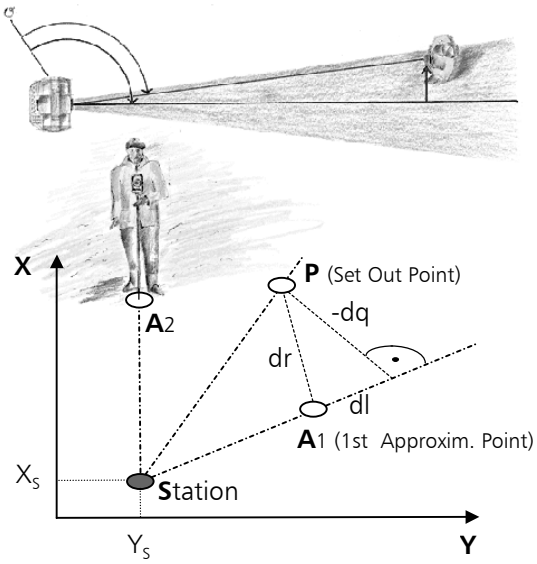
Coordinates 5

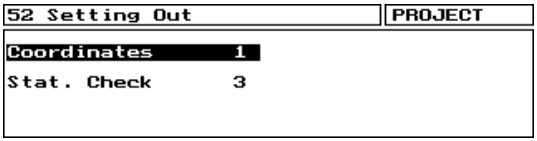
Setting Out 2

Setting-out of coordinate points.

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

The *TrackLight* of the Trimble 5600 is very useful for setting out points and will drastically reduce the time needed to set out a point.





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

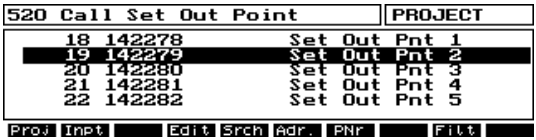
⇨ : S , P
⌖ : $(SD, Hz, V)_{S\text{-}A}$
💻 : $(dl, dq, dr)_{P\text{-}A}$

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

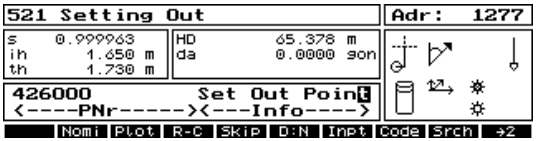
Proj select another project

📖 **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.

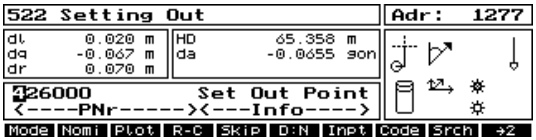
At the same time, the motors turn the instrument to the correct bearing and vertical angle.

The prism should be aligned to the telescope direction.

with prism tracking activated, the instrument will not turn automatically to the bearing.

↵ measure the position of the prism and displays the setting out screen.

The Setting Out screen



Nomi to realign the direction of the Trimble 5600 to the required nominal direction.

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

Setting out with AutoLock in Tracking

 AutoLock-Tracking

Using AutoLock 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

Srch AutoLock modes

A single measurement is activated with

 or PWR.

R-MC Record mode

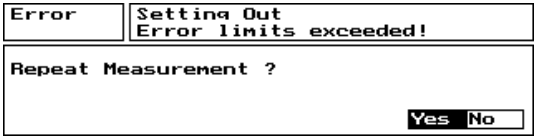
Recording

 **Configuration**
Program
Coordinates
Setting Out

The recording mode is set within the Configuration *Coordinates Setting Out* , but can be toggled using the softkey **R-M**, **R-C**, **R-MC**.

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

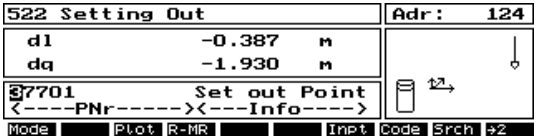
If the error limits are exceeded:



Yes to repeat the measurement.

No Record and call the next point.

Plot Zooming the dl, dq display.

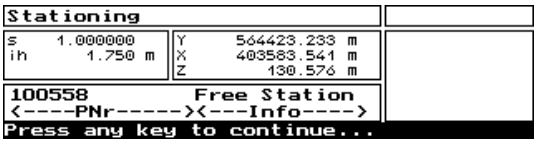


Press **Plot** again for normal viewing.

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.



6 Advanced Applications

This chapter describes advanced applications in the daily surveyor's practical work. This applications are implemented in the menu *Coordinates* and *Special* of the Geodimeter® software.

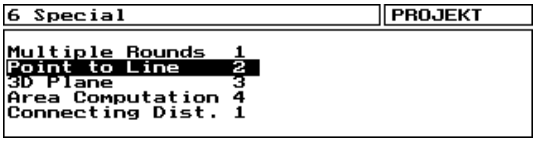
Point-to-Line Distance

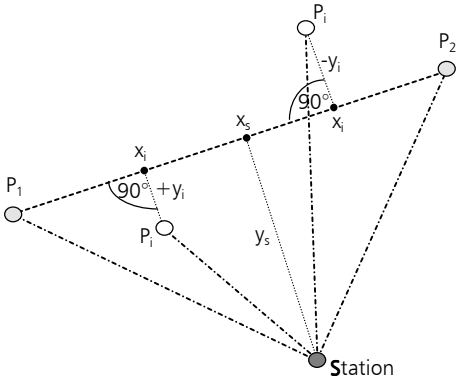
Point-to-Line Distance

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.





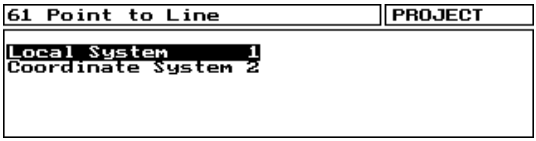
Survey by quasi-perpendiculars, staking out of points or profiles orthogonal to a line can be done by the help of this measuring method.

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.

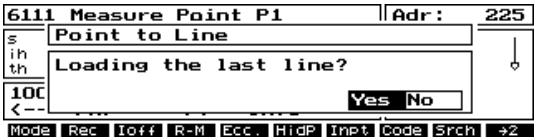
The heights refer to line point P_1 with height z=0 or a heightstationing.

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



Measuring in a local system

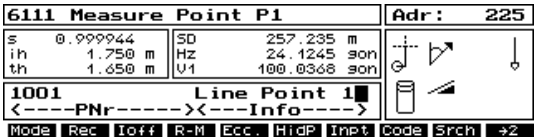
Local System **1**



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

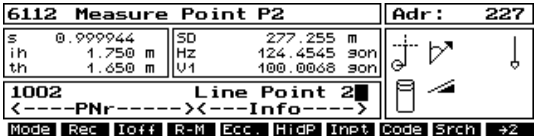
The height reference for defining the line can be selected by the Softkey **Zon**:

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

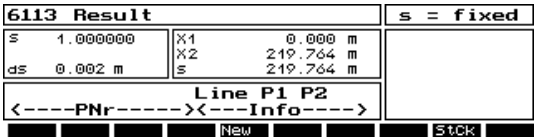
↵ or PWR to measure line point P_1



↵ or PWR to measure line point P_2

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

New New line measuring

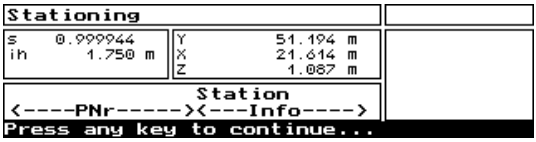


Result of the measured line P_1 P_2. The x-axis is defined by both points with point P_1 as the coordinate origin.

↵ Accept the line measurement.

StCk Station check

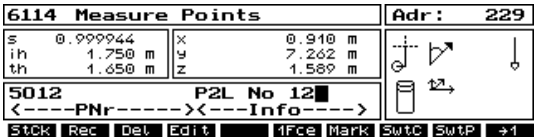
To check the station coordinates referring to the coordinate system defined by the line.



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



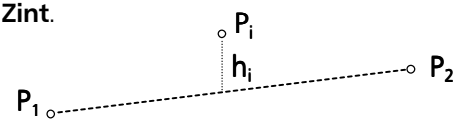
↵ or PWR to measure the points P_i.

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.

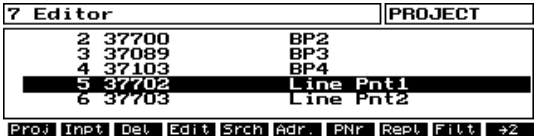
The program starts similar to the local system. You will be asked whether or not you wish to use the last line.

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 :

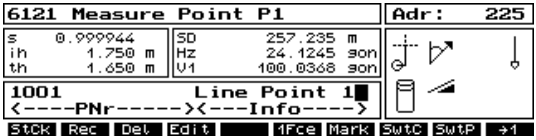


↵ call-up the point P_1 from project file

or

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

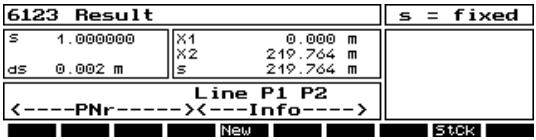
Esc goes to the measurement menu:



↵ or PWR to measure line point P_1

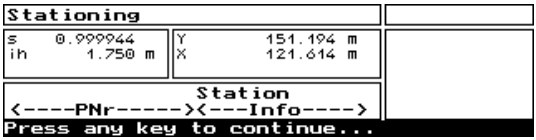
Measuring or calling-up of the second line points leads to the result display:

s Length of line



StCk Station check

The local Station coordinates referring 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.

Point-to-Line distance measurement

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

The measurement is similar to measuring in a local system.

7 Data Management

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

Editor

Data Transfer

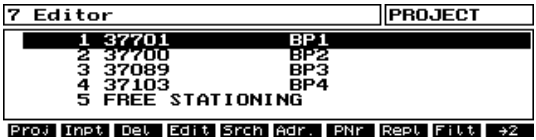
Data Format

PCMCIA Card Data Memory

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
PgUp PgDn	Scrolling the display by four address items
Home End	Jump to the first and last addresses
⇆	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:

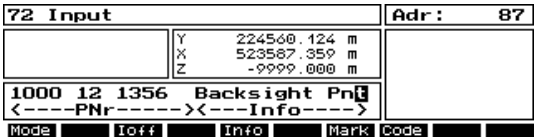
Yes The change (entry) is saved.

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

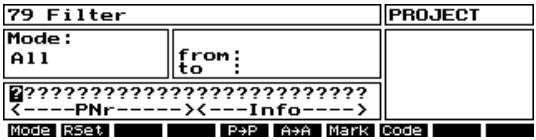
Searching for a record or address

📖 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

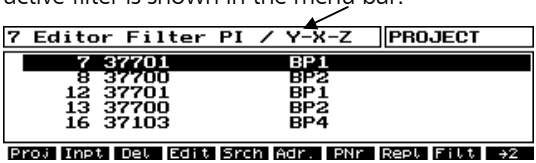
- Point identification (text or code blocks)
- Addresses from - to
- Point numbers from - to
- Attributes of values (Y-X-Z, SD Hz V, etc.)
- Combinations of these options

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.

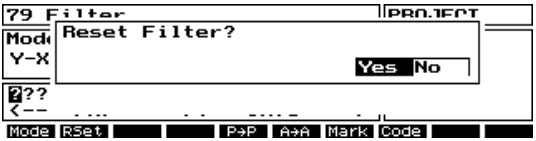
Setting a filter

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.

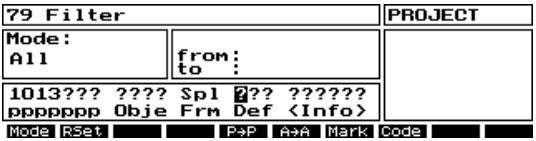
Mark Activating or changing the marking

Point identification filter

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

Code Filtering acc. to coding with code-lists

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**.

Default address range:

from: first address

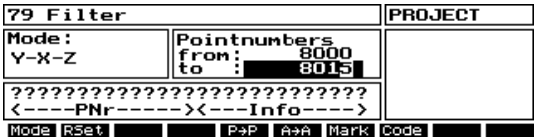
to: last address

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**.

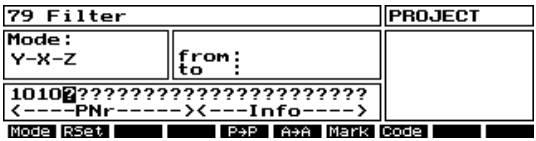
Filtering according to point numbers is independent of the marking, unless PI is used as a filter criterion at the same time.

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:

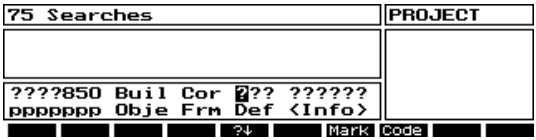
? is like a wildcard

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

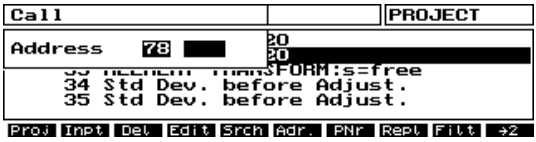
?↑ Search to file beginning

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.

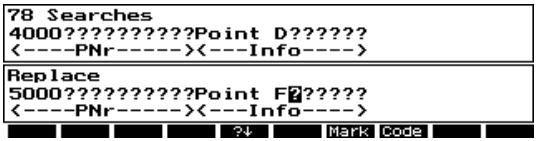
PNr Search for/calling up point numbers

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.

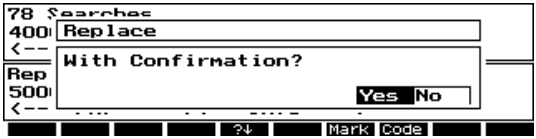
Enter: **Search mask** (-string)
Replacement mask (-string)

↓ To entry of the replacement string

↵ Start search / replace

?↓ Search direction

Confirmation of replacement:



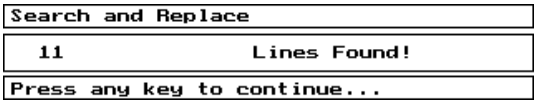
No The new string without prior enquiry replaces all strings conforming to the search criterion.

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.

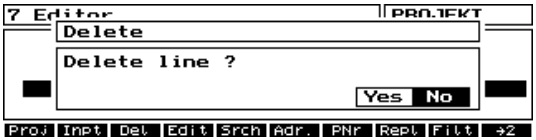
After completion of the search / replacement, the result is displayed:



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

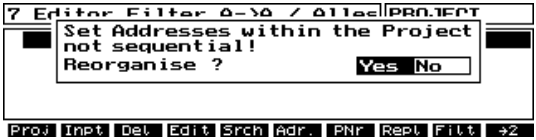
If an output filter is set, this function deletes all records set in the current output filter:

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 reorganised in the same way as by the **OrgP** function:



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

No No data memory reorganisation. 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 reorganisation 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.

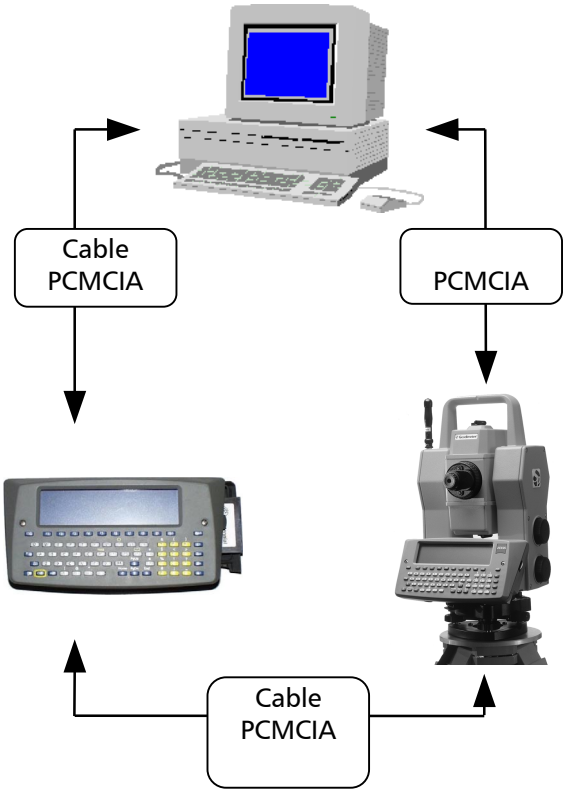
OrgP Data memory reorganisation

Reorganises the data memory in the current project.

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

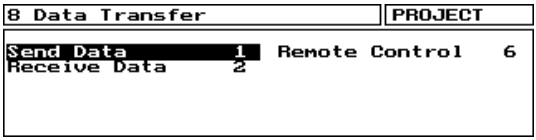
Yes Data memory reorganisation.
Caution! This deletes the data for good!

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



	Data transfer can be done between			by
↔ RS232C cable interface	Geodimeter®	↔	PC	PCMCIA-Card
	Elta CU®	↔	PC	Cable (offline) PCMCIA-Card
	PC	↔	Elta CU	Cable (offline) PCMCIA-Card

Data Transfer 8



Cable for data transfer using the Xon/Xoff protocol:

Elta CU ↔ PC Cable: plus PC adapter
Cat. No.
PC Cable 571 202 188
PC adapter 571 202 204

Data transfer between Elta CU and PC.

Elta CU® ↔ PC

Connect theElta CU with an extermal battery or power supply and start the Elta CU in Offline-Mode. Then connect both devices by a serial interface cable plus pc adapter and start the necessary programs for data transfer.

Default Interface parameters for transmitting and receiving project files:

Baud rate:	19200
Protocol:	Xon/Xoff
Parity:	none
Stop bits:	1
Data bits:	8

☞ Tip

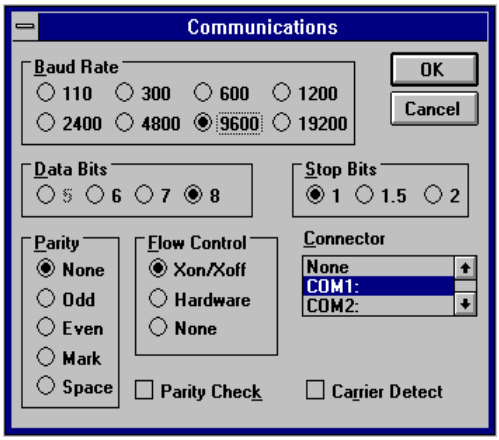
For data transfer to the PC, you can use the MS-Windows™ Terminal program, or the Zeiss Control Centre software.

Attention!

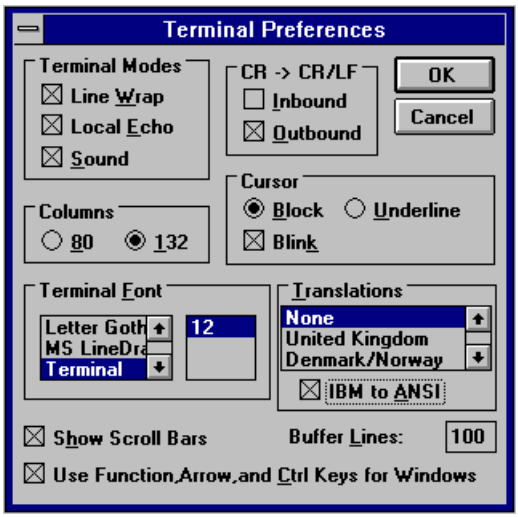
The data transfer via the foot connector of the Trimble 5600 is not active.

PC Terminal settings

Set the communication port as shown in the picture (e.g. for Windows™ 3.xx Terminal program with 9600 Baud Rate):



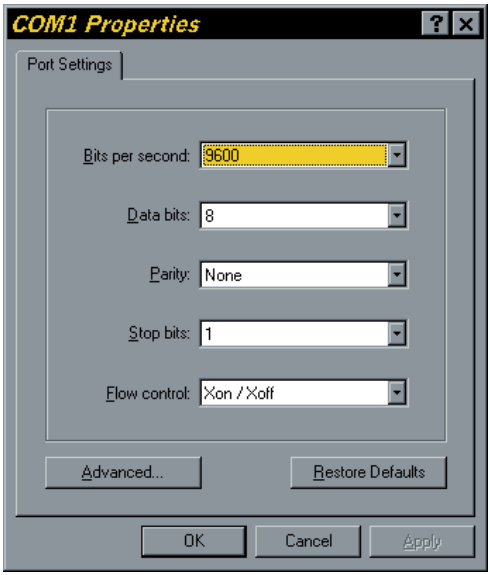
For sending or receiving a project file, set the terminal preferences as shown in the following picture:



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

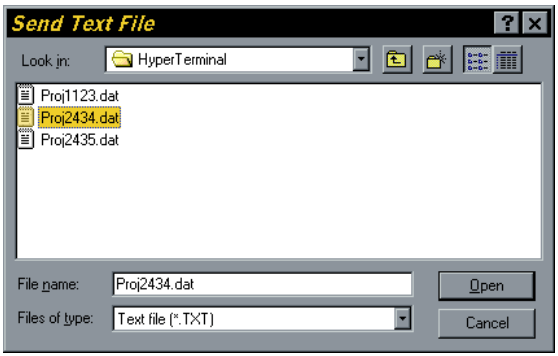
Example Windows™ 95/98 or Windows™ NT Hyper-Terminal Program with 9600 Bits per second:

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 Hyperterminal ASCII-Configuration.

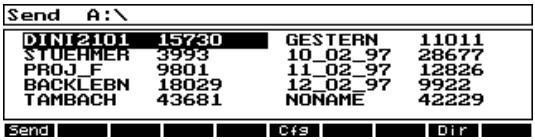
To send or receive a project file, select for transfers "***Send text file***" or "***Receive text file***":



Elta CU Data transmission

Send Data **1**

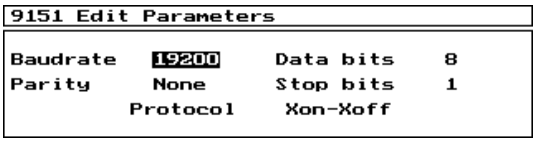
For the transmission of data files.



Send Transmits data files

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

Cfg Configuration of interface parameters



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

Baudrate:	1200 / 2400 / 9600 / 19200 38400 / 57600 / 115200
Parity:	no / odd / even
Protocoll:	Xon-Xoff / Ln-Ctl / Rec500
Data bits:	8 / 7
Stop bits:	1 / 2

 to select parameters,

 to accept.

Dir Change drive

Use the softkey Dir to change the drive:

Data drive Elta CU®

A:\	PC card drive
D:\DATEN	internal drive

This change will be displayed in the menu bar with

Send A:\
Send D:\DATEN

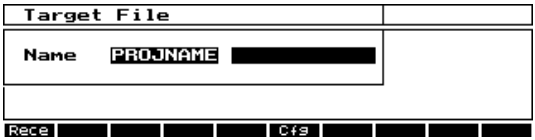
☞ Tip

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.

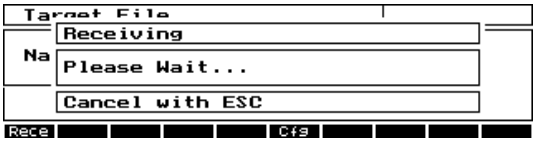
Target drive is the actual data carrier:

A:\ (for Elta CU® PC card drive)
D:\DATEN (for Elta CU® internal drive)

Cfg Configuration of interface parameters

Configuration of interface parameters is similar to Send Data.

The Elta CU is now waiting for the file from the transmitting end:



Esc to continue after receiving the 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.

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 Geodimeter® uses the Zeiss **M5 data format, which** is the common standard for all 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).

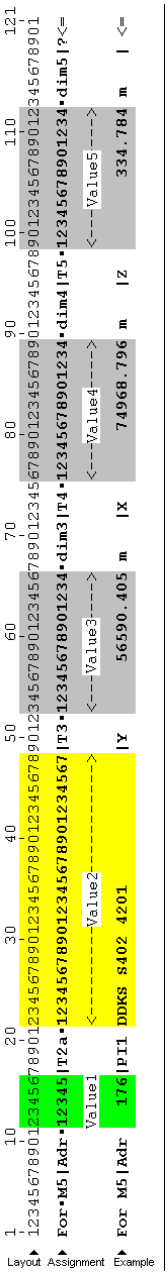
M5 data line

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: Blank field, in case of error „e“
Col. 114-117: Unit for block5

Column 99-112: Block5 value block

Column 96-97: Type identifier5 for block5

Column 91-94: Unit for block4

Column 76-89: Block4 value block

Column 73-74: Type identifier4 for Block4

Column 68-71: Unit for block3

Column 53-66: Block3 value block

Column 50-51: Type identifier3 for block3

Column 22-48: Information block PI or TI (point identification PI or text information TI, TO etc.)

Column 18-20: Type identification2 PIa (a=1-0, for 10 Markings) or TI

Column 12-16: Memory address of data line

Column 8-10: Type identifier1 *Adr* for address

Column 1-6: Defines M5 format

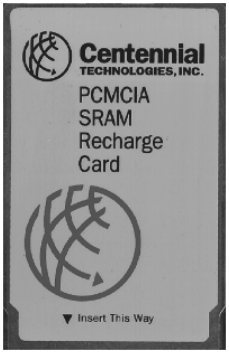
■ blank | separator

Explanations to the data line

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

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

PCMCIA cards



The memory concept of the card is fully MS-DOS®-compatible. The project memory is only limited by the storage capacity of the card.

☛ Tip

When the card is full, you can continue storage on the D:\ drive of the Elta CU®. There is an internal memory with minimum of 3000 data lines available.

SRAM and ATA FLASH PCMCIA cards can both be used.

Elta CU - SRAM-Cards
- ATA-Flash Cards

When using SRAM cards, make sure to check the charge condition of the integrated battery at regular intervals. If this is not possible, change the battery about every 2 years to be on the safe side.

The SRAM card, i.e. the card is automatically loaded during its use in the drive
If you are planning not to use the SRAM card for a prolonged period of time (> 1 year), you should save the data, as there is the risk of battery drain and the resultant loss of the data.

According to the manufacturer, rechargeable SRAM cards have a battery life of approx. 10 years.

☝ Attention!

Please use only the PCMCIA cards recommended by Trimble.

PCMCIA drives

The PCMCIA drive is installed as drive A:\ in the Elta CU®.

The Elta CU® reads and writes **SRAM** and **ATA Flash** cards as well.

Make sure that other computers and PCMCIA drives also use drivers compatible with the Elta CU® drivers for reading and writing the card.

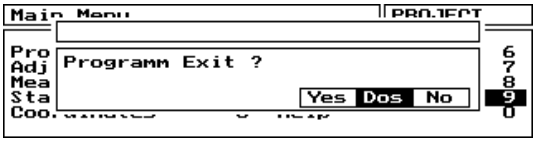
Attention!

Please use only the PCMCIA drives and drivers recommended by Trimble AB.

When in doubt, please contact your authorised Trimble dealer.

Formatting a PCMCIA card

With the Elta CU® it is possible to format a PC card.



Esc in the main menu to leave the program:

DOS go to the MS-DOS® mode.

Elta CU command:

C:\>*SRAMFORM A:*\ ↵ (example)

> **Attention !**
>
> With this command it is possible to format the internal flash drive D:\ of the Elta CU®. This leads to the lost of data and the Elta CU® software. Please make sure, that drive A:\ was selected.

To format different type of PCMCIA cards select the following commands:

SRAM Card:	*SRAMFORM*	↵
ATA Card:	*ATAFORM*	↵
Linear Flash:	*FLASHFMT*	↵

The formatting can take 1-2 min.

Hint to navigate in the full display

📖 Elta CU® Operation Graphical Display

8 Adjustment

The instrument adjustment defines all corrections and correction values for the Trimble 5600®, which are required to ensure optimum measuring accuracy.

Adjusting V-Index / Hz-Collimation

Adjusting Tracker

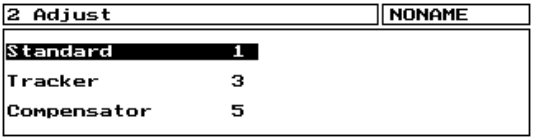
Adjusting Compensator

Adjustment methods

Adjustment 2

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.

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).

Tracker

Determination of the collimation corrections.

Compensator

Determination of the compensator run centre.

Attention!

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

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.

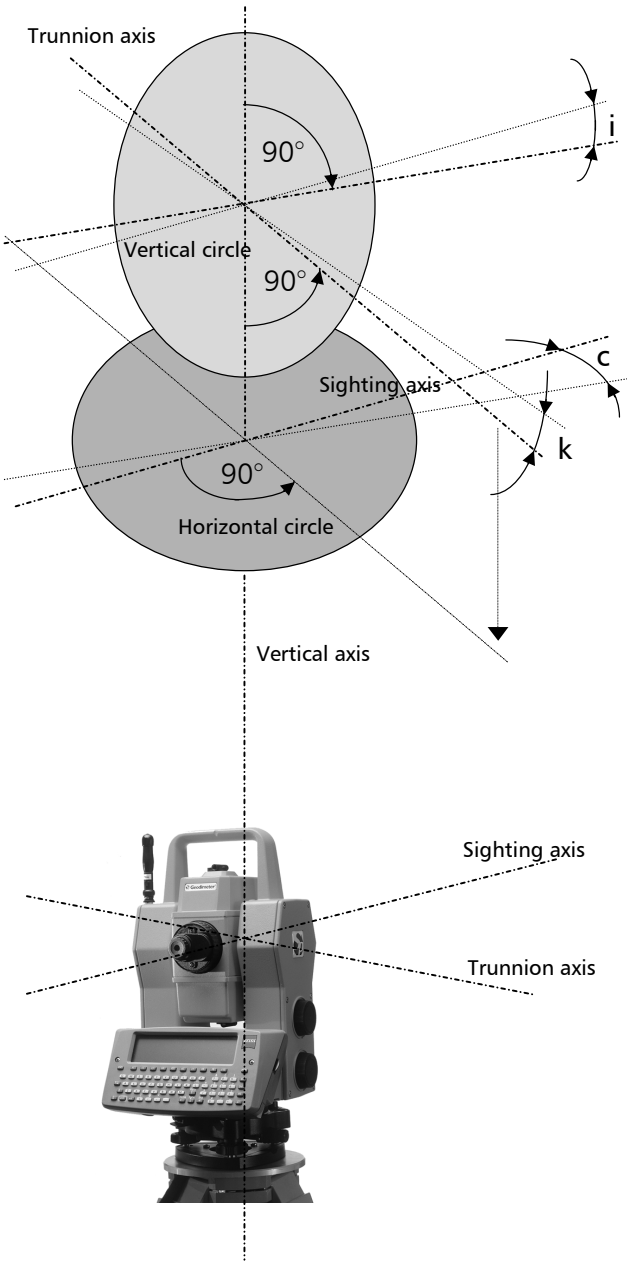
k Trunnion axis correction

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 centre error

Tracker unit error



Adjusting V-Index / Hz-Collimation

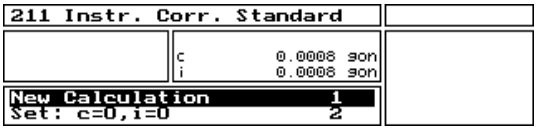
The vertical index and sighting axis corrections should be recomputed after prolonged storage or transportation of the instrument, after major temperature changes and prior to precise height measurements.

> ☞ 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} ±10^{grads}).

Standard **1**

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

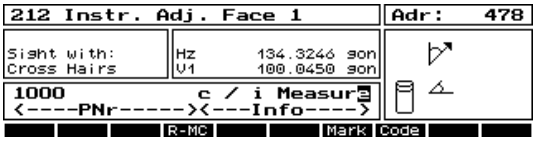


The current **c** and **i** values are displayed in the readings window.

c sighting axis correction
i vertical index correction

New Calculation **1**

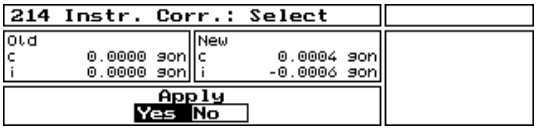
Determination of the **c** and **i** values by measurement in two faces.



↵ for measurement in face 1. The instrument then turns automatically to 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.

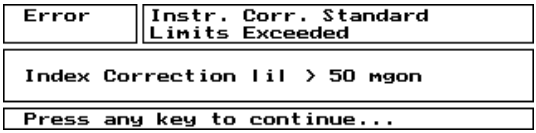
No The old values are retained.

Technical

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

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.

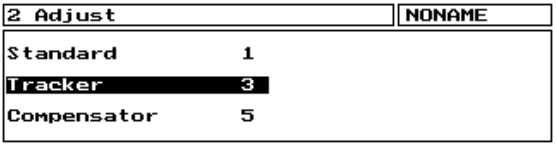
Set: c=0, i=0 2 Setting the **c** and **i** values to zero.

Adjusting Tracker Unit

Tracker Unit 3

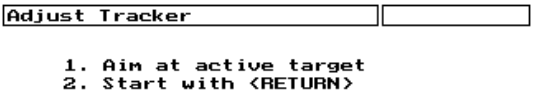
Determination of the collimation corrections similar to the optics of the telescope. The V-Index and Hz-Collimation are taken into account.
Adjust/activate the compensator before.

The initialisation of the compensator has to be done before.



↵ Select Tracker adjustment

.

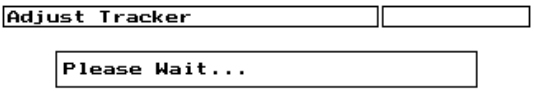


Aim to the RMT.

↵ Start Tracker adjustment

> ☛ Tip
>
> Precisely sight a clearly visible **RMT** from a minimum distance of approx. 100 m.
> Better aim to the RMT in working range!

↵ for adjustment measurement



Tracker adjustment is running.

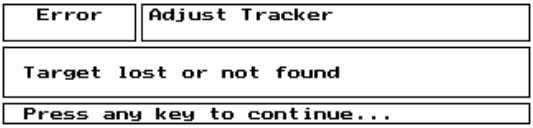
The new values of the corrections are recorded automatically.

The adjustment is automatic and can take approx. 30 seconds. Please take care not to move the instrument or RMT during this time. The program returns then back to the menu.

Attention!

Please pay attention that the RMT is not obstructed during the adjustment e.g. since of traffic and there is no influence of vibrations onto the instrument or the RMT.

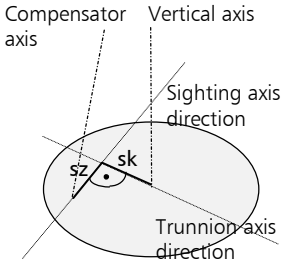
Adjustment failed



RMT was obstructed.
Start adjustment again.

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

Adjusting Compensator



The Trimble 5600® 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 centre should be determined at regular intervals and in particular prior to precise height measurements.

Compensator 5

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

Compensator Initialisation 1

Determination of the new run centre components **of the compensator.**

```
251 Tilt Compensation
Status :
Initialisation necessary

Compensator initialisation    1
Check Levelling               2
```

The current cpompensator status is displayed in the readings window

Start compensator initialisation.

```
Adjust Compensator

Please Wait...
```

Compensator adjustment is running.

```
251 Tilt Compensation
Status :
o.k.

Compensator initialisation    1
Check Levelling               2
```

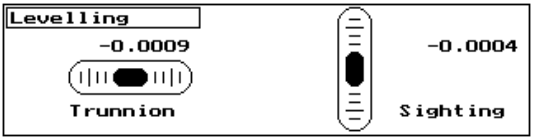
Status: ok. Compensator is adjusted.

Attention!

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

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.

☞ 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 **Ctrl L** hotkey.

Attention!

If the instrument was levelled and centred above a ground point, you have to check the centring with the optical plummet after any relevelling.

9 Configuration

With the configuration, you can adjust the Trimble 5600® to all measurement conditions and requests taking into account an optimum of operator convenience.

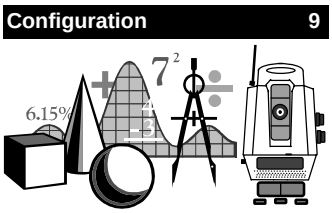
Configuration Instrument

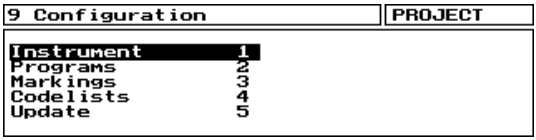
Configuration Programs

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:

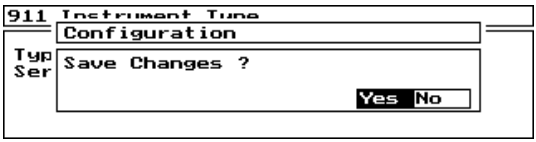
↑ ↓ ⇆ Cursor positioning

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-request for the following descriptions.

📖 **Trimble 5600® The System Total Station** Operation

Configuration Instrument

Configuration 9

Instrument 1

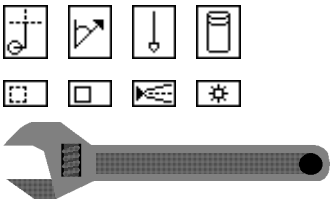
Setting and checking of all switches, parameters and options necessary for best operation of the instrument.

```
91 Instrument
Instrum.-Typ      1   Clock             6
EDM Calibration   2   On/Off-Config     7
Switches          3   Language          8
Prism Sensors     4   Batteries         9
EDM-Setting       5   Default Setting   0
```

Menu of the instrument configuration.
"5 EDM-Setting" active with 5600 DR 200+!

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

Overview Instrument Configuration

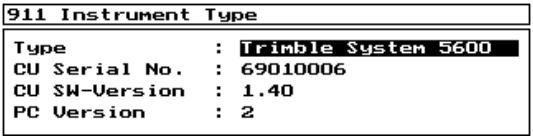


91 Configuration Instrument

- 911 Instrument Type
- 912 External Distance Calibration
- 913 Switches
  - 9131 Illumination
  - 9132 Peripheries
  - 9133 Adjustments
  - 9134 Units / Decimal Points
  - 9135 Reference System
  - 9136 Recording
  - 9137 Error Limits
- 914 Prism Sensors
  - 9141 AutoLock
- 915 EDM-Settings
- 916 Clock
- 917On/Off-Configuration
- 918 Language
- 919 Batteries
- 910 Default

Instrum.-Type **1**

Definition, whether measuring with instrument or by manual input.



Type: Trimble 5600 - Total Station or Manual Input

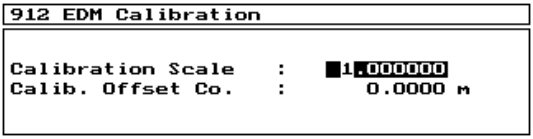
CU Serial No.: Display of ELTA CU serial number

SW Version: Installed Software Release.

PC Version: Display of PC Type
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
✍ 0.998500 < Km < 1.001500

Calib. Offset Co.: Default = 0.0 mm
✍ -12.7 mm ≤ Ac ≤ 12.7 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.

```
913 Switches
Illumination      1   Recording        6
Peripheries       2   Error Limits     7
Corrections       3
Units             4
Reference System  5
```

Menu Switches for instrument configuration.

Switches 3

Illumination 1

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

```
9131 Illumination Switches
Cross Hair    On   Brightness:  Normal
Display       On   Contrast  :  8
```

Cross Hair: on / off

and the switches for the display illumination:

Display: on / off

Brightness: low / normal / high

Contrast: 0 (low) to 10 (high)

Cross Hair **on**

Display **on**

> ☞ Tip
>
> The illumination can also be switched on and off using the hotkey **Ctrl + I.**

Switches 3

Peripheries 2

Switching sensors and actuators on and off.

```
9132 Periphery Switches
Tracklight    Off
Laserp.Off    Off
Sound         On
Signal Volume 0
```

Toggling all switches **On ↔ Off.**

TrackLight **on**

Track Light On: Permanent and Blinking
Laserpointer OFF: Switch OFF mode Pointer
Sound: Keyboard sound
Signal Volume:

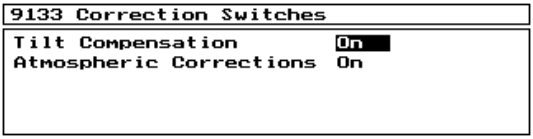
Switches 3

Adjustments 3

Activating and deactivating corrections to the measured bearings and distances.

Compensator **On**

Annex
Glossary



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

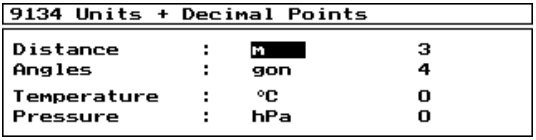
☞ Tip

After instrument startup and adjustment of the compensator 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.

Switchover angle and distance units also via hotkeys **Ctrl+A** and **Ctrl+D**.

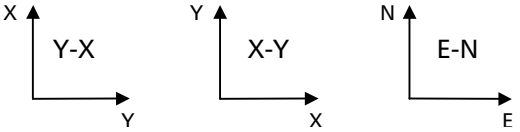
Switches 3

Reference System 5

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

```
9135 Switch Reference System
Axis Definit. : E-N
Display       : E-N
Height        : Z
Hz-Direction  : oriented
Vert.Orient   : Zenith Angle
```

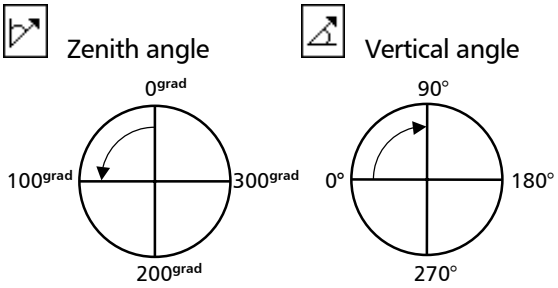
Assignment of coordinates:



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

Height: Z El

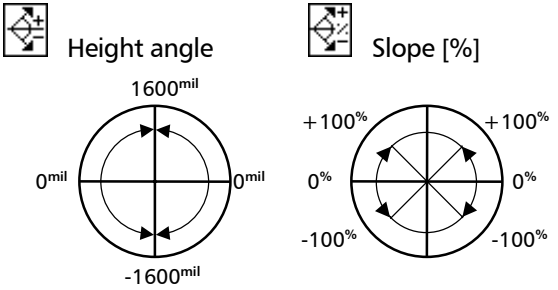
Vertical reference system:



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.

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

Switches 3

Recording 6

Recording **On**

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

Default value: Recording **On**

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

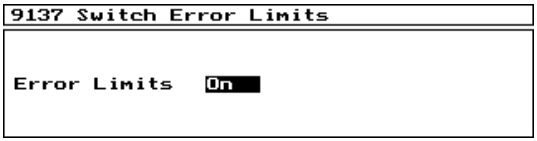
Format: **Rec E** (M5, internal)

Switches 3

Error Limits 7

Error limits **Off**

Error limits **On**



Default value: Error limits **On**

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

Prism Sensors 4

Configuration of the prism sensors.


```
9141 Switch AutoLock
AutoLock                : Off
```

Menu configuration of prism sensors.

AutoLock

Activation and configuration of the AutoLock mode.

```
9141 Switch AutoLock
AutoLock                : On
```

AutoLock: **On / Tracking / Off**
When AutoLock is activated, this setting is offered first in the measurement programs.

EDM-Setting ...5

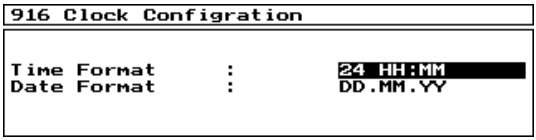
Configuration of EDM-settings for Direct Reflex mode.

```
EDM Settings
Standard deviation      : 0.003 m
EDM Mode                : DR
Dist interval max.      :   500 m
Dist interval min.      :     2 m
Pointer                 : Off
Weak signal             : On
```

Standard deviation: requested accuracy (1mm to 0.9m)
EDM Mode: PR-reflector
DR-no reflector
Dist interval max: distance interval
Standard: 200m
Dist interval min: distance interval
Standard: 2m
Pointer: Laser pointer ON / OFF
Weak signal: reflected signal is weak

Clock 6

Modification of date and time display.



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:

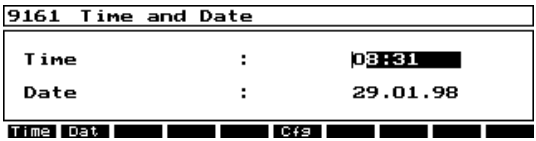
TT.MM.JJ	Day.Month.Year
MM.TT.JJ	Month.Day.Year
JJ.MM.TT	Year.Month.Day

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

Time for time input

Dat for date input

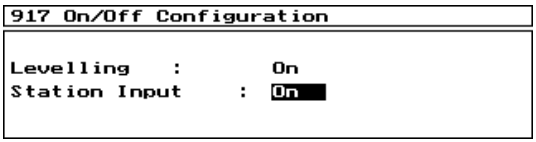
Cfg Configuration display time / date



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.



Toggling of switches **On ↔ Off**.

Levelling: Display levelling menu

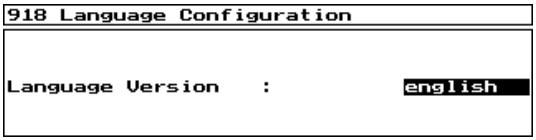
Station Input: Input of station information before start measuring in a local system.

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

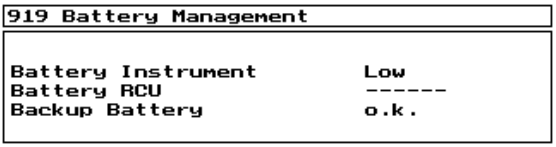
Configuration of the language, in which the software appears on the display.



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 instrument or RCU or backup battery.

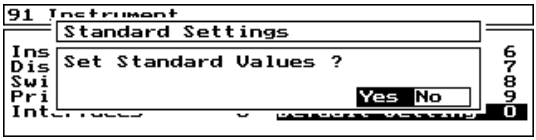
Ctrl B Hotkey for activating the battery manager (in every menu available).

☞ Tip

If the instrument or RCU battery is empty the Elta CU displays a warning and automatically switches over to the Backup Battery. Now disconnect the empty battery and connect the full battery. Meanwhile the Backup Battery will power the system.

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

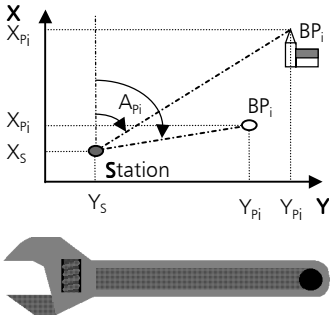
```
92 Program Configuration

Stationing          1
Coordinates         2
Special             3
Gen. Functions      4
Project Info        5   Standard Set.    0
```

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 corresponds 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 centring 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 centring: **sz = 0.000 m**
(centring accuracy reflector above target)

> ☞ 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
```

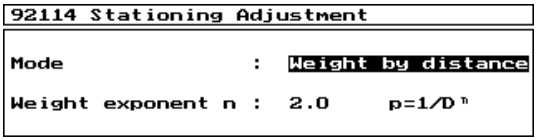
Input of values in given measuring units.

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

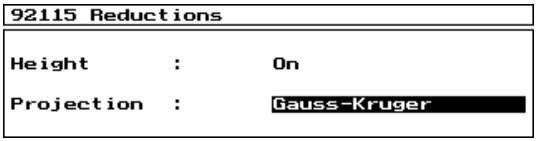
Weight exponent: 0.5 / 1 / 1.5 / 2
For distributing the residuals according to distances by means of the arithmetic mean.

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**

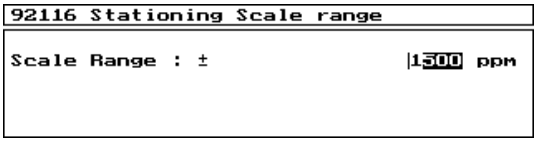
The reductions act (when activated) parallel to the existing scale factor **s** on the distances measured.

Free Stationing 1

Scale Range 6

Definition of the admissible scale range.

✍ -9999 ≤ SR ≤ 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 → $p = c^2 / D^2$
c = 0 → $p = 1 / D^2$

Heightstationing 4

Error Limits 2

Definition of the max. admissible height deviation.

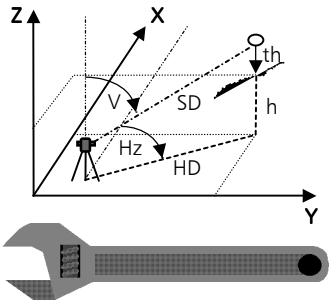
✍ $0 \leq vz \leq 1$ m

```
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

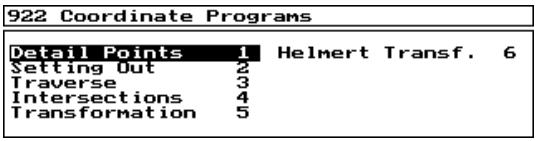


922 Configuration Coordinates

- 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 5600 Manual Part II

The Verification Point Configuration for Detail Point Measurement will be described in Trimble 5600 Manual Part II for the program packages ***Special*** and ***Professional (Professional Plus!).***

Coordinates 2

Setting Out 2

Setting out configuration

```
9222 Setting Out
Error Limits      1
Recording         2
```

Menu of the setting out configuration.

Setting Out 2

Error Limits 1

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

```
92221 Setting Out Error Limits
Linear Dev.   dr :      0.030 m
Height Dev.   dh :      0.030 m
```

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.

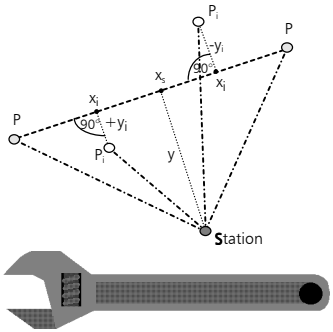
```
92222 Setting Out Recording
Lateral, Orthog. Dev  On
Coord.-Diff.          Off
Actual Coordinates    Off
```

Toggling of switches **On ↔ Off**.

☞ Tip

The description of further coordinate program configuration (Traverse etc.) will be done in the second part of the Trimble 5600 Manual (Special and Professional Software).

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 second part of the Trimble 5600 manual.

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
```

Distance Deviation 1

Input of parameters for computation of the maximum distance deviation.

```
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
```

Scale Range 2

Definition of the admissible scale range.

✍ $-9999 \leq SR \leq 9999$

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

Scale Range: Input in [ppm]

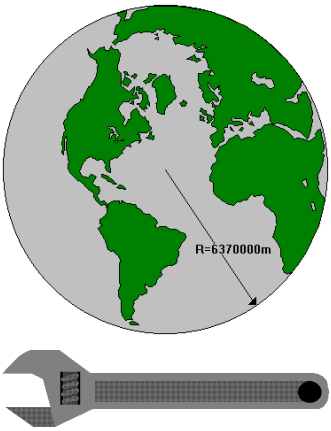
Default Value: ± 1500 ppm

Recording 3

Activation and deactivation of the storage of grid coordinate s.

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

Overview 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
- 9246 Station Definition

General Functions 4

Configuration of general functions 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

```
92422 2-Face Measure. Error Limits

Angle Dev.    da :      0.0050 gon
Orthog. Dev.  dq :        0.020 m
Lateral Dev.  dl :        0.020 m
Height Dev.   dh :        0.020 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

```
9243 Control Point Error Limits

Linear Dev.   dr :        0.030 m
Angle Dev.    da :      0.0050 gon
Orthog. Dev.  dq :        0.020 m
Lateral Dev.  dl :        0.020 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

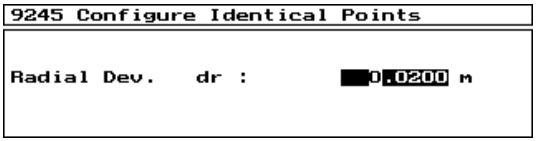
If one value is set to **0**, this error limit will not be checked.

General Functions 4

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

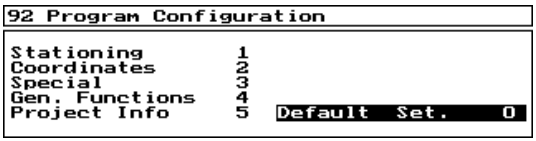
When setting the value for **dr** to **0**, then the default value is used internally.

Configuration Standard Settings

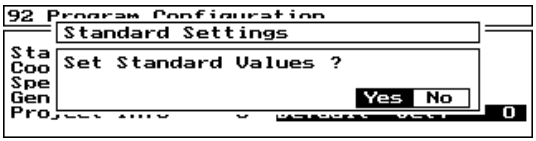
Programs 2

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

Esc for escaping the *Configuration Markings.*

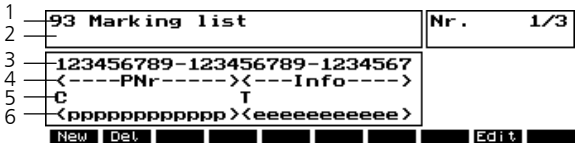
📖 Store marking

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. 1/3 indicates the consecutive number **(1)** of the displayed marking out of all defined markings **(3)**.

↑ ↓ Scrolling in the marking list (endless)

Home Display of the first marking

End Display of the last marking set

↵ Activation of input (like **Edit**)

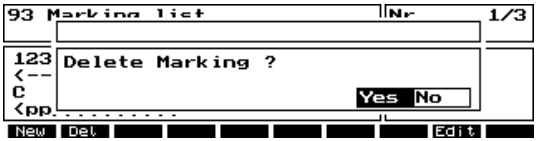
Esc Back to menu *Configuration*

New generate new marking

Del delete displayed marking

Edit edit displayed marking

Delete marking



Yes Marking is deleted, renumbering of the remaining markings.

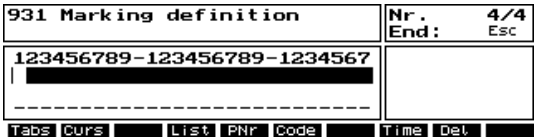
No Back, without deletion of marking.

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

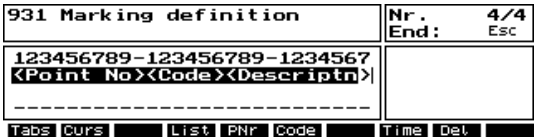
Home cursor jump to column 1

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.



← Ins Del usable for editing.

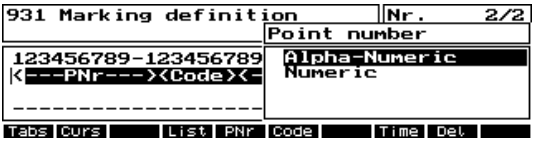
The code field is stored with the marking.

> ☛ 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 initial 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:

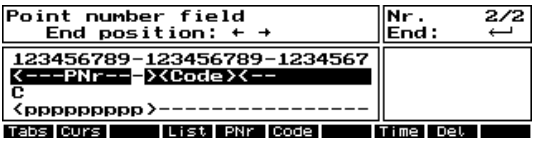
Numeric only numbers in the block ,

Alpha-Numeric all signs allowed.

↓ + ↵ to select.

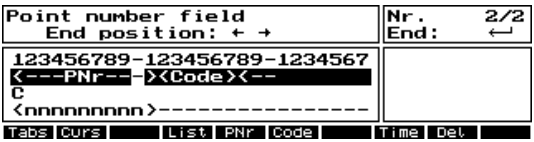
<p> alpha-numeric

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 ≤ 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 initial 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.

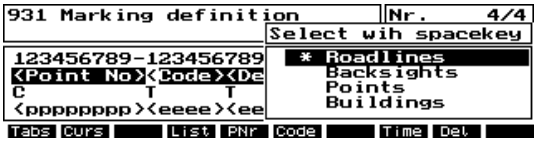
↵ Accept text or code block.

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.

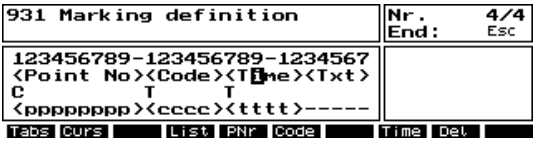
Setting a time block

📖 **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 initial 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 initial position and the marking end or the next block is not sufficient for the configured 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 initial 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 initial 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

 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.

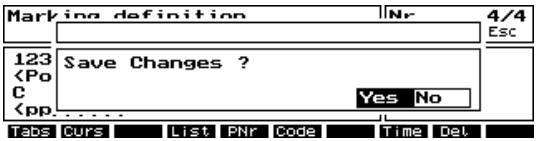
Go to the target position using the cursor control keys and set the position with **Curs.** A **C** will appear in line 5 (control characters). If a tab stop **T** has been set at the same place, this will be overwritten by **C**. The cursor position is of equal importance to the tabulator.

☞ 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.

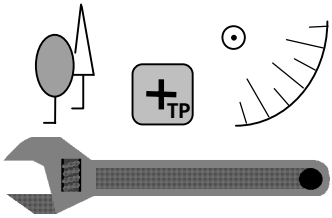
No Marking is not accepted, the old status of the marking list is being re-established. Back to the display of the markings.

Esc Back to the definition of the new marking.

Configuration Codelists

Configuration 9

Codelists 4



For objects of everyday surveying, coded point information 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.

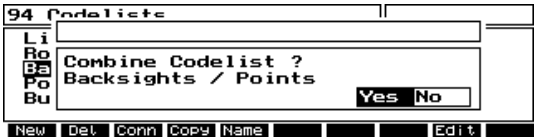
No (or **Esc**) Back, without deletion.

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** or **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

Scrolling in the codelist.

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


Changing the input field between code and meaning.


Accepting code input in list.

Escape editing of codelist.

New Entering a new code

Entering a code and its meaning.

Del Delete code

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

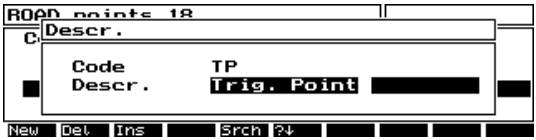
Ins Inserting a code line

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 paid 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.

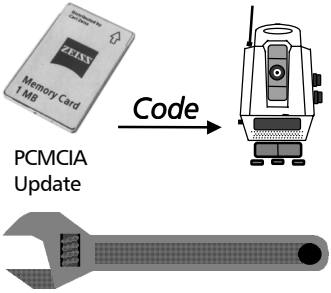
?↓ Continuing search for a code line

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

Configuration Update

Configuration 9

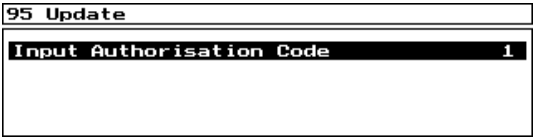
Update 5



PCMCIA
Update

For activation of the software-packages it is necessary, to enter a code generated by Spectraprecision for the Elta CU.

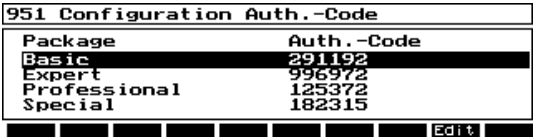
There is one authorisation code for each software package. After input you get access to the software.



Menu Update Configuration.

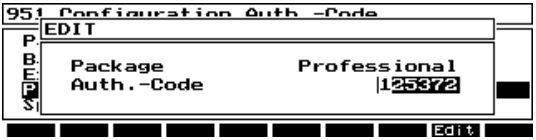
Input Authorisation Code 1

Code Input for each software package.



Select the software-package by cursor-keys.

Edit For code input / change



Input of the authorisation code.

↵ to confirm the code input.

Esc abort input.

10 Annex

The annex contains a compilation of symbols, keys, formulae and constants as well as explanations of concepts used for the Trimble 5600 series total station.

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

Symbols and keys

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

Switch on Target Sensoring*

AutoLock

Tracking*

Tracking switched on Tracking prism lost

Vertical Reference System

Zenith Vertical Height Slope [%]

Error Limits

switched off switched on

TrackLight

PositionLight on

Illumination

Display on Cross hairs on

Recording switched on

Compensator switched on

* not for all instruments

Keys and Function

Escape	Esc	Quitting program levels
Shift	⇧	Dual assignment switchover
Tabulator	⇆	Selector and tab key
Caps	⇩	Upper-case and lower-case letters
Control	Ctrl	Control and hotkeys
Function keys	F1 F10	Softkeys activation
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
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
Alt key	Alt	In connection with Ctrl and MS-DOS®

Backspace	⇦	Delete a sign to the left
Delete	Del	Delete a sign at the Cursor
Insert	Ins	Switch the insert modus on
Additional trigger key	PWR	Trigger key is the Power ON key.

Hotkeys and Function

The most hotkeys are available in every program level. The unit switches only in the measurement menus.

Ctrl B	**B**attery control
Ctrl H	**H**elp
Ctrl I	**I**llumination Display + Crosshair
Ctrl L	**L**evelling Compensator
Ctrl M	Indication of **M**emory capacity (RAM)
Ctrl T	Indication of Date and **T**ime
Ctrl D	Switch **D**istance measurement units on **m / ft**
Ctrl A	Switch **A**ngle measurement units on **gon / dms / deg / mil** in the measuring program
Ctrl Z	Switch the vertical reference system
Ctrl S	Instrument **S**tatus
Ctrl P	Switch the PositionLight **on / off**

Ctrl O Laser Pointer ON / OFF*

Ctrl R Direct Reflex Mode*

This key code is only useful in the MS-DOS® mode.

Ctrl Alt → Scroll display to the right

Ctrl Alt ← Scroll display to the left

Ctrl Alt ↓ Scroll display down

Ctrl Alt ↑ Scroll display up

Reboot of the ZEISS Elta CU® PC

Ctrl Alt Del Reboot of the ZEISS Elta CU® PC

Attention !

In case of reboot the ZEISS Elta CU® in an application programm measurement data or other important settings ca be lost.

	A
Addition correction	Correction of the addition value (''additive constant'') of the distance measuring instrument
Auto Lock= Precise detection	Target focussing by means of sensors, realised automatically and independent of the observer, as well as automatic, motorised readjustment of the 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, characterises 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 centre	electronic centre of the instrument 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.
Conventional	Conventional control of the measuring process by the operator at the instrument.
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**
	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 centre 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
Loss of contact	During a *target tracking* one does not succeed in keeping the prism within the visual field of the *precise target detection*
L1 Norm	Adjustment in which the sum of the absolute corrections is turned into the minimum, for recognising 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	Part of the point identification

Prism Search	Methods for quick finding of a prism.
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 Georadio	Radio communication between station and target for transmitting data and information, 70 cm band. Observe announcement.
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
Remote Control Unit RCU	Alphanumeric computer with radio data transmission module Georadio for controlling the measuring process from the target point
Residual	Difference between nominal and transformed coordinates
Run center	see *Compensator run centres*
	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, reticule scale

Single point adjustment	Method for computing a *free stationing* by adjustment of all distance and bearing observations according 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-centre 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
Target search	Quick search roundabout target sensor of the total station, for search and setting of prisms in the target area
Target tracking	Continuous tracking of the telescope in Hz and V angles after the moving prism with the help of the precise target sensor FineLock
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
Track Light	Quick optical sighting aid for setting out; visualisation of the sighting line for the reflector porter so that he can orientate himself independently and quickly with reference to the sighting line
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 analogue 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)

Electromagnetic Compatibility (EMV)

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

Attention!

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

Interference suppression as per:
EN 55022 class B

Noise immunity:
EN 50082-2

Tip

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

Zeiss Elta® Control Unit

Display screen,	8 lines by 40 columns, CGA graphic display (320x80 pixels), illuminated, optional 2nd display face available
Keyboard	Full QWERTY alphanumeric keyboard
Data recording	Data stored on PC-Card ; storage capacity approx. 8000 data lines per 1 Mb. Internal Flash disk approx. 3000 data lines . Interface RS 232 C
Battery	NiMH 700mAH
Charging time	25min. with 350mA (Single Charger)
Function time	20min. to 2h

If battery-low occurs, an error dialog is shown in the Zeiss Elta® Control Unit Display. There are two different warnings:

Battery - Low - Voltage
- RCU -
Please change !
Press any key to continue...

Opportunity to work after pressing any key - but only for a short time !

Battery - Low - Voltage
- RCU -
Please change immediately !

The battery change must be made within max.2 hours (full charged); otherwise the user has to restart the Zeiss Elta® Control Unit.

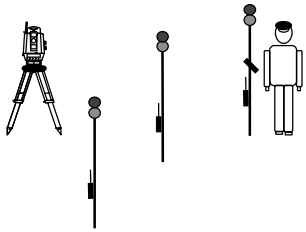
Attention!

This safety backup of the instrument's parameters and functions will work when "Bat Low" appears on the display and if the battery is removed during operation.

Modes of Operation

Remote Control

Robotic Control



☞ Tips

Select an exposed place, if possible, for setting up the instrument. Avoid valleys and depressions, the proximity of big buildings, metal (cars, bridges) and waters.

Turn the cable connections carefully tight

Do not kink or bend the cable connection extremely.

☝ Attention!

The Georadio is provided with a General Admission most countries of the world.
If there should arise questions with reference to the application of the radio data transmission module in other countries than the above mentioned, please contact the trader in your country.
Active neighbouring radio equipments on the same transmitter frequency may possibly lead to adverse effects. In this case, please select other frequency.
The admission becomes ineffective in case of using another antenna (λ/2 antenna or antenna with higher gain).

Please contact us for further instructions.

Computations formula for angle measurement

V angle measurement

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

V_o = uncorrected V circle reading

V_1 = correction due to V circle eccentricity

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

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

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

Hz_o = uncorr. Hz circle reading-(absolut)

Hz_1 = corr. due to Hz circle eccentricity

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

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 formula for distance measurement

Internal correction formula (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 0.85 µm
precision scale 3 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:

$$K_W = 281.8 - \left[\frac{0.29065}{1+\alpha t} P - \frac{4.126 \cdot 10^{-4} \cdot h}{1+\alpha t} E\right]$$

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 = 12 °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 formula

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 12°C and the air pressure to 1013.25 hPa. Then, the internal correction goes to zero. Formulae formula

Prism and Additive Constants

All total stations manufactured by Trimble AB, in combination with their reflectors are adjusted with the **additive constant 0.000**.

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

Another possibility consists in calculating an additive constant by means of the known prism constant of the reflector used and entering it. This prism constant is calculated as function of the geometric value of the prism, the type of glass and the place of the mechanical reference point. The prism constant for reflectors of Zeiss determined that way is **-35 mm or –3mm**.

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

Trimble

Super prism	0 mm
Prism ring	2 mm

Please 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

In this case, in the Geodimeter® additive constant + 0.005 m can be set optionally.

Certificate of Type Approval

Telecommunications Act 1984 (c.12): Section 84

Radiocommunications Agency

APPROVAL No. : 10770
ISSUE No. : 1

ORIGINAL CERTIFICATE DATE : 23 August 94

SUBMITTED BY :	MANUFACTURED BY :
GEOTRONICS AB	GEOTRONICS AB
BOX 64	BOX 64
S182 11 DANDERYD	S182 11 DANDERYD
SWEDEN	SWEDEN

EQUIPMENT TYPE : APPROVED EQUIPMENT
EQUIPMENT CATEGORY : LOW POWER TELEMETRY
TRADE NAME : GEODIMETER
TYPE No. : 5712002234

TEMPERATURE RANGE : -10°C to +55°C

SPECIFICATION(S)	EMISSION CODE(S)	CHANNEL SEPARATION(S)
MPT1329 NOV 86	16K0F1D	25.0kHz

TOTAL UNITS : 1

UNIT No. 1 TYPE : TRANSCEIVER MOBILE

POWER CHARACTERISTICS -
R.F. POWER : 100mW
TERMINATED FIXED

FREQUENCY CHARACTERISTICS - TRANSMITTER : 458.5MHz to 458.8MHz
RECEIVER : 458.5MHz to 458.8MHz

COMMENTS : THE USE OF THIS EQUIPMENT MAY BE SUBJECTED TO THE ISSUE OF A LICENCE.

TOTAL NUMBER OF VARIANTS : 0

MPT 1328
W.T. LICENCE
EXEMPT

CTA1 The Radiocommunications Agency is an Executive Agency of the Department of Trade and Industry

Certificate of Type Approval

Telecommunications Act 1984 (c.12), Section 84

Radiocommunications Agency

Page 1 of 2

APPROVAL No. : 10770
ISSUE No. : 1 ORIGINAL CERTIFICATE DATE : 23 August 94

THE SECRETARY OF STATE FOR TRADE AND INDUSTRY APPROVES FOR THE TIME BEING UNDER SECTION 84 OF THE TELECOMMUNICATIONS ACT 1984 THE EQUIPMENT DESCRIBED ABOVE PROVIDED IT COMPLIES WITH THE ABOVE SPECIFICATIONS AT ALL TIMES FOR THE PURPOSES OF : LICENCES GRANTED UNDER SECTION 1 OF THE WIRELESS TELEGRAPHY ACT 1949 AND/OR ANY EXEMPTION REGULATIONS MADE UNDER THAT SECTION.

SIGNED ON BEHALF OF THE SECRETARY OF STATE :

JOHN POOLE
23 August 94

ADDRESS FOR QUERY : Radiocommunications Agency, Room 514, Waterloo Bridge House Waterloo Road, London, SE1 8UA

END OF CERTIFICATE

FEDERAL COMMUNICATIONS COMMISSION

WASHINGTON, D.C. 20554

GRANT OF EQUIPMENT AUTHORIZATION

Type Acceptance

Date of Grant: August 24, 1994

Geotronics AB
Box 64
S-18211 Danderyd Sweden

File No.: 310[illegible]/EQU 17.9

Application dated: January 3, 1994

Attention: Kjell Lindberg, Product Manager

NOT TRANSFERABLE

EQUIPMENT AUTHORIZATION is hereby issued to the named GRANTEE, and is VALID ONLY for the equipment identified hereon for use under the Commission's Rules and Regulations listed below.

FCC IDENTIFIER [redacted]

Name of Grantee

Equipment Class : Non-Broadcast Transmitter

Note(s)	Rule Part(s)	Frequency Range (MHz)	Output Watts	Frequency Tolerance	Emission
-	90	450-470	.1	.0005	14K8F1D

Mail to:
Hakan L. Orvell
Geotronics of North America Inc.
911 Hawthorn Drive
Itasca, IL 60143

99/144

FEDERAL COMMUNICATIONS COMMISSION

In correspondence concerning this grant, please refer to the FCC IDENTIFIER, File No., and date of grant.

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