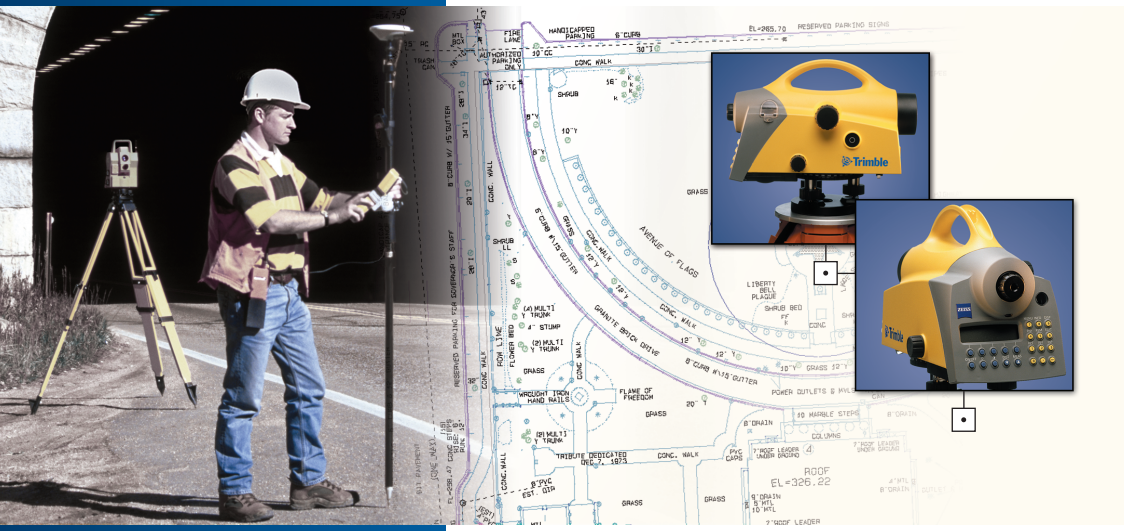
Trimble DiNi® 12, 12T, 22
User Guide



PN 571 703 071

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Trimble

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1 Introduction

Dear Customer

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

The System philosophy

Although the principle of levelling has not changed, surveying today is no longer confined to the measurement of height differences. A demand now exists for complex measuring system, 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 Digital Levels DiNi® from Trimble - proven excellent - now in the third generation with DiNi® 12, 12 T and DiNi® 22 are superb with new features:

comfortable to transport	- integrated handle
faster	- user-adjustable circular bubble
more software	- additional, efficient method for setting out of elevations
stylish new look	- attractive in form and colour

Thus, the DiNi® fit excellently in the complete line of the measuring equipment from Trimble : Data interchange between all the instruments is ensured by a common data format and by the use of the PCMCIA memory card.

Use of this Manual

The manual is divided into 8 main chapters.

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

5 Setting of recording

1 Recording data

1 Remote control on

The pages are divided into two columns:

Principal text including

- descriptions of measuring processes / methods
- instrument operation and keys
- DiNi® display graphics
- drawings and large graphics
- tips, warnings and technical information.

Function text for

Program calls:

Input 1

min. sighting height

MENU **Keys/ Hotkeys**

Line **Keys/Softkeys**

Mode Softkeys and their functions

Cross references to other chapter

Range for values to be entered or preset

Small graphics

☛ 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

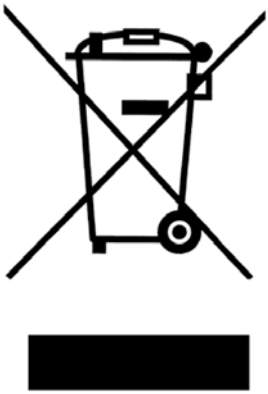
💻 : required/computed values

You will find a list of terms, technical data und key overviews in the annex .

Important notes

☝ Attention !

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



NOTICE FOR TRIMBLE'S EUROPEAN UNION CUSTOMERS

Trimble is pleased to announce a new recycling program for our European Union customers. At Trimble, we recognize the importance of minimizing the environmental impacts of our products. We endeavor to meet your needs, not only when you purchase and use our products, but also when you are ready to dispose of them. That is why Trimble is actively pursuing, and will continue to pursue, the expanded use of environmentally friendly materials in all its products, and why we have established a convenient and environmentally friendly recycling program.

As Trimble makes additional recycling facilities available for your use, we will post their locations and contact information to our Recycling Instructions web page.

For product recycling instructions and more information, please go to

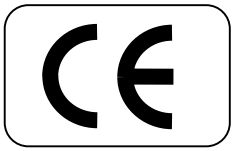
http://www.trimble.com/environment

Recycling in Europe:
To recycle Trimble WEEE,
Call +31 497 53 2430, and ask for the "WEEE Associate"

Or

Mail a request for recycling instructions to:

Trimble Europe BV
c/o Menlo Worldwide Logistics
Meerheide 45
5521 DZ Eersel, NL



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

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

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

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

User Manual:	Edition 4
Cat. No.:	571 703 071
Date:	September 2005
Software-Release:	> V 3.40

☞ Tip

The type label and serial number are provided on the 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:

☐ DiNi® 12

☐ DiNi® 12 T

☐ DiNi® 22

Serial number:

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

Software-Version:

DiNi® 12

DiNi® 12 T

DiNi® 22

Technical Assistance

If you have any questions and cannot find the appropriate information in our documentation, please contact your **local dealer**.

If you need further support, please call our service hotline which is at your disposal from Monday to Friday, 08:00 a.m. to 05:00 p.m.

Tel **+49-6142-2100 555**

Fax **+49-6142-2100 220**

E-mail:

trimble_support@trimble.com.

Homepage:

www.trimble.com

☞ Tip

When contacting our hotline, please have the following information ready:

1. Product name
2. Serial no. of hardware
3. Software version
4. PC Card type
5. Your particular question

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

Yours

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Carl-Zeiss-Promenade 10
D-07745 Jena

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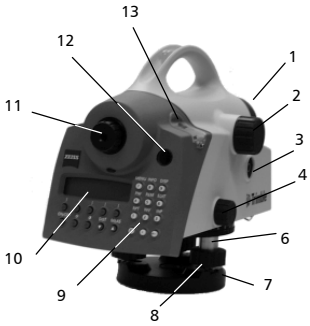
E-Mail: support_trimble@trimble.com
www.trimble.com

2 DiNi® 12, 12 T, 22 Digital Levels

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

It explains briefly the operating concept and function of the most important components such as the compensator, systems for measuring angles, heights and distances, the acoustic signal generator, memory, interface and power supply.

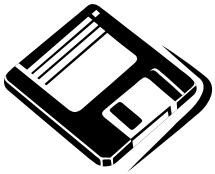
Hardware overview



1	Telescope objective with integrated sun-shield
2	Telescope focusing control
3	Trigger key for measurement
4	Horizontal tangent screw (endless slow motion drive)
5	Graduated circle, external (DiNi® 12, 22)
6	PCMCIA Card (DiNi® 12, 12 T) plug-in module
7	Tribrach
8	Footscrews
9	Keyboard
10	Display
11	Eyepiece
12	Window for circular bubble
13	Cap, to be removed for adjustment of circular bubble
14	Battery compartment
15	Sight vane (notch and bead sights)
16	PCIMCIA Card in the plug-in module (DiNi® 12, 12 T)

Software overview DiNi® 12, 22

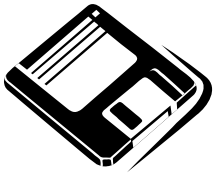
Main Menu DiNi® 12, 22:



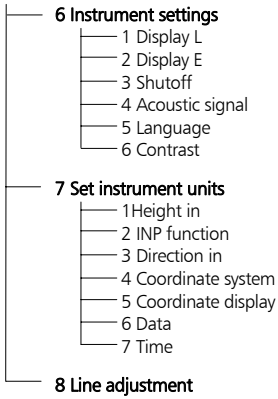
- 1 Input
  - 1 Refraction coefficient
  - 2 Addition constant (offset)
  - 3 Date (DiNi® 12)
  - 4 Time (DiNi® 12)
- 2 Limits / Tests
  - 1 max. sighting distance
  - 2 min. sighting height
  - 3 max. sighting height
  - 4 max. station difference
  - 5 Check 30cm
- 3 Adjustment (current values, status of refraction and earth curvature)
  - 1 Förstner method
  - 2 Näbauer method
  - 3 Kukkamäki method
  - 4 Japanese method
- 4 Data transfer
  - 1 Interface 1
    - 1 DiNi® —> Peripheral unit
    - 2 Peripheral unit —> DiNi®
    - 3 Parameter setting
  - 2 Interface 2 see Interface 1
  - 3 PC DEMO
  - 4 Update / Service
    - 1 PC card (DiNi® 12) formatting or
    - 1 iMEM Initialisation (DiNi® 21)
    - 2 Update DiNi®
- 5 Setting of recording
  - 1 Recording data
    - 1 Remote control
    - 2 Recording
    - 3 Recording data
    - 4 PN0 increment
    - 5 Time (DiNi® 12)
  - 2 Parameter setting
    - 1 Format
    - 2 Protocol
    - 3 Baudrate
    - 4 Parity
    - 5 Stop bits
    - 6 Time out
    - 7 Line Feed
- 6 Instrument settings
  - 1 Height in
  - 2 INP function
  - 3 Display L
  - 4 Shut off
  - 5 Acoustic signal
  - 6 Language
  - 7 Date (DiNi®12)
  - 8 Time (DiNi®12)
- 7 Line adjustment (DiNi® 12)

Software Overview DiNi® 12 T

Main Menu DiNi® 12 T:

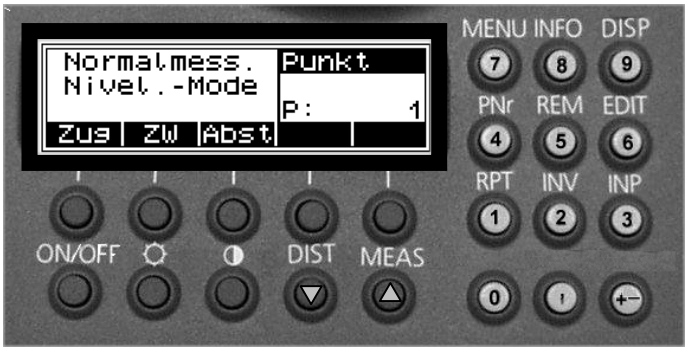


- 1 Input
  - 1 Refraction coefficient
  - 2 Addition constant (L)
  - 3 Addition constant (E)
  - 4 Date
  - 5 Time
- 2 Limits / Tests
  - 1 max. sighting distance
  - 2 min. sighting height
  - 3 max. sighting height
  - 4 max. station difference
  - 5 Check 30cm
- 3 Adjustment (current values, status of refraction and earth curvature)
  - 1 Förstner method
  - 2 Näbauer method
  - 3 Kukkamäki method
  - 4 Japanese method
- 4 Data transfer
  - 1 Interface 1
    - 1DiNi® —> Peripheral unit
    - 2 Peripheral unit —> DiNi®
    - 3 Parameter setting
  - 2 Interface 2 see Interface 1
  - 3 PC DEMO
  - 4 Update / Service
    - 1 PC Card formatting
    - 2 Update DiNi®
- 5 Setting of recording
  - 1 Recording data
    - 1Remote control
    - 2 Recording
    - 3 Recording data
    - 4 PNO increment
    - 5 Time
  - 2 Parameter setting
    - 1 Format
    - 2 Protocol
    - 3 Baudrate
    - 4 Parity
    - 5 Stop bits
    - 6 Time – Out
    - 7 Line Feed


6 Instrument settings
1 Display L
2 Display E
3 Shutoff
4 Acoustic signal
5 Language
6 Contrast
7 Set instrument units
1Height in
2 INP function
3 Direction in
4 Coordinate system
5 Coordinate display
6 Data
7 Time
8 Line adjustment

Keyboard of the control and display unit

Control and display unit of DiNi® 12, 22



ON OFF	Switching the instrument on and off
MEAS	Starting a measurement
DIST	Triggering a single distance measurement
MENU	Calling the main menu
INFO	Display of important instrument parameters
DISP	Switching over to display all existing contents, preselection of data to be displayed
PNr	Input of individual / consecutive point number
REM	Input of point code and additional information
EDIT	Calling the editor for data management
RPT	Multiple measurements
INV	Toggling between normal and inverted measurement
INP	Manual input of measured data (optical staff reading)
✱	Switching the illumination of display on and off
◑	Contrast adjustment of display
0 9	Numeral keys to input numerical values
+/-	Input of preceding sign
,	Decimal point
▼ ▲	Scrolling the data memory

Control and display unit DiNi® 12 T

ON OFF MEAS	Switching the instrument on and off Starting a measurement
Hz-M TS-M	Calling up the Hz measuring mode Toggling between levelling, total station and coordinate mode
Hz DIST	Setting of options for Hz angle measurement Triggering a single distance measurement
MENU INFO DISP	Calling the main menu Display of important parameters Switching over to display all existing contents, preselection of data to be displayed
PNr REM EDIT	Input of individual/consecutive point number Input of point code and additional information Calling the editor for data management
RPT INV	Multiple measurements Toggling between normal and inverted measurement
INP	Manual input of measured data (optical staff reading)
✱	Switching the illumination of display on and off
0 .. 9	Numeral keys to input numerical values
+/- , ,	Input of preceding sign, decimal point
▼ ▲	Scrolling the data memory

22 keys with hardkey and softkey functions, well arranged in groups according to application, provide clarity and help to operate the instrument quickly.

DiNi® 12 ,22

The key field on the right side of the control panel is used to activate functions, after the completion of which the instrument returns to the previously selected measuring program. If certain functions cannot be activated at the moment, the key pressure is ignored. The alphanumeric input is only active in the input functions; no other operations are possible in this case. Ending or reverse deletion of the input is made through softkey control.

DiNi® 12 T

After switching on the instrument, use the TS-M and Hz-M keys in the key field on the right to select the measuring mode. The other keys of the key field on the right are used to activate further functions, after the completion of which the instrument returns to the previously selected measuring program. If certain functions cannot be activated at the moment, the key pressure is ignored.
The numeric input is only active in the input functions; no other operations are possible in this case. For ending or reverse deletion of the input, the softkey control is used.

Switching the instrument on and off

ON OFF switching on and off

A properly charged battery is prerequisite for the operation of the instrument.
Switch on the instrument with the ON key. After a short display of the program version and Logo, the instrument is ready for measurement. The measuring program last selected is always displayed.
If the DiNi® 12, 12 T PCMCIA card isn't inserted the error message appears.

Operation and Control of DiNi®

Adjusting the display contrast:

◑

If the display is poorly legible, switch on the illumination or adjust the display contrast:
DiNi® 12, 22: Hardkey
DiNi® 12 T : Menu
Turned on display illumination is indicated by a flashing star at the top right corner of the display.

Starting the measurement:

MEAS or
◎ (on the right side)

Measurements can be triggered using either the measurement key MEAS of the control panel or the ◎ key on the right-hand side of the instrument. Both keys have an equal status.

Controlling the DiNi® measurement process:

- with the function keys of control and display unit

🕮 3 First steps

- with the softkeys.
  Softkeys are function keys to which different functions are assigned, depending on the program involved. The current functions are shown in the bottom line of the display in abbreviations of maximally 4 characters.

🕮 3 First steps

- with the decision systems: L-menu, scroll bar menu and MOD key

🕮 3 First steps

- input of alphanumeric characters:
  Input of alphanumeric characters is possible at different times within a measuring process or in project management.

🕮 3 First steps

- input of measured data
  This simple numeric input mode is accessible for the input of measured data with the INP function, for input or edit operations with the EDIT function, and for the input of instrument constants.

Compensator

Purpose

Correction of the current line of sight inclination by a mechanical compensator

Function

Automatic alignment of the compensator ensures that an inclined line of sight is automatically levelled within the working range both for visual observation and internal electronic measurement. The compensator cannot be deactivated.

Working range

🕮 8 Appendix Technical data

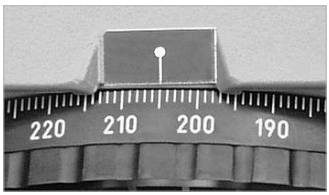
The working range of the compensator is ± 15´ with a setting accuracy of ± 0.2" (DiNi® 12, 12 T) or ± 0.5" (DiNi® 22). If the inclination range is exceeded ("pendulum on stop") , the warning !!Comp!! is displayed in the measurement status field at the upper right of the display. If a measurement is triggered in this case, a warning signal is generated.

Checking

🕮 7 Adjustment

The compensator has a major influence on the instrument's line of sight. For run centre adjustment, determine the residual line of sight inclination to permit distance-dependent correction of the measured values. For this, the Adjustment menu option on DiNi® provides four methods. For precise height measurements, this check should be performed at regular intervals

Angle measuring system



Direct measurement with DiNi® 12, 22

You can perform simple direction measurements and stake-outs. You can read the direction without any aid by means of an index line on the horizontal circle. The circle is graduated to 1 grad/1°, estimated readings are possible down to 0.1 grad/0.1°

Angle measuring system of DiNi® 12 T

for determination of the Hz direction electronic.

Continuos measurement
Hz

Single measurement
TS-M , Hz-M , MOD

Absolute angle measuring system permitting single and continuous measurement with an accuracy of 1 mgrad (5“). The measuring time for one single measurement is normally 0.3 sec..

The angle measuring system is deactivated in the levelling mode and is activated in the total station and coordinates modes.

Height/Distance measuring system

📖 5 Measuring function For details see chapter 5.

Acoustic signal generator

Purpose

Confirmation of functions and warning signal when system messages are displayed.

Function

very short signal:	Confirmation of a key pressure End of a function,
short signal:	e.g. end of measurement
long signal:	Operating error, system message, warning

Activation and deactivation

5 SET INSTR. PARAM.

In the main menu.

Memory

The permanent memory of the DiNi® stores computation constants, operating modes, measuring units, etc. even after instrument shutoff.

The measured data and additional information are stored on the exchangeable PC card (DiNi® 12 and DiNi® 12 T) or the internal memory (DiNi® 22).

Data safety

Data storage on the exchangeable PC memory card or the internal memory (non-volatile data memory without buffer battery) offers data safety for a minimum of one year (see also supplementary information on the provided PC card).

Capacity

DiNi® 22:

The capacity of the internal data memory depends on the measuring mode used and on the type and volume of the data involved. It amounts to approx. 2200 data lines.

DiNi® 12, ,12 T:

The number of data lines that can be stored depends on the PC card used. On a 1 MB card you can store about 10,000 data lines.

Storage method

DiNi® 22:

All data records are filed under their consecutive number (address) and can be called up either under this address or using the point number or point identification. Each data record comprises the address, a point identification with a maximum of 27 places including e.g. the point number, point code and line number, and a maximum of 3 measured and computed values with the appropriate type identifiers.

DiNi® 12 , 12 T:

Data records are stored in the same way as described above for DiNi® 22. On these instruments, however, project-oriented storage is possible. On the PC memory card you can create DOS-compatible directories and files (projects) and save data records to optional projects.

Exchange of PC memory card

The PC memory card is accommodated in a protective slide at the bottom of the instrument. The card slide must be pulled out horizontally to the right. For this, hold the instrument slightly with the left hand. Let the thumb of the right hand rest against the instrument case and the other fingers

take hold of the underside of the slide. Pull on the marked area of the slide until you get over the click stop. Now, the slide moves easily. After you have reached the external stop, you may easily take the card with thumb and forefinger to take it out. A spring pushes the card slightly upward.

When you insert the new card take care of proper orientation of the card. Push in the slide completely.

Interface

Purpose

The RS 232 C interface permits software- or line-controlled transmission of measured and computed data from the DiNi® and the memory to peripheral units or from peripheral units to the DiNi® and the memory.

📖 6 Data management

Power supply

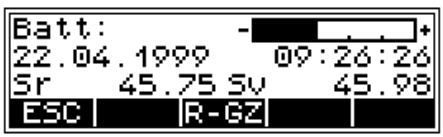
Service life of the battery

Due to the implemented power management and the liquid-crystal graphic display, the DiNi® uses very little energy. Depending on the age and condition of the battery, a charged battery lasts for about 3 days (on DiNi® 22 about 1 week) of measurement in extensive surveying tasks (approx. 800 - 1000 single measurements per day).

Call up the battery capacity

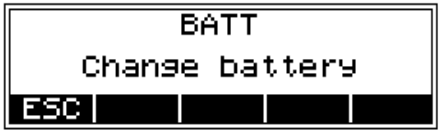
INFO

The condition of the battery can be called up with the INFO key. The current battery capacity is shown in the bar symbol on the top right of the display.



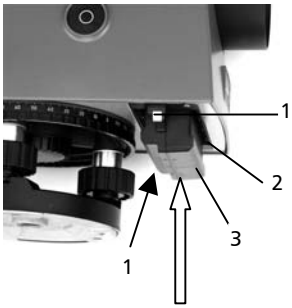
Battery change

When the battery has run down, the message appears in the display:



If this message is confirmed with ESC key , several measurements can still be performed. As a reminder, the display briefly turns inverse at 10 sec intervals.

After this warning, a charged battery should be inserted as soon as possible. Make sure to switch off the instrument for the replacement. No data will be lost in this case.



The battery (3) is easily replaced by pulling the holding clips (1) of the battery compartment (2) outward with both hands. For this, let the thumbs rest on the top of the instrument body while the other fingers operate the holding clip and simultaneously grasp the sliding out battery. Insert the battery in reverse order.

When changing the battery, take care that the battery does not fall down when you open the lock of the battery compartment (2).

Charging the battery:

🕮 8 Appendix

Electrical and thermo-mechanical fuses protect instrument and battery during the operation and the battery during the charging process. Charge the battery of the DiNi® with the Single Battery Charger.

Risk in use

Instruments and original accessories from Trimble must only be used for the intended purpose. Carefully read the manual before the first use and keep it with the instrument so that it will be ready to at any time. Be sure to comply with the safety notes.

☝ Attention !

- Don´t make any changes or repairs on the instrument and accessories. This must be done only by a service team or by authorised technical staff.
- Do not point the telescope directly at the sun.
- Do not use the instrument and accessories in rooms with danger of explosion.
- Operate the instrument only in the compliance with the operating conditions specified.
- Protect operator and instrument sufficiently at the site of measurement (e.g. construction site, roads, etc.). Observe any relevant national regulations and the Road Traffic Act.
- Tread tripod legs firmly into the ground to prevent sinking in and falling over of the instrument by wind pressure.
- Mount the instrument to the tripod using the tripod screw immediately after you take the instrument from its case. Never leave the instrument placed loosely only on the tripod head. After loosening the tripod screw, immediately store the instrument in its case.

☝ Attention !

- When you work with staves in the vicinity of electric plants (e.g. electric railways, aerial lines, transmitting stations, etc.) your life is acutely endangered. This risk exists independent of the staff material (e.g. aluminium or wood). In such cases it is necessary to inform the competent and authorised safety authorities and observe their instructions.
- Check your instrument at regular intervals in order to avoid faulty measurements, especially after it has been subjected to shock or heavy punishment.
- Don't use the instrument too long when it is raining. During breaks, cover the instrument with the protective hood. Wipe the instrument and case dry in the field and let it dry completely indoors, with the case open.
- In a thunderstorm, don't carry out surveying work to avoid being struck by a lightning.
- Remove the batteries in case of unloading or a longer time without using the instrument. Recharge the batteries with the Single Battery Charger.
- Properly dispose of the batteries and equipment taking into account the applicable national regulations. Prevent improper use of the disposed instrument by proper disposal.

☝ Attention !

- Before every use of the instrument, verify that it is in perfect condition, particularly after longer transportation, fall or any other improper use. Systematic check measurements particularly before and after extensive surveying projects will help to avoid erroneous measurements.
- Do not operate the battery charger and PC card reader in humid conditions (risk of electrical shock). Make sure the voltage setting is identical on the battery charger and voltage source. Do not use instruments while they are wet.
- The magnetic PC card cover should always be in place to stop environment damage (water, dust).
- Do not use destroyed plugs and cables for accessories with the instrument.

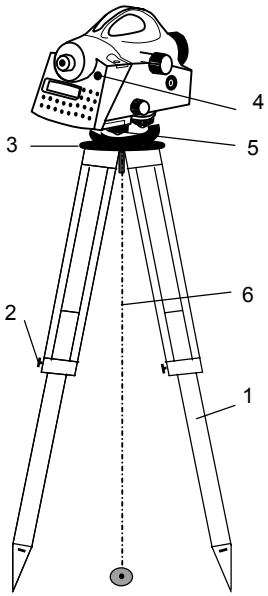
☝ Attention !

Initialisation of the data memory deletes all stored data.

3 First Steps

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

Set-Up and Coarse Centring



In order to guarantee the stability of measurement we recommend the use of a Trimble tripod.

Set-up:
Extend the tripod legs (1) to a comfortable height of observation and fix them using the tripod locking screws (2). Screw the instrument centrally to the tripod head plate (3). The tribrach screws (5) should be in mid-position.

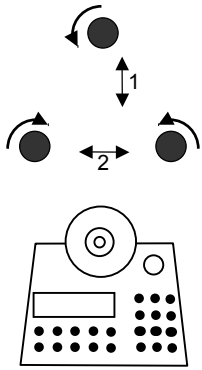
Coarse Centring (DiNi® 12 T only):
Set up the tripod roughly above the station point (ground mark). The tripod head plate (3) should be approximately horizontal.

Hook the plumb line (6) into the retaining screw and set up the tripod roughly centred above the ground mark.

Levelling and Fine Centring

Coarse Levelling:

Level the circular bubble (5) by adjusting the length of the tripod legs (1).

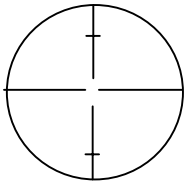


Precision Levelling:

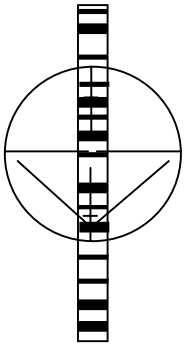
Align the control unit parallel with the imaginary connecting line between two tribrach screws. Level the instrument in the telescope axis (1) and rectangularly to it (2) by means of the tribrach screws. For checking, turn the instrument round the vertical axis in the diametrical position. In any case, the residual inclination should be within the working range of the compensator (± 15´) after having centred the circular bubble.

Fine Centring (DiNi® 12 T only):
Shift the tribrach on the tripod head plate until the plumb line is hanging centrally above the ground mark; repeat the levelling various times, if necessary.

Telescope Focusing



Visual field DiNi® 12, 22



Visual field DiNi® 12T

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

☝ Attention !

Sighting of the sun or strong light sources **must by all means be avoided** because it would cause irreparable damage to your eyes.

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

☞ Tip

Check the telescope parallax: If you move your head slightly whilst looking through the eyepiece, there must be no relative movement between the crosslines and the target; check focusing, if necessary.

📖 7 Adjusting

Attention !

Residual inclinations of the line of collimation remaining after having centred the circular bubble are eliminated by means of the **compensator**. But it **does not compensate** any **inclinations** caused **by insufficient adjustment of the circular bubble or of the line of collimation**. For this reason, both adjustments have to be checked.

Switching the Instrument On and Off

ON/OFF to press key

Operating the OFF function unintentionally does not lead to a loss of measured values. The system will ask in case of certain functions, but on principle, all current values (line levelling) are saved in a non-volatile working memory.

Triggering Measurements

MEAS — Key on the control panel

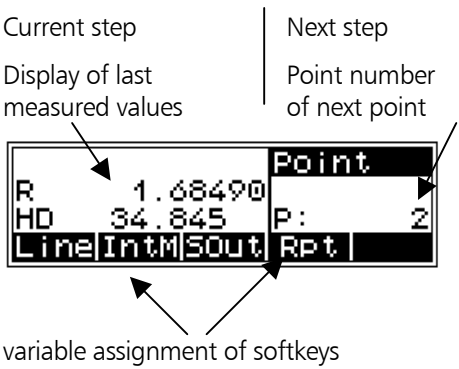
◎

Key on the right side of the instrument

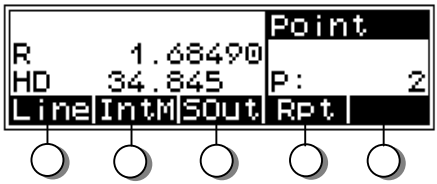
DIST — Distance measurements only (e.g. in line levelling)

Hz — Angle measurements only, Hz tracking

Principles of Display



Softkeys



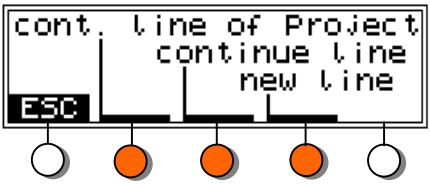
☞ Tip

The signification of the keys below the display is allocated to the lower fields of the display.

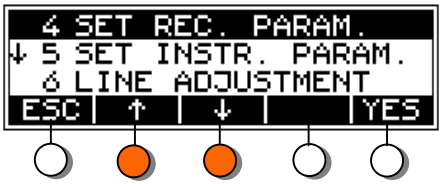
These fields indicate in each case the next possible settings - do not mix it up with the current setting.

Decision Systems: L Menu, Scroll Bar Menu and Mode Key

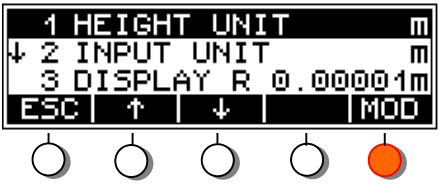
Softkeys beneath this sign can be used



↑, ↓ With these two softkeys you can select decisions



MOD This softkey is used to modify settings



Alphanumeric Inputs

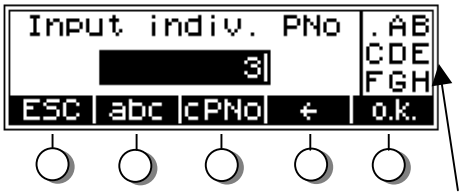
abc, ABC, NUM to switch between small/ capital/ numerical

← to delete input

0 .... 9 numeral keys, also for entering letters

MEAS, DIST to change range of characters

o.k. to confirm input



Allocation of numeral keys according to characters displayed

Setting the Instrument

MENU

Basic declarations concerning measuring units, digits after the decimal point of measured values displayed, the acoustic signal, language and time. The values are always saved with complete number of digits.

6 SET INSTR. PARAM.

YES

↑, ↓ to select decisions

MOD to modify settings

Settings:

1 HEIGHT UNIT m	m – meter; ft – foot; in – inch
2 INPUT UNIT m	m – meter; ft – foot; in – inch (to input values of staves with metric division)
3 DISPLAY R 0.00001m	0.001m; 0.0001m; 0.00001m
4 SHUT OFF 10 min	10min; OFF
5 SOUND ON	ON; OFF
6 LANGUAGE E__320	four languages are available,
📖 **8 Annex**, *Update*	loading see *Update*
7 DATE dd.mm.yy	dd.mm.yy; mm.dd.yy; yy.mm.dd (DiNi® 12 only)
8 TIME 24h	24h; AM/PM (DiNi® 12 only)

Setting Input

MENU

1 INPUT

and

2 LIMITS/TESTS

↑, ↓ to select decisions

MOD to modify settings

Inputs for high precision line levellings and measurements of target height and sighting distance as well as control parameters, which ensure an automatic supervision and warn the user (decisions on the repetition of measurements or the acceptance of values), can be realised at any time.

Settings:

1 Refr.coeff. 0.130	-1 - + 1	
2 Vt. offset 0.00000	0 m - 5 m	
3 Date 13.08.2001	1.1.1994 - 31.12.2093	(DiNi® 12 only)
4 Time 17:07:46	00:00:00 - 23:59:59	(DiNi® 12 only)

Limits / Tests

1 Max. dist. 40	10 m - 100 m
2 Min.sight. 0.50000	0 m - 1 m
3 Max.sight. 2.90000	0 m - 4,0 m
4 Max. diff. 0.00020	0 m - 0,01 m
5 Check 30cm OFF	ON / OFF

Setting of Recording

MENU

Definition which data will be saved on which medium (internally or externally):

5 SET REC. PARAM.

YES

1 RECORDING OF DATA

YES

📖 6 Data Management

The parameter settings are only of interest for external saving and data transfer. Saving on the PC memory card is in M5 format only.

↑, ↓ to select decisions

MOD to modify settings

Settings:

1 REMOTE CONTRL ON

OFF, ON

📖 **6** *Remote Control* (Control of DiNi® from PC)

2 RECORD. PC Card

PC CARD, V.24, none (DiNi® 12)
iMEM, V.24, none (DiNi® 22)

3 ROD READINGS RMC

RMC, R – M measured and computed values or measured values only (line adjustment: RMC)

4 PNo INCREMENT 1

-100 - + 100
Point number is incremented

5 TIME ON

ON, OFF (DiNi® 12 only)
Saving in PI

📖 **6 Data Management**

See also:
Recording Data and Data Lines

Setting the Instrument

MENU

Setting of the declarations for digits after the decimal point of measured values displayed, for switching the instrument off, acoustic signal, language and contrast. The values are always saved with complete number of digits.

6 SET INSTR. PARAM.

YES

↑, ↓ to select decisions

MOD to modify settings

Settings:

1 DISPLAY R 0.00001m — 0.001m; 0.0001m; 0.00001m

2 DISPLAY HD 0.001m — 0.01m; 0.001m;

3 SHUT OFF 10 min — 10min; OFF

4 SOUND ON — ON; OFF

5 LANGUAGE E__320 — four languages are available, loading

📖 **8 Annex**, *Update*

6 CONTRAST ↑↓ MOD — Regulation in 20 steps

Setting Units

Setting of Units:

7 SET INSTR. UNIT

YES

↑, ↓ to select decisions

MOD to modify settings

Settings:

1 HEIGHT UNIT m	m; ft; in
2 INPUT UNIT m	m; ft; in
3 ANGLE UNIT gon	gon; deg; DMS
4 COORD.SYSTEM X↑→Y	N↑→E; X↑→ Y↑→X
5 COORD.DISPLAY Y,X	(Y,X); (X,Y); (N,E); (E,N)
6 DATE dd.mm.yy	dd.mm.yy; mm.dd.yy; yy.mm.dd
7 TIME 24h	24h; AM/PM

Setting Input

MENU

1 INPUT

and

2 LIMITS/TESTS

↑, ↓ to select decisions

MOD to modify settings

Inputs for target heights, sighting distances and control parameters which ensure an automatic supervision and warning function to the user are important for high precision line levellings and measurements. Furthermore, declarations for refraction coefficient, addition constant and time are possible:

Input:

1 Refr.coeff. 0.130	-1 - + 1
2 Vt. offset 0.00000	0 m - 5 m
3 Date 13.08.2001	1.1.1994 - 31.12.2093
4 Time 17:07:46	00:00:00 - 23:59:59

Limits / Tests:

1 Max. dist. 40	10 m - 100 m
2 Min.sight. 0.50000	0 m - 1 m
3 Max.sight. 2.90000	0 m - 4,0 m
4 Max. diff. 0.00020	0 m - 0.01 m
5 Check 30cm OFF	ON / OFF

Setting of Recording

MENU

Definition which data will be saved on which medium (internally or externally):

5 SET REC. PARAM.

YES

1 RECORDING OF DATA

YES

The parameter settings are of interest for external saving and data transfer only.

📖 6 Data Management
Data Transfer

Saving on the PC memory card is in M5 format only.

Settings:

1 REMOTE CONTRL OFF
📖 **6** *Remote Control*

OFF, ON
(to Control DiNi® from PC)

2 RECORD. PC Card

PC CARD, V.24, none
iMEM, V.24, none

3 PNo INCREMENT 1

-100 - + 100
Point number is incremented

4 TIME ON

ON, OFF
Saving in PI

📖 **3 First Steps**
Presettings

For the definition of values to be saved see later in this chapter under Measuring Modes – *Total Station and Coordinates Mode*.

📖 **6 Data Management**

See also:
Recording Data and Data Lines

Normal Measurement (Digital Staff Reading) - Levelling Mode

After bringing the digital staff into focus, make to coincide the vertical line of the instrument cross-hairs with the staff and press the start button. The staff reading and the distance will be displayed after 2 (DiNi® 22) and 3 seconds respectively.

Visual Measurement

INP

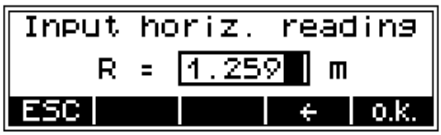
In special cases, the input of visual readings from a metrical staff into the instrument may become necessary.

In this connection, take into account that visual readings naturally are less precise than digital staff readings and, furthermore, the adjusting measurement has been carried out electronically (reticle shifted to the nominal value according to electronic adjustment) (identity of electronic and optical horizon).

← to delete input

0 .... 9 numeral keys for input

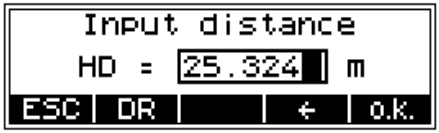
o.k. to confirm input



← to delete input

0 .... 9 numeral keys for input

o.k. to confirm input



The softkey EL allows you to enter also readings from the upper and lower Reichenbach stadia lines and the instrument will then compute the distance.

Repeat Measurements

RPT

Repeat measurements (nM) can be defined to make sure that the accuracy required will be obtained.

Criteria:
Definition of the number of repeat measurements or the maximally admissible standard deviation (sR) -max. 10 measurements.

↑, ↓ to select

MOD to call modification

ESC to quit submenu and confirm settings

nM=1 one measurement only
nM>1; mR=0 Performance of all n measurements
nM>1; mR>1 Performance of measurements until number of repetitions or standard deviation has been reached

In repeat measurements, the mean values of staff reading and distance and the standard deviation are displayed after each measurement.
If the standard deviation has been defined, at least three measurements are performed.
When the desired standard deviation has been obtained, the process can be stopped by pressing the softkey ESC. But take into account that vibrations to the instrument by this key depression have to be avoided – otherwise the last value would falsify the result.

The saving of the standard deviation can be defined:

📖 **3 First Steps**
Presettings
Setting of Recording

DiNi® 12: R- M
DiNi® 12 T R,HD,sR

☝ **Attention !** In this case, line adjustments are not possible.

The number of measurements is always saved.

(2)

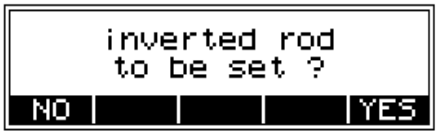
For M5|Adr 32|KD1 2fhcd5 14:15:062 11|Lr 1.24108 m |E 23.936 m | |

Inverted Measurements

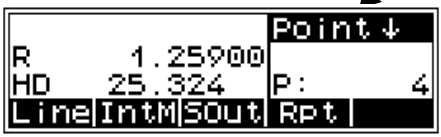
INV

Inverted measurements are required for underground works and in buildings (staff base is turned upwards).

YES to confirm



The setting is permanently marked by the arrow pointing downwards.



The actual staff position has to correspond with the measuring mode selected.

The switchover is presented only if it is useful. It will not be presented, e.g., in the following cases:
- in backsights, when point has been captured in foresight
- during the adjustment
– in other setting menus.

Total Station and Coordinates Modes (DiNi® 12 T)

The electronic Hz circle allows not only the storage of the Hz value additionally to the staff reading and distance, but also the computing / storage of coordinates with the instrument station point (0,0). For storing the coordinates, a second line containing the coordinates is filed.

A special distance measuring program requires a 50 cm bar code section to be visible on the staff on either side of the line of sight..

See also:
📖 **6 Data Management** *Recording Data and Data Lines*

There are two options for measuring the Hz angle:
- simultaneously to the staff reading or
- prior to the staff reading

Selection of the Total Station Mode:

TS-M

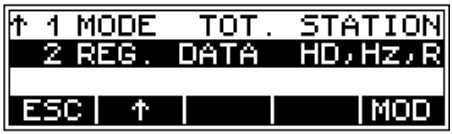
MOD

1 MODE TOT. STATION

The Hz angles are determined additionally to the staff readings.

Recording in the Total Station Mode:

MOD



Options:
HD,Hz,R; HD,Hz,Z; R,HD,sR; R,HD,Z

Selection of the Coordinates Mode:

TS-M

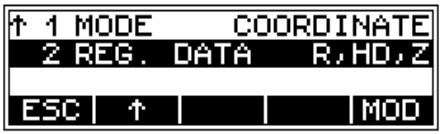
MOD, MOD

1 MODE COORDINATE

Coordinates are computed from angle, distance and height.

Recording in the Coordinates Mode:

MOD to change



The second data line containing the coordinates cannot be influenced.

Coordinates of station: 0,0.

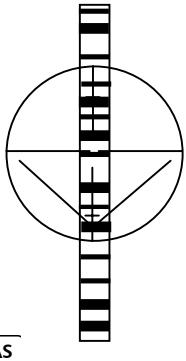
Options:
R,HD,Z; HD,Hz,R; HD,Hz,Z; R,HD,sR

Simultaneous or Separate Hz Measurement (DiNi® 12 T)

Hz-M

Calling the setting

MOD to change



Sight the staff symmetrically using the special cross-hair pattern.

MEAS

Simultaneous Measurement
Measurement of Hz direction and staff reading are performed directly one after the other (avoid turning the instrument).

MEAS, MEAS

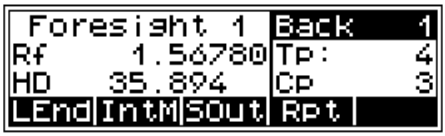
Separate Measurement
Hz direction is measured first, staff reading is performed after that.

The display of results and the recording are identical in both measuring modes.

4 Measuring Programs

After having completed all settings according to chapter 3, you can now proceed with this chapter which describes measurements to points without reference height, with reference height and line levellings as well as line adjustments.

Repetition of Measurements



Rpt to call a repeat measurement

Technical Information

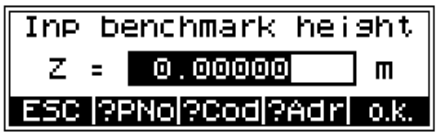
The last measurement can be repeated in each case. As far as it is reasonable from the technical point of view, the last station (line levelling) can be repeated as well. In this case, the original data lines are marked with ##### in the code range of PI and not used for computing.

Search for Reference Heights in the Memory

PRJ to select project, see also:

📖 ***6* Data Management**

? to search in memory using specified criteria

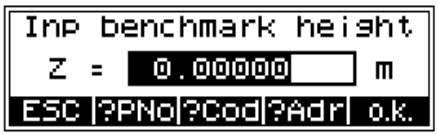


Search for:

?PNo point number

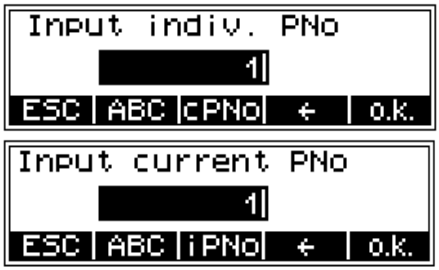
?Cde point code

?Adr address in project



Consecutive and Individual Point Number

PNr to enter the point number



Technical Information

The cPNo and iPNo keys allow to toggle between the input of consecutive and individual point numbers. The consecutive number is incremented by 1. In line levellings, the input of the number of the backsight point and end point is requested.

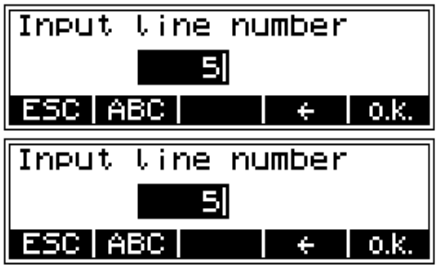
Alphanumeric Inputs

NUM, abc and ABC to toggle between digits, small/capital letters

← to delete input

0 .... 9 numeral keys for input

o.k. to confirm input



Technical Information

The ▼ (DIST) and ▲ (MEAS) keys allow to scroll through the character set. The letters appearing at the right of the display are allocated to the numeral key block 1 to 9

Input of Point Code and Text Information

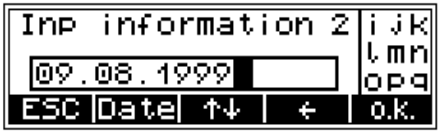
REM to call the input of text information

Technical Information

Whenever it is necessary during the measurement, alphanumeric text information up to 10 lines with 21 characters each, including the current date and time, can be entered successively.

↑↓ to switch over for calling date and time

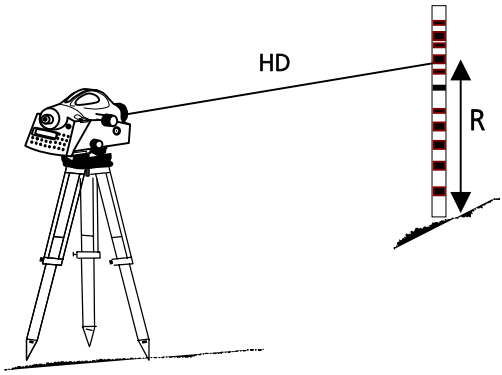
Date to call date



Time to call time

Measurement from the Start-up Menu (without Reference Height)

When measuring from the start-up menu without reference height, staff readings can be displayed successively and independently of each other. If recording and point number incrementation have been activated, the measurements are stored correspondingly.



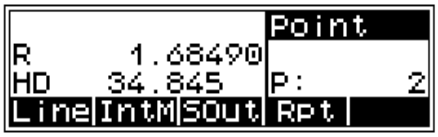
R – Staff reading
HD – Horizontal distance

PNr, REM to enter point number and code

MEAS to release measurement

To release measurement:

Result:

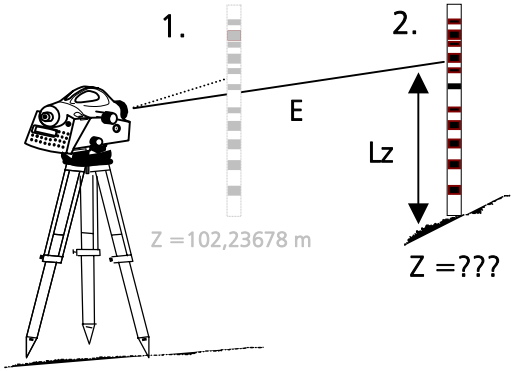


☞ Tip

The point number and code entered will be stored with the next measurement.

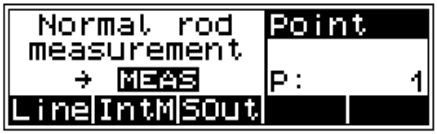
With Reference Height

After a backsight measurement of a point with known height, the heights of discretionary points are determined.



Rz – Staff reading of intermediate sight

IntM to start

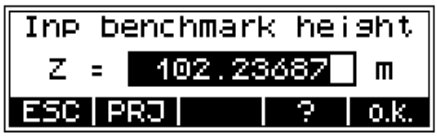


Height of backsight point:

0,1,2 Indication of value

PRJ to select project

? to search in memory



📖 **6 Data Management** Editor, *Editing of project and display of data lines*

o.k. to accept the input / the calling

Technical Information

After acceptance, the height and the respective point number / code are displayed. The PNr and REM keys allow to change the point number and code.

PNr, REM to change point number and code ?

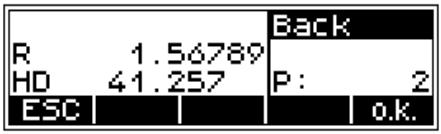
MEAS to release measurement

To release measurement of point with known height:

o.k. to confirm measurement

MEAS to repeat measurement

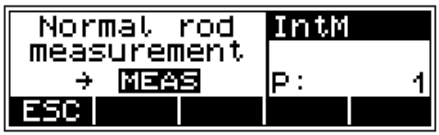
Result of the backsight measurement:



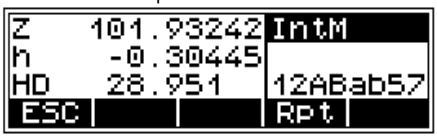
PNr, REM to enter point number and code

MEAS to release measurement

Measurement of new points:

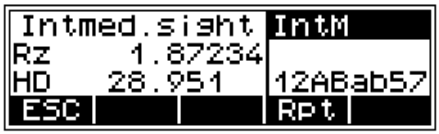


Result of new point:



DISP to change display

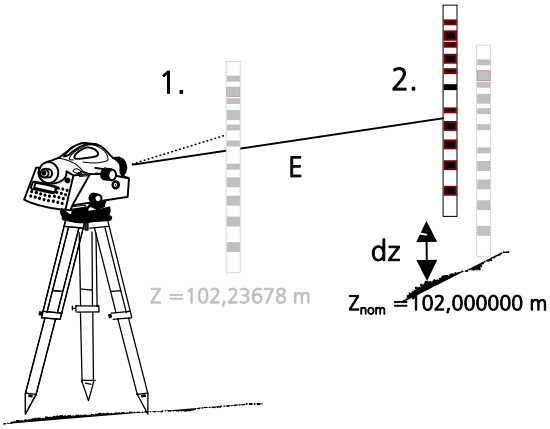
MEAS to measure another point



Z – Height of the new point
h – Height difference between new point and known point
Rz – Staff reading of intermediate sight

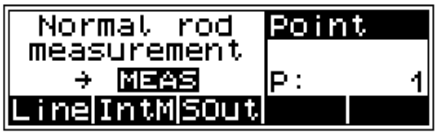
Starting the Stake Out

After the measurement of a point with known height, the heights of the points to be staked out (approximate points) and the differences between nominal and actual values are determined. The staff is shifted until the difference measured between the nominal and actual values has been reduced sufficiently.



dz – nominal - actual deviation

IntM to start



Reference Height

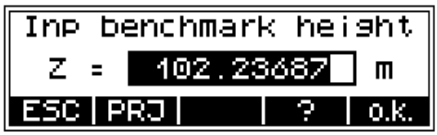
0,1,2 Indication of value

PRJ to select project

? to search in memory

📖 **6 Data Management** Editor, *Editing of project*

o.k. to accept the input / the calling



PNr, REM to change point number and code

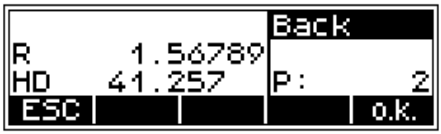
MEAS to release measurement

o.k. to confirm measurement

MEAS to repeat measurement

To release measurement of point with known height:

Result of the backsight measurement:



Stake Out

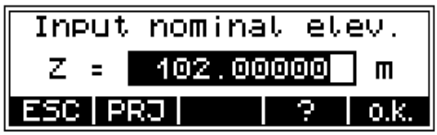
0,1,2 Indication of value

PRJ to select project

? to search in memory

📖 **6 Data Management** Editor, *Editing of project*

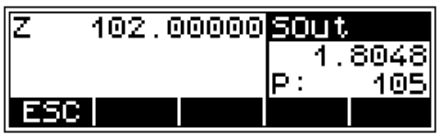
o.k. to accept the input / the calling



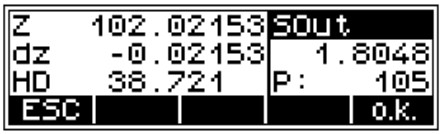
Measurement to Digital Graduation of Staff (1st approximate point)

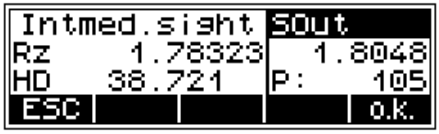
PNr, REM to change point number and code

MEAS to release measurement



Display of result:





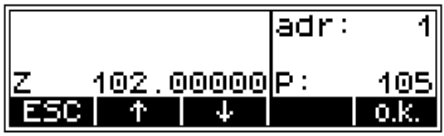
According to the deviation dz, staff will be shifted and measurement repeated until dz has been reduced sufficiently

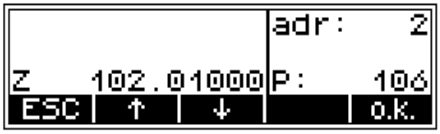
o.k. to confirm the result and to save

↓ to call the next height to be staked out

Technical Information

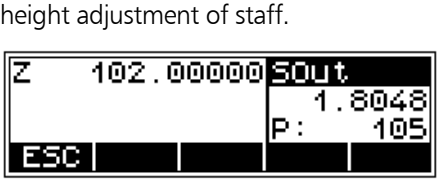
When calling the heights to be staked out from the memory of the instrument, the address of the last height just staked out appears after the result has been confirmed. By pressing the softkey ↓, the next height to be staked out can be called immediately, provided that the heights have been stored in the desired order in the project. With ESC you can return to the menu to enter heights and call up search.





Stake Out with Metrical Graduation of the Staff

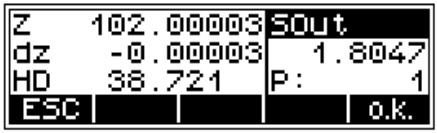
Staff carrier turns staff with metrical graduation towards the observer and receives instruction for height adjustment of staff.

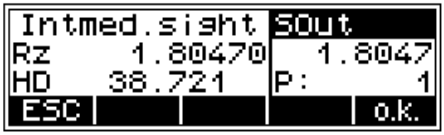


PNr, REM to change point number and code

MEAS to release measurement

Control measurement - code graduation of staff towards the instrument

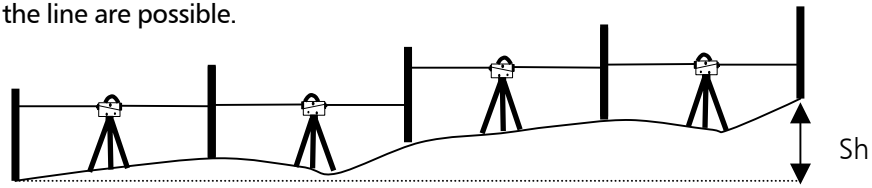




The individual height differences are measured and added up. When entering the heights of the start and end points, the nominal - actual difference is computed. Intermediate sights and stake out within the line as well as continuing the line are possible.

Result:

Sh:	total height difference
Db,Df:	sum of backsight and foresight distances
dz:	final difference (if reference heights for start and end points have been entered)



📖 **3 First Steps**
Presettings
Setting of Recording

📖 **3 First Steps**
Presettings
Setting Input

Tip

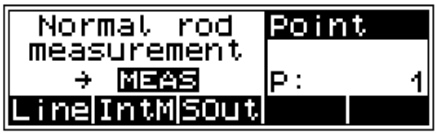
All important settings (point number incrementation, resolution of measured data) are to be made before starting the line measurement. That refers especially to the saving as relevant aspect for the line adjustment option.

The DiNi® 12T allows a subsequent line adjustment only when measuring in the level mode.

To ensure a high accuracy, it is possible to monitor the maximum sighting distance, the minimum sighting height and the maximum station difference.

Starting New Line / Continuing Line

Line to start a line



└ to select according to situation

Technical Information

With *continue line* the line not yet completed will be continued immediately.
With *continue line of project* calling of line by means of the line number is requested.

Each completed line within a project can be continued. A final line adjustment through all data of a line is also possible.

Tip

In order to minimise potential problems in long lines, we recommend to insert now and then fixed change points where the line ends and is continued immediately with the "continue line" option. This operation (line end / continuation) does not affect further line computing, but enables you, in case of a problem, to link the possibly lost line to this point and to connect later the partial lines manually (to add them).

0,1,2 Input

← to delete input

ABC to toggle

o.k. to accept input

MOD to select measuring method

↑↓ to select alternate sequence Yes / No

Technical Information

Method	DiNi® 12	DiNi® 12T	DiNi® 22
BF	X	X	X
BFFB	X	X	X
BFBF	X	X	
BBFF	X	X	

In the alternate method, even and odd stations are differently observed.

not alternate sequ.		alternate sequence	
1.station	2.station	1.station	2.station
BF	BF	BF	FB
BFFB	BFFB	BFFB	FBBF
BFBF	BFBF	BFBF	FBFB
BBFF	BBFF	BBFF	FFBB

0,1,2 Indication of value

PRJ to select project

? to search in memory

📖 **6 Data Management** Editor, *Editing of project and display of data line*

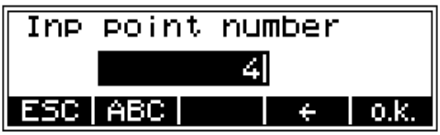
o.k. to accept the input / the calling

0,1,2 Input

← to delete input

ABC to toggle between digits and letters (small/capital)

o.k. to accept input



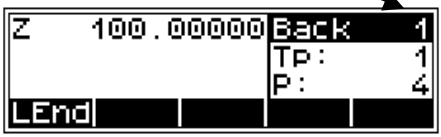
Technical Information

For entering point numbers during the further line measurement you can select between consecutive number (number will be incremented) cPNo or individual point number iPNo (softkey in the middle).

Backsight and Foresight Measurements

Backsight is requested

MEAS to release backsight measurement

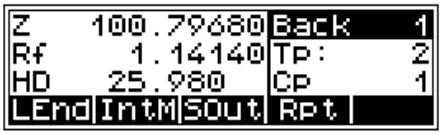


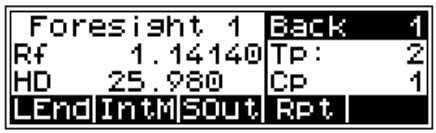
Result of backsight measurement:

Height of line of sight *Foresight is requested*

MEAS to release foresight measurement

Result of foresight / station (RV method):



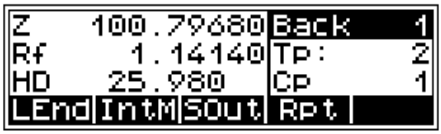


Technical Information

DISP is used to change the display. A setting once selected is retained until the next change.

Intermediate Sights in Line Levelling

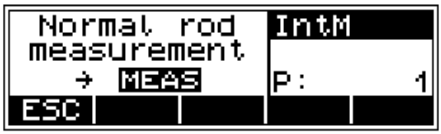
IntM to start



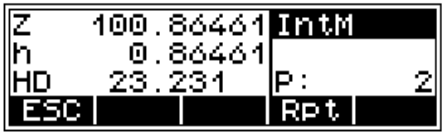
Technical Information

Further steps are identical with those in the single point measurement with reference height. The backsight measurement has already been carried out with the line measurement. Intermediate sight measurements are possible immediately.

MEAS to release intermediate sight measurement

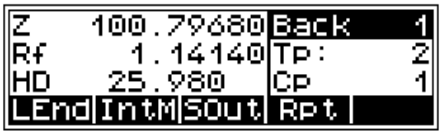


ESC to return to line measurement



Stake Out during Line Levelling

SOut to start



Technical Information

Further steps are identical with those for stake out with reference height. The back-sight measurement has already been carried out with the line measurement. Stake out is possible immediately.

0,1,2 Indication of value

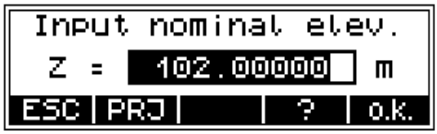
PRJ to select project

? to search in memory

📖 **6 Data Management** Editor, *Editing of project and display of data lines*

o.k. to accept the input / the calling

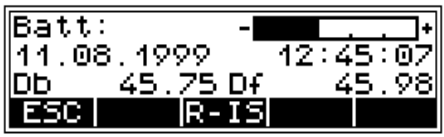
ESC to return to line measurement



Selectable and Automatic Controls during Line Levelling

Display of total sighting distances

INFO

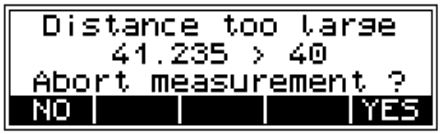


Technical Information

As total sighting distances are known, the next stations have to be selected in such a way that the total sighting distances Db and Df are almost identical at the end of the line.

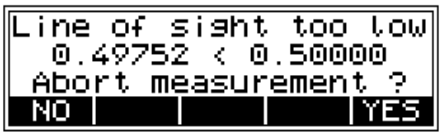
Exceeding the settings:

- maximum sighting distance
- minimum sighting height
- maximum station difference (e.g. BFFB)



NO to accept measurement

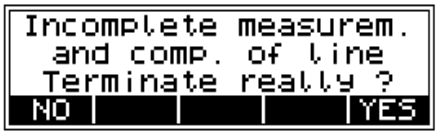
YES to repeat measurement



End of line selected without useful completion

NO to continue line

YES to end line intentionally



On/Off has been pressed

NO instrument will not be switched off

YES instrument will be switched off

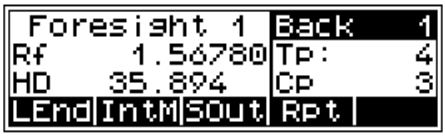
Technical Information

The instrument can be switched off intentional or unintentionally anywhere in the programme. When switching the instrument on again, it will start at the position where it stopped without any loss of data. During transports in line measurements, the instrument can be switched off without hesitation.

Data get lost, of course, when leaving a station incompletely measured.

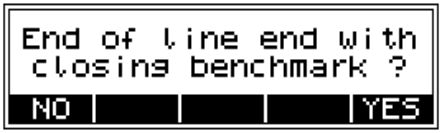
Ending a Levelling Line

LEnd to initiate line ending



YES to end line at a point with known height

NO to end line at a point with unknown height



0,1,2 Indication of value

PRJ to select project

? to search in memory

📖 **6 Data Management** Editor, *Editing of project and display of data lines*

o.k. to accept the input / the calling

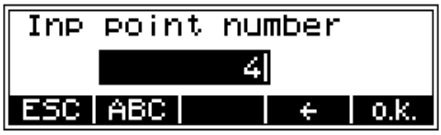
ESC to return to line measurement

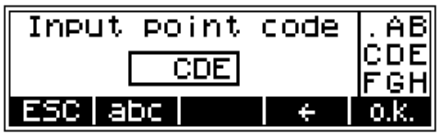
0,1,2 Input

← to delete input

ABC to toggle between digits and letters (small/capital)

o.k. to accept input





ESC to finish line measurement

Result:

Sh: total height difference

dz: final difference (if reference heights for start and end points have been entered)

Db,Df: Sum of backsight and foresight differences

Line Adjustment (DiNi® 12 and DiNi® 12 T)

In line levelling, a line is linked to points with known heights at the beginning and at the end so that the measured height difference can be compared with the nominal height difference.

The "line adjustment" program allows to spread the occurring difference over the individual staff stations proportionally to the sighting distances, obtaining adjusted heights as result. During this operation, the measured values (staff readings, distances) are not changed. Intermediate sights are only improved according to the improvement of the respective instrument station.

Line adjustments can only be performed if the levelling line has been completed and saved on the memory along with the intermediate heights. Line adjustments are only possible with lines measured with software version V 2.00 or higher.

It may happen that the definite heights of backsight points are not yet known when the line is measured. In this case, the nominal height values can be entered during the line adjustment. It is also possible to adjust loops. Loops are levelling lines with identical start and end height.

Requirements for a line adjustment:

① The entire levelling line has to be recorded in one project on the PC memory card.

② Set **in any case**
the recording mode **RMC (DiNi® 12)** or the recording data **R, HD, Z (DiNi® 12T)**.
Otherwise line adjustment will not be possible, as in the project no space is reserved for the adjusted heights.

③ While measuring a station, the levelling line must not be interrupted in such a way that measurements are skipped.

④ The common adjustment of successive partial lines is only possible if they are linked by the "continue line" option.
But they can be positioned in chronological order at different spots in the project. Different partial lines started in each case with "new line" can only be adjusted separately.

⑤ Line adjustment does not include averaging between fore and back reading.

⑥ Line adjustment cannot be repeated.

⑦ Before starting line adjustment, make sure the battery is sufficiently charged.

⑧ The data stored on memory must not be changed between line measurement and line adjustment. (Before line adjustment is actually started, the levelling line is checked by recalculating the measured line. The program accepts the following differences between original and recalculated values:
Heights: 0.00002 m
Distances: 0.02 m)

MENU

Starting the program.

ó LINE ADJUSTMENT

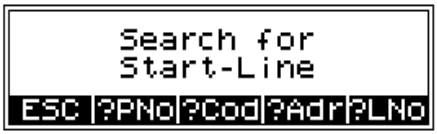
to search with:

?PNo point number

?Cde point code

?Adr address

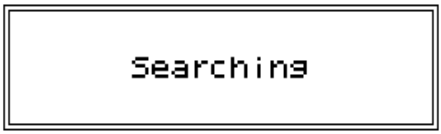
?LNo line number



o.k. to confirm

↑, ↓ to continue search in memory

ESC to abort adjustment



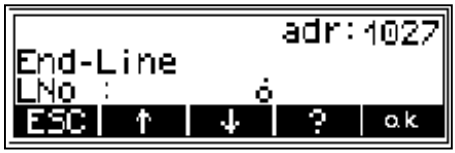
↑↓ to confirm

? to continue search for line end

↑, ↓ to search in memory

o.k.

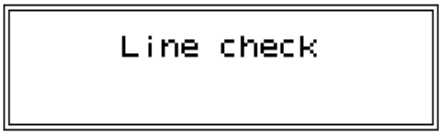
ESC to abort adjustment



YES to confirm line

NO new start

Check of measured values



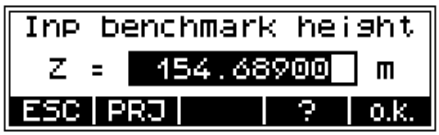
Technical Information

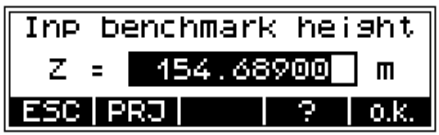
Now the instrument checks the data lines for changes. Changed levelling lines cannot be adjusted.

0,1,2 Input of values

PRJ to select project

? to search in memory





📖 **6 Data Management** Editor, *Editing of project and display of data line*

o.k. to accept the input / the calling

NUM ,0,1,2 to toggle input

← to delete

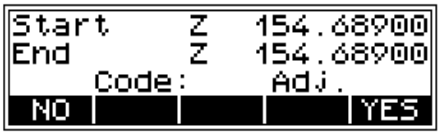
o.k. to accept input

o.k. to confirm

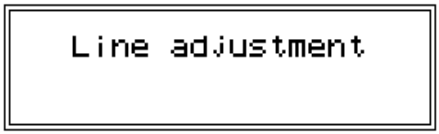
ESC to abort adjustment

YES to confirm the reference heights again

NO to abort – call the reference heights again



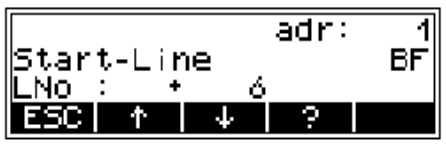
Computing of line adjustment



ESC to return to main menu

Technical Information

After calling in the editor menu, the levelling line number contained in the first levelling line address is marked by a "+" sign. This levelling line has already been adjusted and cannot be adjusted again.



5 Measuring Function

For operating a Digital Level properly, it is necessary to know and to observe some marginal conditions.
Our recommendations shall enable you to utilise the precision offered by the instrument to its full extent.

DiNi® height measurement

The method of single interval measurement is used to determine the height value (comprising a code and interpolation value) on the basis of 15 two-centimetre intervals of the staff and to average the results. For perfect recognition of the intervals and the coded information which they contain, it is essential that the staff image be accurately focused on the instrument cross-hairs. The usual fluctuations in focusing does not influence the measurement result.

DiNi® distance measurement

In DiNi®, the distance to the staff is computed together with the determination of the height. This distance is the horizontal distance between the vertical axis of the instrument and the plane of the graduation of the staff (not the centre of the staff base). The instrument-software allows to consider the staff thickness.

Staff section in the levelling mode

For the determination of heights and distances on DiNi® 22, 12 and in the levelling mode of DiNi® 12 T, the instrument only requires a 30 cm staff section positioned symmetrically to the sighting axis. To ensure optimum measurement results, this staff section must be free from interruptions. Normally this can be easily checked in the eyepiece. For sighting distances of less than 14 m, however, a staff section larger than the visible one is evaluated.

If the staff section is interrupted (e.g. by branches) or if measurements are taken beyond the base or top of the staff, the evaluated staff section is no longer symmetrical to the sighting axis.

Since major asymmetries may impair the measuring accuracy, measurement is blocked if obstacles cover more than a few centimetres beyond the cross-hairs (error message: 322 "out of measuring range").

For distances between the minimum sighting distance and a few meters, the instrument only requires a staff section of 10 cm. Due to this minimum measuring section, a range of approx. 6 cm from the beginning and end of the staff is not read for the shortest sighting distance.

Staff section in the total station/coordinates mode of DiNi® 12 T

In the total station or coordinates mode, the height is computed in the same way as in the levelling mode using a 30 cm staff section. This reduces the influence of refraction on the height measurement to a minimum. For distance measurement, a staff section of approx. 1 m length is used which should be symmetrical to the sighting axis, if possible.

If a suitable staff section cannot be found due to interruptions, the instrument measures a shorter staff section as long as this does not significantly impair the accuracy. If large distances are involved and the staff section available is less than 60 cm, distance measurement in the total station mode is blocked (error message 326 "staff section too small"). In this case the distance obtained in the levelling mode can be used.

Staff code

The staff code consists of 2 cm intervals filled white (yellow) / black or half white (yellow) / half black. For height and distance measurements, only the edges of the 2 cm intervals are used. Thus, necessary controls of invar staves are made easy. The precision code consisting of 1 mm wide lines is only used for decoding purposes in case of sighting distances of less than 6 metres.

Pendulum stop

If the pendulum is at its stop, measurement cannot be started. If the pendulum reaches its stop in the measuring process, the measurement is stopped and error message 202 "compensator out of range" is displayed.

Light conditions

sun

Direct solar irradiation in the telescope must be avoided as this may be harmful to the eye and may cause failure of the measurement. If sun reflections are visible in the telescope (sun low on horizon), shade the telescope with your hand until the reflections disappear. In the case of sun reflections on the staff, turn the staff sideways until the reflections are no longer visible to the observer.

strong light

If measurements are performed against strong light, the measuring time may be increased and the accuracy of the measured data may be reduced.

variation in brightness/ overexposure

If variations in brightness during the measuring process lead to overexposure of individual measurements (the sun comes out) , the measurement is automatically restarted. If this situation occurs repeatedly, measurement is stopped with error message 321 " Change in brightness too great ". It can then be started again.

twilight/ insufficient illumination

If the measuring signal in twilight is too weak for reliable measurement, if the staff section available is not sufficient for measurement or if no staff has been sighted, error message 323 or 324 "Staff cannot be read" is displayed. If the brightness is just about sufficient for measurement, the measuring time may be markedly increased. Should the resulting measuring times exceed 5 seconds, reduced accuracy of the measured data must be expected. In such cases, it is advisable to illuminate the staff.

staff illumination

If the staff has to be illuminated, we recommend to use a fluorescent lamp installed laterally in front of the staff beside the graduation. If the lamp is placed approximately at the height of the line of sight, a 10 W lamp (12 V, 220 V) will do. Directional light, e.g. by using an accumulator lamp, is not recommendable due to inhomogeneous illumination, formation of shadows or reflexes which could lead to errors of measurement.

Measuring beam interruption

In sunlight, a short interruption of the measuring beam is of virtually no importance, due to the short exposure times. If the measuring beam is interrupted by traffic and measurements are lost, the measuring time will be extended accordingly.

Vibrations

The displayed reading is a mean value obtained from several measurements. In the case of major differences between the individual measured values, the measurement is rejected and error message 325 "Standard deviation out of range" is displayed. This only eliminates gross errors; an assessment of the quality of the measured data is not made. In the case of vibrations or air turbulences, it has been found that the measurements displaying the smallest deviations need not necessarily provide the best measured data.

Multiple measurement

We recommend to use the multiple measurement option in such cases. Avoid triggering a measurement in moments of strong vibration, e.g. when a heavy vehicle is passing. This can be visually checked.

5 m telescopic staff

DiNi® instruments provide measurements with DiNi code staves of up to 5 m length. For this, the 5 m telescopic staff Td 24 and TD 25 are available. For the measurements all staff sections below the measured height value must be slid out and locked. If you take measurements with the staff being pushed in either partially or completely, for example as you do not need the full length of the staff, make sure not to sight at the pushed in section of the staff. Otherwise, erroneous measurements or nonsensical results cannot be precluded.

A digital level is an optical level with automatic data logging, data storage and data processing. For this reason, the marginal conditions to be observed when using a digital level are the same as with an optical level.

Hints for precision levelling

Do not expose tripod and instrument to one-sided irradiation by sun light. Avoid sighting across fields with intense irradiation by sun light, e.g. at noon.

Take into account that also digital levels require sufficient time to adjust to the ambient temperature. The following rule-of-thumb for a high precision measurement applies: Temperature difference in Kelvin x 2 = duration in minutes required for the instrument to adjust to the new temperature. For measurements of normal accuracy, e.g. using foldable staves, at least half the above duration should be considered for temperature adjustment.

The DiNi® instruments are equipped with a temperature sensor which cannot be read out externally. The temperature gradient of the line of sight of the instrument is determined and stored by the factory. The instrument carries out the necessary improvement of the line of sight immediately during the measurement. This correction is only possible in instruments completely adjusted to the ambient temperature and, consequently, does not make the temperature adjustment unnecessary.

Equal sighting distances shall by all means be kept to eliminate possible variations of the line of sight by temperature, mechanical stress and instrumental effects (focusing lens).

Do not choose sighting distances that are considerably longer than 30 m.

To obtain the specified accuracy of the instrument and eliminate the residual compensator error, make sure the circular level has been adjusted well and apply one of the following methods for measuring:
a.) Measurement according to an alternate method, known as "two-peg" method (RVVR,VRRV).
b.) Measurement according to a non-alternate method (RVVR,RVVR) after measuring R,V, readjust the circular level with orientation to foresight.

Before triggering a measurement, make sure that vibrations and shocks transmitted to the instrument e.g. from passing heavy vehicles or strong gusts of wind have decayed (check by viewing through telescope or decide by experience).

New features in v3.40

In previous versions, a warning could be set if a sight was being taken to the lowest part of the staff, for example to avoid taking sights too close to the ground, which may be affected by heat shimmer. A similar warning can now be given if a measurement is being taken at the top extent of the staff, with the maximum height at which a sight can be taken being user defined.
A check can now be made to ensure that a full 30cm of the staff is visible, equally spaced around the horizontal cross hair. If a measurement can still be made, but the full 30cm is not visible, the user can be warned.
These features are useful if many sights are being taken to the top part of the staff, where a full 30cm may not always be visible, or in environments where the 30cm section may be partially obscured by obstruction. Although a reading may still be possible in these circumstances where the full 30cm is not visible, using the maximum height and the "30cm check" will ensure maximum accuracy.

Underground, staff sinking into the ground, vertical positioning, turning	Similar to optical levels.
Invar staves	On request there is a staff certificate, which describes the staves. The staves have to be used, transported and stored properly and to be calibrated in corresponding time intervals.

Hints for precision measurement - area levelling

For precise area levelling, the adjustment of the line of sight is of great importance due to the different sighting distances. In line levelling, the possible inclination of the horizon is eliminated by equal sighting distances. For precise area levelling, the adjustment of the instrument prior to the measurement is absolutely advisable. In measurements carried out throughout the day, with great temperature differences between the beginning and end of measurements and additionally strong irradiation by sunlight, the internal temperature correction system of the instrument eliminates the main part of the variations of the line of sight. But to make sure, comparison measurements to fixed points should be made and readjustments should be carried out in between, if necessary.

Calling up Instrument Information

INFO

The following important instrument information can be called up with the **INFO** key:

- Display of the battery voltage

- Date and time (not on DiNi® 22)
- The total sighting distances Db and Df (separately for back- and foresight). These values are only displayed during the measurement of a line and refer to the last completed station. Any backsights which have already been measured at the new station are not included.

R-IS

It is possible to document the basic status of the instrument. Data lines with the following contents are then successively recorded:

- Measuring unit
- Amount of the line of sight correction
- Date of last adjustment
- Earth curvature / refraction setting
- Refraction coefficient
- Staff offset/addition constant

ESC

to quit the instrument information

Example for storage:

```
For M5|Adr   149|TO  Mass unit        m
For M5|Adr   150|TO  Adjustment                    |c_        0.00000 DMS|
For M5|Adr   151|TO  00.00.0000   00:00:00         |                     |
For M5|Adr   152|TO  Earth OFF/Refract OFF
For M5|Adr   153|TO  Input value                   |rk          0.130    |
For M5|Adr   154|TO  Input value                   |Lx        0.00000 m  |
```

6 Data Management

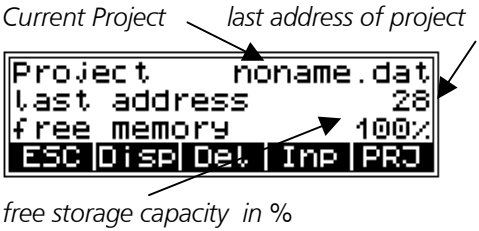
This chapter describes all operations connected with the instrument memory, the data transfer to the PC and the declarations required.

DiNi® 12 and DiNi® 12 T offer a project oriented data storage in various directories to be created by the user.

In DiNi® 21, data are stored in chronological order in a project (iMEM) with 2200 data lines.

Calling the Edit Menu

EDIT to call the menu



Display of Data Lines

Disp to call display

? to call search menu

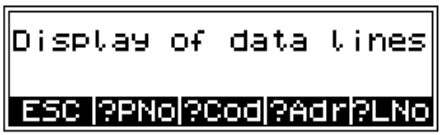
Search for:

?PNo point number

?Cod point code

?Adr address in project

?LNo line number



DISP to change page

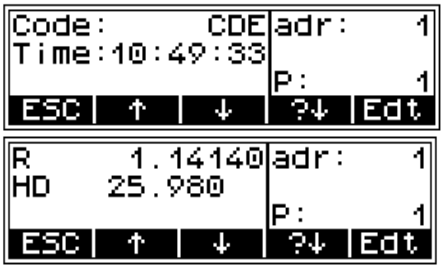
? ↓ to continue search using the same criterion

↑, to scroll memory

↓

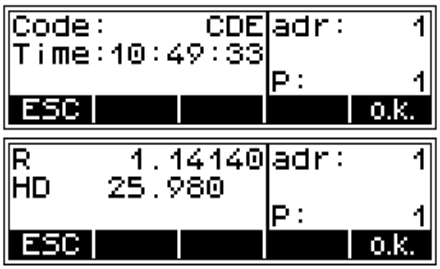
Edt to call menu to change point number and code

Display of data lines on two pages



PNr to change point number

REM to change code



After changing point number and code, confirm the entries pressing o.k..

Technical Information

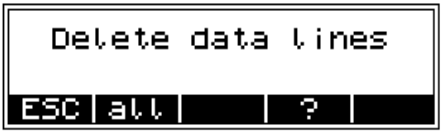
Point number and code can be changed only. Measured and computed values cannot be changed.

Deleting Data Lines

Del to call the function

? to call search menu

all to select all lines



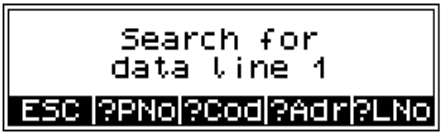
Search for data lines 1 and 2:

?PNo point number

?Cod point code

?Adr address in project

?LNo line number



YES to delete lines

NO to revoke selection

Input of Data Lines

Inp to call input

← to delete input

0 .... 9 numeral keys for input

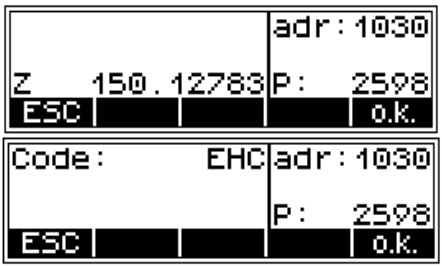
o.k. to confirm input

DISP to change page

PNr to enter point number

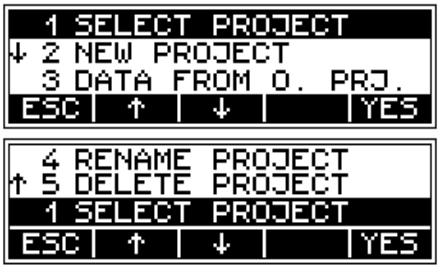
REM to enter code

o.k. to confirm input



Editing the Project

PROJ to activate project menus



Selecting the Project

1 SELECT PROJECT

YES to confirm the project selected

↑, ↓ to scroll

CD to change directory

Creating a New Project

2 NEW PROJECT

INPUT PROJECTNAME

CREATE DIRECTORY

↑, ↓ to scroll

CD to change directory

YES to confirm selection

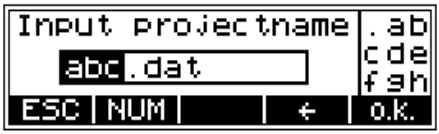
Technical Information

Directories can be created in up to 5 levels!

← to delete input

NUM, abc, 0 .... 9 input options

o.k. to confirm input



Technical Information

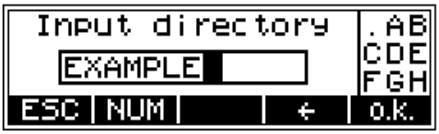
Input of small letters and digits, according to the file name conventions under DOS.

and

← to delete input

NUM, ABC, 0 .... 9 input options

o.k. to confirm input



Technical Information

Input of capital letters and digits.

Data Transfer from one Project to Another

```
3 DATA FROM O. PRJ.
```

Technical Information

Data from a project selected now will be copied into the current project.

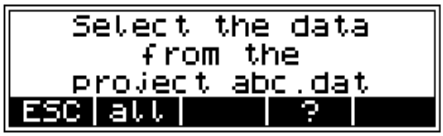
YES to confirm the project selected

↑, **↓** to scroll

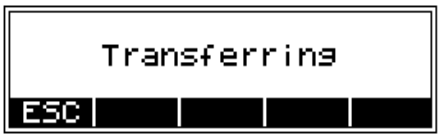
CD to change directory

? to call search menu

all to select all lines



YES, **NO** to accept or reject selection



ESC to quit menu

Deleting Project

5 DELETE PROJECT

YES, NO to accept or reject selection

Calling the project to be deleted:

Technical Information

Do not delete the project just selected.

Always delete the files in the DiNi® instrument, being implicated in this operation the deletion of the pertinent configuration files.

Directories are deleted by formatting the PC card!

Changing Project Name

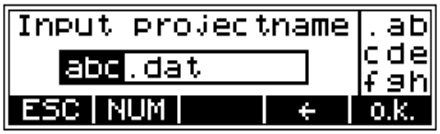
4 RENAME PROJECT

Calling the project name to be changed

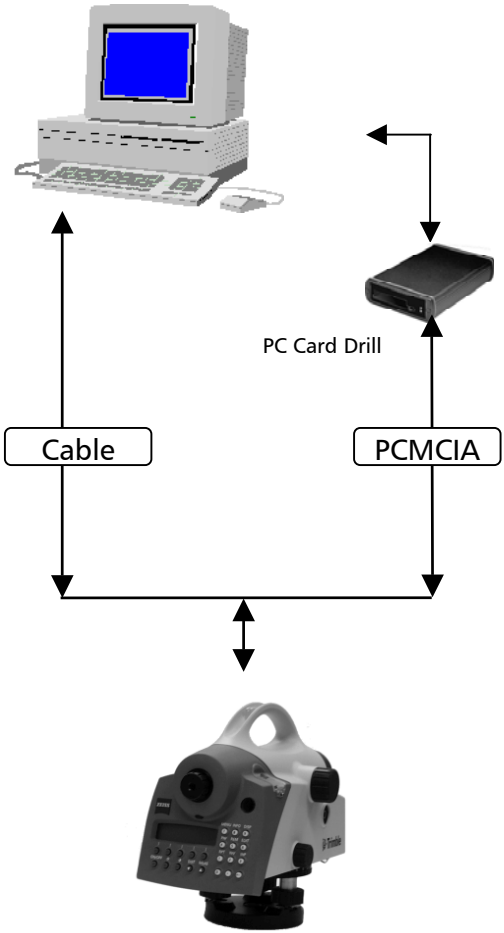
← to delete input

NUM, abc, 0 .... 9 input options

o.k. to confirm input



Data Transfer between DiNi® and PC



Cable for data transfer with Xon/Xoff protocol:

DiNi® ↔ PC cable:
Order number
708177-9470.000

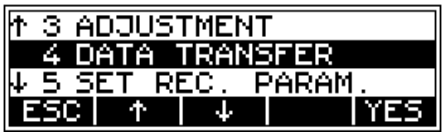
Data can be transferred between DiNi® ↔ PC via cable or PCMCIA card.

This allows an easy data exchange between instrument and computer.

MENU

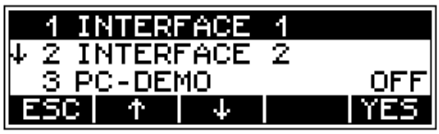
Select the data transfer.

4 DATA TRANSFER



Two different interfaces can be defined (e.g. COM1 and printers).

1 INTERFACE 1



First, the interface parameters are defined once, followed by the definition of the direction of transfer.

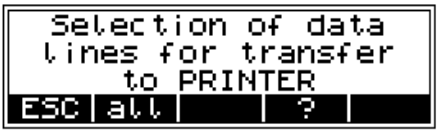
3 SET PARAMETERS

Interface parameters for transmitting and receiving project files.:

Baudrate:	9600
Protocol:	Xon/Xoff
Parity:	ungerade
Stop bits:	1
Data bits:	8

Select the direction of transfer

Select the data lines to transfer



📖 **6 Data management**
Editor
Display of Data Lines

☞ Tip

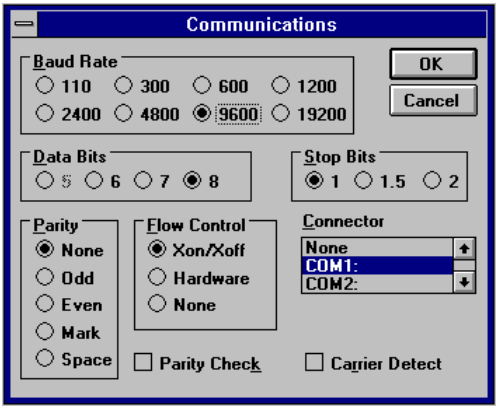
For data tranfer to the PC, you can use e.g. the MS-Windows™ Terminal program.

Connect both devices, the instrument and the PC, by a serial interface cable and set the interface parameters in the Terminal program.

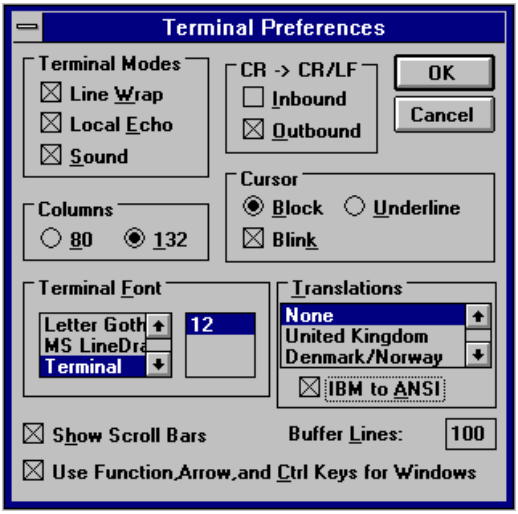
PC Terminal Settings

Example for Windows™ 3.xx Terminal program:

Set the PC for data trandfer as follows: communication port as shown in the picture (e.g.):



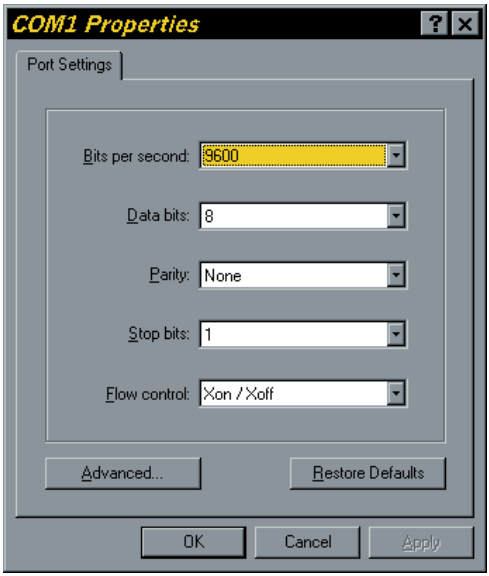
For sending or receiving a project file, set the terminal preferences as shown in the following picture:



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

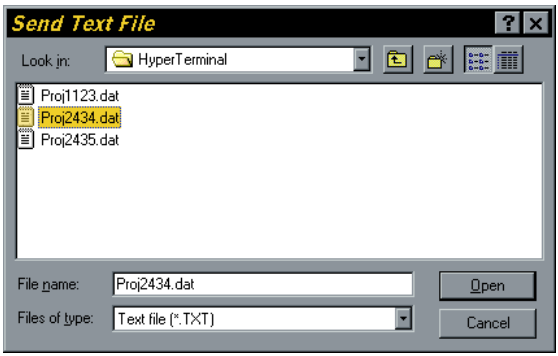
Example Windows™ 95/98 or Windows™ NT Hyper-Terminal Program:

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



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

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



PC – Demo

To use this function, a small PC program (PCDEMO) is necessary which can be delivered at your request.

This function is useful for demonstrating purposes.

MENU

To call up this function at the instrument.

To switch the PC-DEMO mode "ON".

After the program has been started on PC, it is immediately connected with the instrument and displayed online on the PC screen.

Data record formats of Dini®

M5 and Rec 500 record format

The two record formats (Rec 500, Rec E) can be used for both recording and data transfer. Please note that the Rec 500 format contains less information as it does not include the type identifier for the identification block and the measuring units for the data.

> **Technical**
>
> It is recommended to use the Rec E format only.

It should be noted for both formats that the address fields are only loaded with values if data is transferred from the DiNi® to the periphery. In the periphery → DiNi® transfer, the address may be loaded with values, but is not evaluated.

The M5 data record format

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

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

1 Address block

1 information block
3 numerical data blocks

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

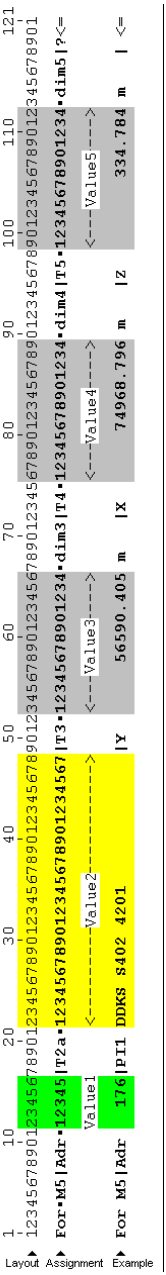
The M5 data line

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

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

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

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



Col. 120-121: Carriage Return <, Line Feed
Column 119: Blank field or internal code
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	DiNi® 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	Internal Code or ■

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

📖 **6 Data management**
Data format
PI and Markings

The point identification (PI) in M5 Format

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

The text information in the M5 Format

Content: ASCII-Text with Type identifier TI, TG, TP, TO...

The text information has 27 characters available and is placed in the same position as the PI.

📖 **6 Data management**
Data format
Type identifier (TK)

The type identifier in the M5 Format

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

TK defined with two characters.

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

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

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

Example:

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

The configuration file CTL$$$xx.CFG

The configuration file is used for the project administration of the DiNi® 12 and 12 T instruments with PCMCIA Data memory.

```
file=11_02_97.DAT
maxpoint=1000
lastpoint=106
startsearch=1
maxmark=7
actMark=1
mark(1)=TM
BC2D2D2D2D2D2D432D2D2D2D2D3EBC2D2D2D2D2D492D2D2D2D2D3E000D000023000008
mark(2)=TM
00000000000000000000000000000000000000000000000000000000000023FFFF08
mark(3)=TM
00000000000000000000000000000000000000000000000000000000000023FFFF08
mark(4)=TM
00000000000000000000000000000000000000000000000000000000000023FFFF08
mark(5)=TM
00000000000000000000000000000000000000000000000000000000000023FFFF08
mark(6)=TM
00000000000000000000000000000000000000000000000000000000000023FFFF08
mark(7)=TM
00000000000000000000000000000000000000000000000000000000000023FFFF08
```

Example of a configuration file from Rec Elta® with specified marks.

Statement	max. length	Content of the configuration file
file=	16 Bytes	Name of project data file with extension .DAT Value range: FILENAME.DAT
maxpoint=	6 Bytes	Max. number of lines. Value range: 1 , ... , 9999
lastpoint=	6 Bytes	Number (Address) of last line. Value range: 1 , ... , 9999
startsearch=	6 Bytes	Number (Address) of first line. Value range: 1
maxmark=	6 Bytes	Max. number of markings. Value range: 1 , ... , 7
actMark=	6 Bytes	Index of current markings. Value range: 1 , ... , 7
mark(1)= mark(7)=	80 Bytes ... 80 Bytes	Definition of marking number 1 (Index) until Definition of marking number 7 (Index)

📖 **6 Datenmanagement**
Data formats
PI and Markings

A detailed description of the marking information and definition will be given in the ***PI and Markings*** chapter.

Generation and storage of configuration data files

In the instrument, the configuration data file will be generated automatically on the PCMCIA card once the project is opened up. To every data file, a configuration file is assigned containing control data. The file name is:

CTL$$$xx.CFG xx=00 to 99

The number xx is given in the order the projects will be opened.

The configuration data file of the current project uses the extension .000 in place of .CFG

CTL$$$xx.000 xx=00 to 99

In this file, the statement **file=** shows the current project file in the instrument.

Differences between the Rec Elta® and DiNi® standard configuration file upon generation in the instrument:

Rec Elta®	**DiNi®**
maxpoint=500	maxpoint=max. data lines
lastpoint=0	lastpoint=1 (a data line with a project name has already been generated)
mark(1)= one standard mark	mark(1)= , mark(2)= Standard mark occupied with 2 standard marks

Standard configuration file DiNi®:

```
file=NONAME.DAT
maxpoint=9999
lastpoint=1
startsearch=1
maxmark=7
aktMark=1
mark(1)=TM
BC44694E69504E3EBC2D432D3E20BC2D54494D452D3E20BC5A4E3E00070E0223000008
mark(2)=TM
BC44694E69504E3EBC2D432D3E20BC413E202020202020BC5A4E3E0007000023000008
mark(3)=TM
00000000000000000000000000000000000000000000000000000000000023FFFF08
mark(4)=TM
00000000000000000000000000000000000000000000000000000000000023FFFF08
mark(5)=TM
00000000000000000000000000000000000000000000000000000000000023FFFF08
mark(6)=TM
00000000000000000000000000000000000000000000000000000000000023FFFF08
mark(7)=TM
00000000000000000000000000000000000000000000000000000000000023FFFF08
```

📖 **6 Data management**
Data formats
PI and Markings

In DiNi® are usually only two definitions of marks, mark(1) and mark(2), available. The other marks, mark(3) to mark(7), are not used, but are kept for compatibility reasons.

Project working documentation.

With every relevant action (storing, exchange of marks), the configuration file in the instrument is kept operating.

The output of data in the M5 format on a printer

The output of data in the M5 format on a printer may cause problems as the data lines are longer than a normal print line for A 4 sheets. The following is therefore recommended:

Direct data transfer to a printer

Select condensed font in the printer or use A 3 printer

Printing data from a DOS editor

Select condensed font in the printer or use A 3 printer

Printing from a WINDOWS applcation

do not use TrueType font or proportionally spaced font, but e.g. Courier, select a small font size, use landscape print format

Description of the Rec500 Data Record Format

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

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

1 Address block
1 Block Information
3 numeric Data blocks

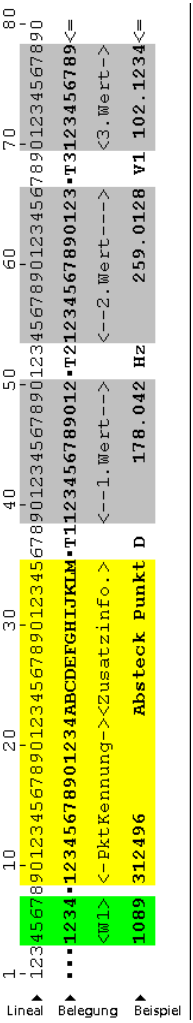
The Rec500 format is divided in 5 marking blocks (analogous the M5 format). These blocks differ in their block length from the M5 format, 80 characters (Bytes) are available on a data line.

The Rec500 Data line

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

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

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



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

Column 70-78: 3. Value block

Column 68-69: Type identifier for 3. Value

Column 54-66: 2. Value block

Column 52-53: Type identifier for 2. Value

Column 39-50: 1. Value block

Column 37-38: Type identifier for 1. Value

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

Column 9-35: Point identification PI

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

Column 4-7: memory address of data line

Column 1-3: 3 Blanks

■ Blank

The point identification in Rec500 Format

📖 PI and markings

The PI is divided into two areas:

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

Area 2: alpha numeric area for additional point information

Definition of the Type Identifiers

Definition	Type identifiers are assigned to the 5 measuring data blocks of pre-set codes, which show the number or character value of the block.
Type ID´s are defined with two characters.	Type identifiers are (except for **Adr**) defined with two characters. If only one character is necessary, the second character is blank. The code is case sensitive.

Type identifiers - CZ Formats M5 and Rec500

TI in Display.	TI in Record	Designation
R	R	Single staff reading
Rb	Rb	Staff reading in backsight
Rf	Rf	Staff reading in foresight
Rz	Rz	Staff reading in intermediate sight
sR	sR	Standard deviation of mean staff reading (in multiple meas.)
Ri	Ri	Minimum sighting height
dR	dR	Station difference
Z0	Z	Height of backsight point
Z	Z	Height of a point measured in foresight
Z	Z	Height of intermediate sight
Zi	-	Instrument height (equal to sight. h.)
Zs	Z	Nominal height/closing height
dh	dh	Height difference from previous measurement
h	-	Height difference of a station (for display only)
Sh	-	Height difference of complete line (for display only)
dz	dz	Setting out difference (nominal-actual)
dz	dz	Closing difference of line (nominal-actual)
HD	HD	Single distances
HD	HD	Backsight distance
HD	HD	Foresight distance
Da	-	Mean value of backsight distance (for display only)
Da	-	Mean value of foresight distance (for display only)
x	x	Local x coordinate *)
y	y	Local y coordinate *)
n	n	Local n coordinate *)
e	e	Local e coordinate *)
Hz	Hz	Hz direction *)
A	A	Distance addition constant *)
HD	HD	Intermediate sight distance
Dm	Dm	Maximum sighting distance
Db	Db	Total of backsight distances
Df	Df	Total of foresight distances
c_	c_	Line of sight error
rk	rk	Refraction coefficient
Of	Of	Staff offset
P, PNo	*	Point number (* recorded in PI)
Code	*	Point code (* recorded in PI)
Zno	*	Line number (* recorded in PI)
Sno	*	Station number (* recorded in PI)
-	TO	Text information, general
-	KD	Point identification (general data)

***)** on DiNi® 12 T only

Attention! Values which are neither displayed nor recorded are marked by a dash (–). The Db and Df data refer to the last station completed.

Type identifier according to language

The following table lists all type identifiers and the possible position of characters after the comma (,????) as well as signs (±) which differ in their meaning from the English type identifiers:

Type identifier	,????	±	Meaning
Db			Total of backsight distances (levelling)
Df			Total of foresight distances (levelling)
Dm			Maximum sighting difference (levelling)
dR			Station difference (levelling)
e	2,3,4		Easting-Coordinate (local)
HD			Horizontal Distance
KN			Point identification leveling (beginning and end of line)
n	2,3,4		Northing-Coordinate (local)
Of			Staff offset (levelling)
R			Single staff reading (levelling)
Rb			Staff reading backsight (levelling)
Rf			Staff reading foresight (levelling)
Ri			Minimum sighting height (levelling)
Rz			Staff reading in intermediate sight (levelling)
SD			Slope Distance (levelling)
TN			Text information levelling (beginning and end of line)

Definition of PI and Markings

Point identification

The **Point identification PI** is used for the description of point measuring data. To permit the identification of a measurement in subsequent evaluation, it must be marked or described further.

Markings

The data structure with PI is defined by **Markings** which define how the point identifier is put together. The following codes are used for the marks in the CZ data formats:

- Point number (numeric, in increments)
- Point information (add. text information)
- Point codes
- Time information

Availability

The availability and convenience of the markings depends on the memory and the data format definition of the instruments.

Markings in the M5 Format

PI in Column 22-48 of M5 Data line.

PI and markings in the M5 Format consist of 27 characters (Bytes).

A maximum number of 10 marks can be assigned to the PI in the M5 format (depending on the instrument) which are marked by PI1 to PI0 (Column 18,19,20) in the preceding type identification.

DiNi® - Markings in the M5 Format

✍ 2 Markings PI1 and PI2

The DiNi® provides 2 different types of markings for the PI.

Storage of DiNi® Markings

The DiNi® markings are stored in the internal memory. In the DiNi® instruments provided with PCMCIA memory, these 2 markings are stored in the configuration files CTL$$$xx.CFG of the projects. For this purpose, at least two markings have still to be freely available in the CFG file.

The structure of the DiNi® Markings

```
Layout gage:  1         10        20      27
              12345678901234567890123456
```

Marking 1: **ppppppppccccc tttttttnzzzz**

Marking2: **ppppppppccccc aaa zzzz**

Meaning:

pppppppp 8-digit point number block

ccccc 5-digit point code number block

tttttttt measuring time block in the selected time format (e.g. hh:mm:ss)

zzzz 4-digit line number

aaa 3-digit number of instrument stations

n number of measurements (0 corresponds to max.10 measurements)

> ☞ Tip
>
> The two PI versions have been permanently set and cannot be influenced by the user. The entries of the values are always right-aligned, any missing digits are filled with blanks.
>
> Mark version no. 1 is normally used in all measured data lines. Only the number of instrument stations is recorded in mark version no. 2 the value **aaa** at the end of a levelling line for checking purposes.

Description of the Value blocks

3 Value blocks

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

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

Type identifiers

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

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

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

Caution!

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

The following units are defined:

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

CZ Format ID and address block

CZ Format ID in Columns 1-6

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

For M5 Format marking for M5 Format

„For" and the marking M5, R4 or R5 are divided by a Blank (ASCII 32).

Address blocks

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

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

Adr 00001 or
Adr 1 is allowed.

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

Selecting the Recording Data

DiNi® 12, 22
Selecting the recording data

- Standard deviation of the mean staff reading sR is recorded only R-M mode and in repeat measurements.

- If line levelling is active at the time of recording, the line number is recorded at the last 4 places of point identification PI in every data line (also lines of text).

- In place of ....., the current point identification is output..

- Later **line adjustment** is possible only, if for line levelling the recording data **RMC or R,HD.Z** had been selected (DiNi® 12).

DiNi® 12 T
Selecting the recording data

- The standard deviation of the mean staff reading sR is recorded only in multiple measurement in the R, HD, sR mode.

- In single point measurements and intermediate sights in the coordinates mode, the coordinates are always recorded in a second line. The names and sequence of the axes depends on the settings in the Set Instr. Param. menu. The options are y,x , x,y , n,e or e,n.

- If line levelling is active at the time of recording, the line number is recorded at the last 4 places of point identification PI in every data line (also lines of text).

- In place of ....., the current point identification is output.

Set the recording parameters

Later **line adjustment** is possible only, if for line levelling the recording data **R, HD, Z** had been selected.

📖 **3 First steps**
Presettings
Setting of Recording
DiNi® 12/22/12 T

Recording data and data lines with DiNi® 12, 22

Mode	Content of Record							Comments
	Content of PI	R-M			RMR			
		T1	T2	T3	T1	T2	T3	
SPM *1)	.....	R	HD		R	HD		
RPT	.....	R	HD	sR	R	HD		
Line	Start of line BF							
	Start of line BFFB							
	.....			Z			Z	reference height
	Continue line							after line interruption
Line BF	.....	Rb	HD	sR	Rb	HD		backsight 1
	.....	Rf	HD	sR	Rf	HD		foresight 1
	.....						Z	foresight height
Line BFFB	.....	Rb	HD	sR	Rb	HD		backsight 1
	.....	Rf	HD	sR	Rf	HD		foresight 1
	.....	Rf	HD	sR	Rf	HD		foresight 2
	.....	Rb	HD	sR	Rb	HD		backsight 2
	.....						Z	foresight height
Line IntM	Intermediate sights							
	.....	Rz	HD	sR	Rz	HD	Z	
	End of interm. sights							
Line SOut	Stake out							
	.....		dz	Z		dz	Z	stake out diff., nom. height
	.....	Rz	HD	sR	Rz	HD	Z	check measurement
	End of stake out							
Line end	.....		dz	Z		dz	Z	nominal closing height
	.....	Db	Df	Z	Db	Df	Z	actual closing height
	End of line							

***1) SPM = single point measurement**

Mode	Content of Record						Comments
	Content of PI	R-M			RMR		
		T1	T2	T3	T1	T2	T3	
IntM,SOut during SPM *1)	Backsight measurement							
	.....			Z			Z	reference height
	.....	R	HD	sR	R	HD		backsight meas.
	refract.ON/ earth curv.ON							
	Date Time							
INP	optical measurement							before input data
Input	Input value	rk			rk			
	Input value	Lx			Lx			
REM line	Info							enter info
Meas. unit	Measuring unit: meters							m, ft or inch after change
Normal/INV	Normal measurement							after change
	Inverse measurement							after change

The recording data line "Optical measurement " refers to the next measurement even if it is not recorded in the following data line.

Recording data and data lines with DiNi® 12 T

Mode	Content of Data Record												Comments
	Content of PI	Recording Setting											
		-R , HD, sR-			-R, HD, Z-			-HD, Hz, R-			-HD, Hz, Z-		
		T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	
SPM *1)	.....	R	HD		R	HD		HD	Hz	R	HD	Hz	R	
RPT	.....	R	HD	sR	R	HD		HD	Hz	R	HD	Hz	R	
	.....	y	x		y	x		y	x		y	x		only in coord. mode
Line	Start of line BF													
	Start of line BFFB													
	.....			Z			Z			Z			Z	reference height
	Continue line													after line interruption
Line BF	.....	Rb	HD	sR	Rb	HD		HD	Hz	Rb	HD	Hz	Rb	backsight 1
	.....	Rf	HD	sR	Rf	HD		HD	Hz	Rf	HD	Hz	Rf	foresight 1
	.....						Z						Z	foresight height
Line BFFB	.....	Rb	HD	sR	Rb	HD		HD	Hz	Rb	HD	Hz	Rb	backsight 1
	.....	Rf	HD	sR	Rf	HD		HD	Hz	Rf	HD	Hz	Rf	foresight 1
	.....	Rf	HD	sR	Rf	HD		HD	Hz	Rf	HD	Hz	Rf	foresight 2
	.....	Rb	HD	sR	Rb	HD		HD	Hz	Rb	HD	Hz	Rb	backsight 2
	.....						Z						Z	foresight height
Line IntM	Intermediate sights													
	.....	Rz	HD	sR	Rz	HD	Z	HD	Hz	Rz	HD	Hz	Z	
	.....	y	x	Z	y	x	Z	y	x	Z	y	x	Z	only in coord. mode
	End of interm. sights													
Line SOut	Stake out													
	.....		dz	Z		dz	Z		dz	Z		dz	Z	stake out diff., nom. height
	.....	Rz	HD	sR	Rz	HD	Z	HD	Hz	Rz	HD	Hz	Z	check measurement
	End of stake out													
Line end	.....		dz	Z		dz	Z		dz	Z		dz	Z	nominal closing height
	.....	Db	Df	Z	Db	Df	Z	Db	Df	Z	Db	Df	Z	actual closing height
	End of line													
IntM,SOut in SPM *1)	Backsight measurement													
	.....			Z			Z			Z			Z	reference height
	.....	R	HD	sR	R	HD		HD	Hz	R	HD	Hz	R	backsight measurem.

*1) SPM = single point measurement

Mode	Content of Data Record												Comments
	Content of PI	Recording Setting											
		- R, HD, sR -			-R, HD, Z-			-HD, Hz, R-			-HD, Hz, Z-		
		T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	
Rpt	Repeat station													before repetition
	Repeat measurement													before repetition
Adjustment	Adjustment	c_			c_			c_			c_			
	refract.ON/ earth curv.ON													
	Date Time													
INP	optical measurement													before input data
Input	Input value	rk			rk			rk			rk			
	Input value	Lx		A	Lx		A	Lx		A	Lx		A	
REM line	Info													enter info
Meas. unit	Measuring unit: meters													m or ft after change
	Measuring unit: DMS													DMS, grad, deg
Normal/INV	Normal measurement													after change
	Inverse measurement													after change
Meas. mode	Levelling mode													
	Total station mode													
	Coordinates modes													
	Distance E326													single distance measurement in levelling mode

The recording data lines "Optical measurement " and "Distance E 326" refer to the next measurement even if it is not recorded in the following data line.

What is an Interface?

An interface is the point of contact between 2 systems or system areas, i.e. the point where information is interchanged. To ensure that it is understood by both the transmitting and receiving unit, specific rules must be defined for the transmission of signals and data.

Hardware interfaces are a physical connection between functional units such as measuring instruments, computers or printers. The following factors, for example, are of significance for the user:

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

Software interfaces establish the link between programs or program modules. The data to be transmitted must conform to a defined structure: the record format. If the two programs use different internal record formats, reformatting (data conversion) is required at one end.

User interfaces A further interface which is of particular importance for the handling of a system is the user interface. Interfaces between the user and the system are the screen, the keyboard and the options for user guidance provided by the software. In the DiNi® concept, special emphasis has been placed on the design of the user interface.

Hardware Interface of DiNi®

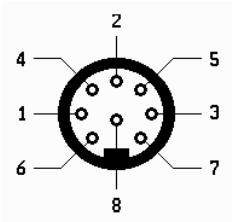
The interface for the periphery is of the asynchronous, serial type and conforms to DIN 66020 (RS 232 C / V.24 standard).
The interface is at the underside of the instrument.

The interface functions:

(1) Data transfer:
- Direct transmission of measured data between DiNi® and peripheral units (computers , printers)
- DiNi® control by function requests (remote control)
- Setting of parameters and constants, e.g. for external control or by service programs.

(2) Software updating

Assignment of the interface, connecting cable



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

Pin	Signal	Direction	Designation
1	*RTS	Out	RTS = 1:DiNi® is ready to receive data
			RTS = 0:DiNi® is not ready
2	*Gnd	-	Ground
3	*CTS	In	CTS = 1: periphery is ready to receive data
			CTS = 0: periphery is not ready
4	SD	Out	Transmitted data
5	ED	In	Received data
6	*Vcc	In	External supply voltage
7	*Vcc	In	External supply voltage
8	*Gnd	-	Ground

*not available in this cable

Connecting cable

The following cable can be used for data recording and for controlling the DiNi® by function requests from a PC:

708177 – 9470

☞ Technical

The "line control" protocol cannot be used as these cables do not include control lines.

Transmission Parameters and Protocols

Selectable transmission parameters

Recording data:
For the setting of recording parameters (selection of data to be recorded) see chapter 3 First steps /Before measurement .

Interface:

Parameters	Setting options
Format	REC E, REC 500
Protocol	REC 500, LN-CTL, XON-XOFF
Baud rate	300, 600, 1200, 2400, 4800, 9600, 19200
Parity	odd, even, none
Stop bits	1, 2
Time-out	OFF, 10-90s
Line feed	YES, NO

Transmission protocols

☞ Technical

The transfer direction to the DiNi® as described in the control diagrams is only possible in data transfer and in the remote control mode.

Definition of the terms used in the control diagrams of the protocols:

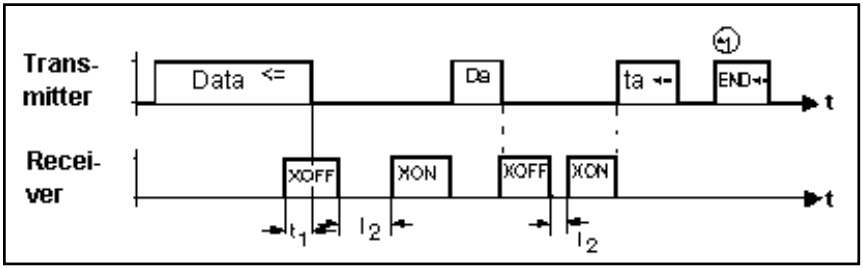
The transmitted data line is an output port on the DiNi®, the received data line is an input port on the DiNi®.
The following ASCII characters are used:

Text character A	=	ASCII character dec. 65
Text character B	=	ASCII character dec. 66
Text character Z	=	ASCII character dec. 90
< stands for CR	=	ASCII character dec. 13 (Carriage Return)
= stands for LF	=	ASCII character dec. 10 (Line Feed)
Control character XOFF	=	ASCII character dec. 19
Control character XON	=	ASCII character dec. 17

XON/XOFF control

The XON/XOFF protocol is a very simple, but efficient and frequently used data transfer protocol. It should preferably be employed for so-called terminal programs (e.g. terminal under Windows, Norton or Xtalk) and can be used for both data recording and data transfer from memory to a computer. For data transfer to the DiNi®, the same control diagram applies as for the software dialog with modem control. The designations of the transmitted data line and received data line, however, are interchanged, as the DiNi® is now the data receiver.

time t_1: is dependent on the baud rate setting. On reception of a XOFF signal, the character transmission in progress is always completed. A further character may follow, especially if a high baud rate has been set.



Control diagram of the XON/XOFF software dialog´ protocol

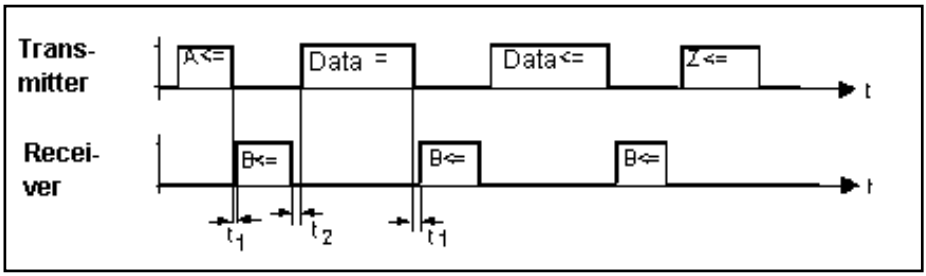
time t_2: is dependent on the time-out setting. If time-out has been set e.g. to 20 sec, the XON signal must arrive at the DiNi® transmission line not later than after these 20 sec in order to permit the transfer to be continued. Otherwise, the error message Time-out will be displayed.

Technical*1

If the XON/XOFF protocol is used in data transfer (transmission of data from memory via the serial interface to the periphery), the additional character string `END CR/LF´ is output at the end of the transfer. This does not happen in the recording mode.

*1 see Fig. " Control diagram of the XON/XOFF protocol" on preceding page.

Rec 500 software dialog (Rec 500 - Protocol)



Control diagram of the `Rec 500 software dialog´ protocol

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

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

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

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

$10 \text{ ms} > t_2 < 100 \text{ ms}$

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

Rec 500 software dialog with modem control

For data transfer via a modem (dial-line modem), the Rec 500 software dialog with additional active control lines can be used.

This protocol does not make any sense in the recording mode and is therefore not available there. It has only been installed in the data transfer mode and is suitable for bidirectional transfer.

Make sure to use a cable with correct wiring as specified below:

DiNi® connector (8-pin plug)		Modem (25-pin plug)	
1	RTS	4	RTS
2	Ground	7	Ground
3	CTS	5	CTS
4	SD	2	SD
5	RD	3	RD

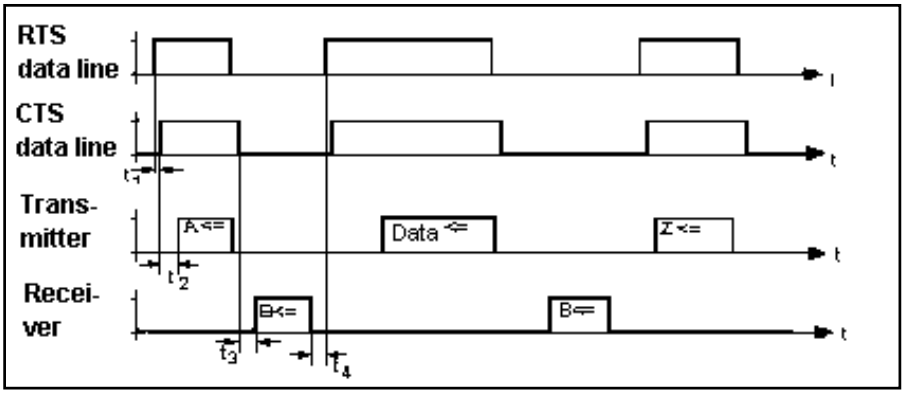
In addition, it may be necessary to implement a bridge from DTR to DSR in the modem. If there are still any problems, contact the system technology or customer advice department of the Surveying Division.

☝ Attention!

Make sure that the interface parameters such as the baud rate and parity between DiNi® and the modem and, at the other end, between the computer and the modem correspond to each other.

Once the transfer process has been started, the RTS line switches to the `Log. 1´ status, thus signalling the transfer request to the modem. As soon as a connection exists between the modem and the opposite station, this is indicated by a 0/1

status change in the CTS line.



Control diagram of the protocol 'Rec 500' software dialog with modem control

time t_1 is typically 80 ms of this process. If no connection can be established or if the time required for this process exceeds the selected time-out, an error message is displayed.

time t_2 is the interval between a 0/1 status change of CTS (ready to receive status) and the transmission of a character string by DiNi®. Depending on the type of string to be transmitted (control character or recording line), this interval is

$$1 \text{ ms} < t_2 < 100 \text{ ms}$$

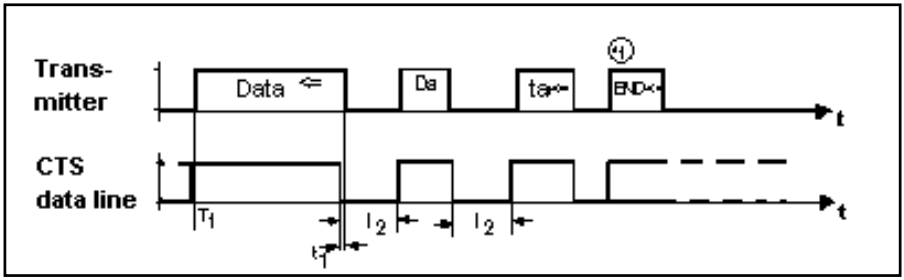
time t_3 is the time required for the switchover of the transfer direction. Since a modem link normally transmits data only in semiduplex operation, this time is required after the end of the RTS-CTS transmission request to also allow the opposite station to signal a transmission request.

$$80 \text{ ms} < t_3 < t_{\text{Time-out}}$$

time t_4 is 10 ms to 100 ms depending on the type of recording line involved.

Line control (LN-CTL)

This line handshake widely employed in the past can be used both in the recording mode and for data transfer. In the recording mode, preference should be given to the XON/XOFF or Rec 500 control protocol. For data output on a printer, however, the line control protocol is very frequently used.



Control diagram of the line control protocol in data output

time moment T_1: prior to the output of the first data record, the CTS line must have been switched to the `Log 1´ status by the connected peripheral unit. If the CTS line is set to the `Log 0´ status when transmission is started, the counting for time-out is initiated. After the end of time-out, the error message Time-out is then displayed before any data is output.

> **Technical**
>
> If data transfer using the line control protocol is not possible, this may be due to incorrect or defective wiring of the connecting cable.

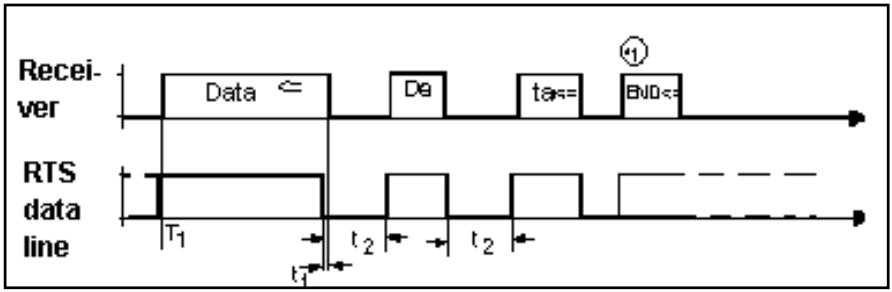
time t_1 is dependent on the baud rate setting. When the CTS line status changes from 1 to 0, the

transmission of a character in progress is always completed. A further character may follow, especially if a high baud rate has been set.

time t_2 is dependent on the time-out setting. If time-out has been set e.g. to 20 sec, the CTS line status must change from 0 to 1 not later than after these 20 sec in order to permit the transfer to be continued. Otherwise, the error message Time-out will be displayed.

Technical

***1:** If the line control protocol is used in data transfer (data transmission from memory via the serial interface to the periphery), the additional character string `END CR/LF´ is output at the end of the transfer. This does not happen in the recording mode.



Control diagram of the line control protocol in data reception

In the transfer direction `Transmit data to DiNi®´, the data transfer is controlled by the RTS line. The DiNi® is only ready to receive data if the RTS line (DiNi® output port) switches to the `Log. 1´status.

If the RTS setting is reversed (1 / 0 status change), **time t_1** allows the current byte to be completely transmitted by the periphery.

With the RTS line switched to the `Log 1´ status, characters are expected within the selected time-out. Otherwise the error message I/O Time-out is displayed.

This transfer direction can only be used in the data transfer mode, not in the recording mode.

DiNi® Control via Serial Interface (Remote Control)

5 SET REC. PARAM.
1 RECORDING OF DATA
1 REMOTE CONTRL ON

The DiNi® can largely be remote-controlled by the exchange of control commands between the periphery and the instrument via the interface.

> **Attention!**
>
> For the operation of the DiNi® via the keyboard, it is of no importance whether remote control is switched on or off. It is recommended, however, to deactivate remote control if this function is not used. This helps to further reduce the power consumption of the instrument.

Triggering Measurements

Measurements can be triggered in the DiNi® by sending a function request via the RS 232 C interface:

2 PARAMETER SETTING

- set measuring mode in DiNi®
- set the interface parameters for this control mode
- set the record format: either the Rec E format or the Rec 500 format can be used.

No matter whether the measurement is triggered via function requests or on the keyboard, the transmitted record content is the same. If the record comprises less than 3 values, the remaining space is filled with blanks so that the overall record length always remains constant.

Data set content:

Value 1: Staff reading
Value 2: Distance, height difference
Value 3: Height (not possible with remote control)

Command (function request) to be transmitted to :

DiNi® 12, 22

FML ↵ Triggers a measurement (staff reading and distance measurement)

SEO ↵ Shuts off the instrument

DiNi® 12 T

FML ↵ Triggers a measurement (staff reading and distance measurement) in the levelling mode

FMR ↵ Triggers a measurement in the total station mode

FMK ↵ Triggers a coordinate measurement

FMW ↵ Triggers an angle measurement

SEO ↵ Shuts off the instrument

📖 **5 Measuring Principles and Components**
Multiple measurements

For measurement commands FML, FMR and FMK, the current settings of repeat measurement apply. If you have set the parameters nM and mR before sending the measurement command, it is possible to trigger repeat measurements also via the interface. The data record will then contain the number of measurements actually carried out in place of the obtained standard deviation of mean staff readings.

Technical

The measurement result will be recorded anyway, even if the pre-set standard deviation was exceeded after the maximum number of measurements had been taken.
Hence, you must compare the computed standard deviation with the pre-set one externally.

Response from DiNi® to the function request:

the DiNi® transmits a data record in the selected record format.

Commands for Reading and Setting Instrument Parameters on DiNi® 12, 22

Meanings of the Commands	R-Commands	Response from DiNi® 12, 22 and Setting Commands	Response in case of error
Instrument identif.	?0000↙	!0000ΔΔ|Δ701530Δ0000.000ΔΔΔΔΔ↙	E↙
Instrument number	?0100↙	!0100ΔΔ|ΔΔΔΔΔΔΔΔ0205549ΔΔΔΔΔ↙	E↙
Collimation error	?Kc_Δ↙	!Kc_ΔΔΔ|ΔΔΔΔΔΔΔΔΔΔ0.0033ΔDMSΔ↙	E↙
Max. sighting distance	?KEaΔ↙	!KEaΔΔΔ|ΔΔΔΔΔΔΔΔΔΔΔΔ100ΔmΔΔΔ↙	E↙
Minimum sighting height	?KLiΔ↙	!KLiΔΔΔ|ΔΔΔΔΔΔΔΔ0.00000ΔmΔΔΔ↙	E↙
Maximum sighting height	?KLaΔ↙	!KLaΔΔΔ|ΔΔΔΔΔΔΔΔ0.00000ΔmΔΔΔ↙	E↙
Max. station difference	?KdLm↙	!KdLmΔΔ|ΔΔΔΔΔΔΔΔ0.01000ΔmΔΔΔ↙	E↙
30 cm Test; 1=ON 0=OFF	?KT30↙	!KT30ΔΔ|ΔΔΔΔΔΔΔΔΔΔΔΔΔΔ0ΔbitΔ↵↵	E↵↵
Refraction coefficient	?KrkΔ↙	!KrKΔΔΔ|ΔΔΔΔΔΔΔΔΔΔ1.000ΔmΔΔΔ↙	E↙
Staff offset	?KLxΔ↙	!KLxΔΔΔ|ΔΔΔΔΔΔΔΔ0.00000ΔmΔΔΔ↙	E↙
Setting the system time	?KSDT↙	!KSDTΔΔ|ΔΔΔΔΔΔΔΔ15:56:44ΔΔΔΔΔ↙	E↙
Setting the system date	?KSDD↙	!KSDDΔΔ|ΔΔΔΔΔΔΔΔ02.01.95ΔΔΔΔΔ↙	E↙
Setting the system time format 24h or AM/PM	?KFDT↙	!KFDTΔΔ|ΔΔΔΔΔΔΔΔΔΔΔΔ24hΔΔΔΔΔ↙	E↙
System date format ddmmyy/yymmdd/mmddyy	?KFDD↙	!KFDDΔΔ|ΔΔΔΔΔΔΔΔΔΔttmmjjΔΔΔΔΔ↙	E↙
Measuring unit and resolution for heights	?KSML↙	!KSMLΔΔ|ΔΔΔΔΔΔΔΔ0.00001ΔmΔΔΔ↙	E↙
Measuring unit for visual staff reading	?KSMI↙	!KSMIΔΔ|ΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔmΔΔΔ↙	E↙
Max. standard deviation for Repeat measurement	?KmLΔ↙	!KmLΔΔΔ|ΔΔΔΔΔΔΔΔΔΔ0.005ΔmΔΔΔ↙	E↙
Maximal number of Repeat Measurements	?KnMΔ↙	!KnLΔΔΔ|ΔΔΔΔΔΔΔΔΔΔΔΔΔΔ8ΔΔΔΔΔ↙	E↙
Resolution for distances (measuring unit is ignored)	?KSMS↙	!KSMSΔΔ|ΔΔΔΔΔΔΔΔΔΔ0.001ΔmΔΔΔ↙	E↙
Earth curvature correction 1 = on 0 = off	?KEKR↙	!KEKRΔΔ|ΔΔΔΔΔΔΔΔΔΔΔΔΔΔ0ΔbitΔ↙	E↙
Refraction correction 1 = on 0 = off	?KREF↙	!KREFΔΔ|ΔΔΔΔΔΔΔΔΔΔΔΔΔΔ1ΔbitΔ↙	E↙
Inverse measurement 1 = on 0 = off	?KFIR↙	!KFIRΔΔ|ΔΔΔΔΔΔΔΔΔΔΔΔΔΔ0ΔbitΔ↙	E↙
Acoustic signal on/off	?KSND↙	!KSNDΔΔ|ΔΔΔΔΔΔΔΔΔΔΔΔΔΔ1ΔbitΔ↙	E↙
Automatic shutoff 1 = on 0 = off	?KAPO↙	!KAPOΔΔ|ΔΔΔΔΔΔΔΔΔΔΔΔΔΔ1ΔbitΔ↙	E↙
Request for languages available in the instrument	?KLN1↙ ?KLN2↙	!KLN1ΔΔ|ΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔD__Δ↙ !KLN2ΔΔ|ΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔE Δ↙	E↙

| ASCII character 124 Δ Symbol for space ↵↵ Symbol for CR/LF

☝ Attention! Special aspects see on the over-next side.

Commands for Reading and Setting Instrument Parameters on DiNi® 12 T

Meanings of the Commands	Reading Commands	Response from DiNi® 12 T and Setting Commands	Resp.in case of error
Instrument identific.	?0000↙	!0000ΔΔ|Δ701530Δ0000.000ΔΔΔΔΔ↙	E↙
Instrument number	?0100↙	!0100ΔΔ|ΔΔΔΔΔΔΔΔ0205549ΔΔΔΔΔ↙	E↙
Collimation error	?Kc_Δ↙	!Kc_ΔΔΔ|ΔΔΔΔΔΔΔΔΔ0.0033ΔDMSΔ↙	E↙
Maximum sight.dist.	?KEaΔ↙	!KEaΔΔΔ|ΔΔΔΔΔΔΔΔΔΔΔ100ΔmΔΔΔ↙	E↙
Min.sighting height	?KLiΔ↙	!KLiΔΔΔ|ΔΔΔΔΔΔΔΔΔ0.00000ΔmΔΔΔ↙	E↙
Max.sighting height	?KLaΔ↙	!KLaΔΔΔ|ΔΔΔΔΔΔΔΔΔ0.00000ΔmΔΔΔ↙	E↙
Max.station difference	?KdLm↙	!KdLmΔΔ|ΔΔΔΔΔΔΔΔΔ0.01000ΔmΔΔΔ↙	E↙
30cm Test; 1=ON 0=OFF	?KT30↙	!KT30ΔΔ|ΔΔΔΔΔΔΔΔΔΔΔΔΔΔ0ΔbitΔ↙	E↙
Refraction coeffic.	?KrkΔ↙	!KrKΔΔΔ|ΔΔΔΔΔΔΔΔΔΔ1.000ΔmΔΔΔ↙	E↙
Staff offset	?KLxΔ↙	!KLxΔΔΔ|ΔΔΔΔΔΔΔΔΔ0.00000ΔmΔΔΔ↙	E↙
Distance add. Const.t	?KAΔΔ↙	!KAΔΔΔ|ΔΔΔΔΔΔΔΔΔ0.00000ΔmΔΔΔ↙	E↙
Setting the time	?KSDT↙	!KSDTΔΔ|ΔΔΔΔΔΔΔΔ15:56:44ΔΔΔΔΔ↙	E↙
Setting the date	?KSDD↙	!KSDDΔΔ|ΔΔΔΔΔΔΔΔ02.01.95ΔΔΔΔΔ↙	E↙
Setting the syst.time format 24h or AM/PM	?KFDT↙	!KFDTΔΔ|ΔΔΔΔΔΔΔΔΔΔΔΔ24hΔΔΔΔΔ↙	E↙
System date format ddmmyy/yymmdd/mmddyy	?KFDD↙	!KFDDΔΔ|ΔΔΔΔΔΔΔΔΔttmmjjΔΔΔΔΔ↙	E↙
Measuring unit and resolution for Height	?KSML↙	!KSMLΔΔ|ΔΔΔΔΔΔΔΔΔ0.00001ΔmΔΔΔ↙	E↙
Meas. Unit for angle.(resol.is ignored)	?KSMW↙	!KSMWΔΔ|ΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔgonΔ↙	E↙
Measuring unit for visual staff reading	?KSMI↙	!KSMIΔΔ|ΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔmΔΔΔ↙	E↙
Max. stand. deviation for Rep.measurement	?KmLΔ↙	!KmLΔΔΔ|ΔΔΔΔΔΔΔΔΔΔ0.005ΔmΔΔΔ↙	E↙
Maximal number of Repeat Measurements	?KnMΔ↙	!KnLΔΔΔ|ΔΔΔΔΔΔΔΔΔΔΔΔΔΔ8ΔΔΔΔΔ↙	E↙
Resol.for distances (meas.unit is ignored)	?KSMSΔ↙	!KSMSΔΔ|ΔΔΔΔΔΔΔΔΔΔ0.001ΔmΔΔΔ↙	E↙
Coordinate system and sequence of axes	?KSKO↙	!KSKOΔΔ|ΔΔΔΔΔΔΔΔΔΔΔΔΔ12ΔΔΔΔΔ↙	E↙
Earth curvature correction; 1=ON, 0=off	?KEKR↙	!KEKRΔΔ|ΔΔΔΔΔΔΔΔΔΔΔΔΔΔ0ΔbitΔ↙	E↙
Refraction correction 1 = on 0 = off	?KREF↙	!KREFΔΔ|ΔΔΔΔΔΔΔΔΔΔΔΔΔΔ1ΔbitΔ↙	E↙
Inverse measurement 1 = on 0 = off	?KFIR↙	!KFIRΔΔ|ΔΔΔΔΔΔΔΔΔΔΔΔΔΔ0ΔbitΔ↙	E↙
Acoustic signal on/off	?KSND↙	!KSNDΔΔ|ΔΔΔΔΔΔΔΔΔΔΔΔΔΔ1ΔbitΔ↙	E↙
Automatic shutoff 1 = on 0 = off	?KAPO↙	!KAPOΔΔ|ΔΔΔΔΔΔΔΔΔΔΔΔΔΔ1ΔbitΔ↙	E↙
Request for and setting of Hz orient.	?KHzΔ↙	!KHzΔΔΔ|ΔΔΔΔΔΔΔΔΔ0.0000ΔgonΔ↙	E↙
Request for languages available in the instrument	?KLN1↙ ?KLN2↙	!KLN1ΔΔ|ΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔD__Δ↙ !KLN2ΔΔ|ΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔE__Δ↙	E↙

| ASCII character 124 Δ Symbol for space ↵ Symbol for CR/LF

Special aspects:

Setting of the instrument identification and instrument number is not possible.

The setting command
!KLNn∆∆|∆∆∆∆∆∆∆∆∆∆∆∆∆∆∆∆aaa∆↙ is used for setting the appropriate language aaa as the current language, irrespective of number n of the language. Only those languages can be selected, which have previously been retrieved and are therefore available in the instrument.

The collimation error c- is transferred in the measuring unit DMS (degrees, minutes, seconds). The value 0.00033 DMS corresponds to 0°00'03.3"

For setting repeat measurements, observe the following items:
mR = 0 In any case, nM measurements are taken
mR > 0 When sR < mR is reached, repeat measurements are aborted.
Maximally, nM measurements are carried out.

If the command syntax is not correct, the DiNi® transmits the message: E↙

In the event of a functional error of the DiNi®, the DiNi® sends the message: Exxx↙, where xxx is the error code of the DiNi® 12,12 T or 22.

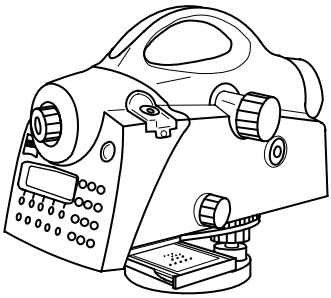
Used for DiNi® 12 T only

?Khz∆↙ is used to request the Hz direction currently set.
The Hz direction transferred with
!KHz∆∆∆|∆∆∆∆∆∆∆∆0.00000∆gon∆↙ (in this case 0.00000 grad) is assigned to the sighted direction after the next measurement. This permits the orientation of the Hz circle.

The values ab in the setting command
!KSKO␣␣|␣␣␣␣␣␣␣␣␣␣␣␣ab␣␣␣␣␣␣↵
have the following meanings:

a=1: HW=x, RW=y
(HW.. northing, RW.. easting)
a=2: HW=y, RW=x
a=3: HW=n, RW=e
b=1: sequence 1.RW, 2.HW
b=2: sequence 1.HW, 2.RW

The use of rechargeable PCMCIA SRAM cards from Centennial



The use of rechargeable PCMCIA SRAM cards from Centennial provides the following advantages:

- No change of batteries at recurring intervals required
- No problems with the back-up battery that, with some types of card, preserves data while changing the battery
- Due to their encapsulated construction and special case design, these cards feature higher resistivity, rigidity and robustness.

Data preservation and charging

- If the card is not inserted, preservation of stored data is guaranteed for a period of one year in the temperature range from 0 °C to 40 °C. In the temperature ranges from - 40 °C to 0 °C and from 40 °C to 85 °C and with the card not being inserted, data preservation is guaranteed for a period of 20 days.
- If the card is rarely used, the rechargeable battery may discharge partly or even completely. This state will be displayed on DiNi® by two corresponding system messages when inserting the card.
- If the battery is completely discharged, it must be inserted in the switched on PC for at least 8 hours to become fully recharged.

Compatibility of DiNi® SRAM DOS format with PCMCIA standard

The SRAM cards of Type 1 of the following memory capacities are supported: 256 KB, 0.5 KB, 1 MB, 2 MB, 4 MB and max. 8 MB

For general handling of these cards refer to the instructions and recommendations given by the card manufacturer.

Also, for formatting such cards on PC and checking the used back-up batteries refer to the information provided by the manufacturer of the PCMCIA drive and their PC utility software.

The DOS format is handled by the DiNi® 12 / 12 T PCMCIA interface as per PCMCIA Standard Card Services Specifications (CIS) Revision 2.1 of July 1993.

The SRAM card is formatted as pseudo floppy disk. Thus, the SRAM floppy disk contains a CIS block, the DOS boot sector and three additional files containing DiNi® specific information.

Attention!

If you should use cards on the DiNi® with attribute memory (to be recognised only by the information provided with the cards), make sure to format the card on the PC only. Although formatting on the instrument is possible to carry out field work, reading of the card on the PC however cannot be guaranteed. If this procedure should nevertheless be necessary, data transfer will be possible then only from card to PC through the RS232 port. Subsequently, reformat the card on the PC..

CIS information

The CIS block is the first sector on the card. This block contains bit areas (Tupel) that, in defined order and size, represent a minimum of SRAM card parameters. Table 1 summarises the CIS Tupels used by DiNi® formatting software (this is important for selecting and using appropriate PC driver software).

List of CIS Tupels employed by DiNi® formatting software

Tupel code (hex)	Name	Description
	Layer 1	*Compatibility*
01	CISTPL_NULL	Null Tupel, to be ignored
13	CISTPL_LINKTARGET	Target for link
14	CISTUPL_NO_LINK	No link
	Layer 2	*Recording format*
40	CISTPL_VERS_2	Version 2 identifier
41	CISTPL_FORMAT	Format
44	CISTPL_DATE	Initialising date
	Layer 3	*Data organisation*
46	CISTPL_ORG	Organisation of data
FF	CISTPL_END	End of Tupel list identifier

The DiNi® formatting software is setting an SRAM access time of 250 ns (default setting in CIS block).

If you should use faster SRAM cards with a lower current consumption, these cards must be formatted on the PC using suitable driver software. Formatting on the PC provides higher efficiency only in processing SRAM card data on the PC. For data recording on the DiNi®, only the information listed in Table 1 is significant.

Contents and utilisation of CIS block information are described in detail in the PCMCIA standard, Revision 2.1 (July 1993).

DOS boot sector

Data recording of DiNi® 12 /12 T requires MS-DOS compatible data organisation of the PCMCIA SRAM card. Information necessary for access to individual sectors and data structures are prepared and stored in the boot sector during the formatting process.

The logic sector 0 of a DOS mass storage medium is its boot sector.

For reasons of compatibility, the DiNi® formatting software organises the boot sector of the SRAM pseudo floppy disk as per MS-DOS 3.30.

The structure of the boot sector and the access to the information contained in it is described in the MS-DOS 3.30 Programmer's Reference.

DiNi® - PCMCIA - Memory Card - Files

The DiNi® 12 PCMCIA interface software provides project-oriented data recording in maximally 5 directory levels. The data belonging to a project are saved to a selected directory by means of .CFG and .INI control files.

The root directory can handle a maximum of 240 file name entries.

Data file

With the DiNi® PCMCIA interface, the data file has a filename that corresponds with MS-DOS file naming conventions and filename extension .DAT. The data file may contain up to 9999 data lines. The data lines are stored on the SRAM card in REC E format M5.

The .CFG control file

To every data file, a configuration file is assigned containing control data. The name of this file is CTL$$$xx.CFG, where xx = 00 ... 99. The control file of the currently used data file uses the extension .000 in place of .CFG. Control and data files of the same name may be stored in different directories.

Field name	Max. field length (bytes)	Range of values (min., max.)	Meaning
file=	16	file-name.dat	name of project date file
maxpoint=	6	1, ..., 9999	max. number of lines
lastpoint=	6	1, ..., 9999	no. of last line
startsearch=	6	1	no. of first line
maxmark=	6	1, ..., 7	max. number of marks
aktmark=	6	1, ..., 7	index of current mark
mark(1)=	80	🕮 6 *Interface*	mark 1
.....	80	"	
mark(7)	80	"	mark 7

The .INI control file

The DNI$$$00.INI file is always created in the root directory. This file contains information on the current project data file and the file for data transfer from another project. The information structure of this file is formed by the filenames and path specifications of the current project file (CTL$$$xx.000) and data transfer file (CTL$$$xx.CFG).

Structure of control file DNI$$$00.INI

When an empty PCMCIA memory card is inserted in the drive, automatically three files will be created in its root directory:
- data file NONAME.DAT
- control file CTL$$$00.00 and
- control file DNI$$$00.INI

(In this case, project file and data transfer file are identical as no project has been selected yet by instrument operation.)

Field name	Field length (bytes)	Contents/ meaning	Example
Current project	15	filename CTL$$$xx.000	CTL$$$11.000
PATH current project	max. 68	path for CTL$$$xx.000	\BAU\BAUST1
Data transfer proj.	15	filename CTL$$$xx.CFG	CTL$$$01.CFG
PATH data transfer proj.	max. 68	path for CTL$$$xx.CFG	\INFO

Formatting a PC Card

MENU

4 DATA TRANSFER

4 UPDATE / SERVICE

1 FORMAT PC Card

With the DiNi® 12 and 12T it is possible to format a SRAM - PC Card.

Attention !

Make sure to transfer the data stored in the PC Card to another storage medium beforehand, as all data in the memory is lost during formatting.

7 Adjustment

The instrument adjustment defines the necessary corrections and correction values for the line sight of DiNi®, which are required to ensure optimum measuring accuracy. In this chapter the adjustment of the circular bubble is explained as well.

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 measurement results, particularly in case of different distances from instrument to staff. If the adjustment function of the main menu is activated, the instrument then offers the choice among different methods to eliminate such errors.

Calling up the adjustment function

```
3 ADJUSTMENT
```

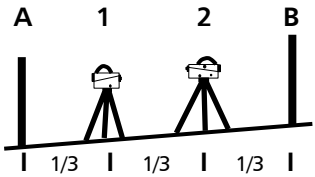
Adjustment:
the following adjustment functions are available:

Adjustment Menu

```
  1 Förstner method
↓ 2 Näbauer method
  3 Kukkamäki method
ESC | ↑ | ↓ |  | YES
```

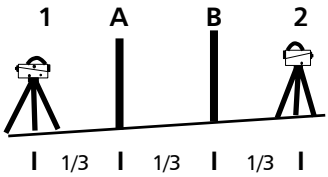
```
↑ 2 Näbauer method
  3 Kukkamäki method
↓ 4 Japanese method
ESC | ↑ | ↓ |  | YES
```

Förstner method



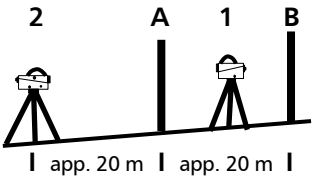
Set up two staves (A,B) roughly 45 m apart. Divide this distance into three and define 2 instrument stations (1,2) about 15 m away from the staves on the connecting line between them. Measure both staves from each of these stations.

Nähbauer method



Define a distance of approx. 45 m length and divide it roughly into three. Create an instrument station (1,2) at either end and set up a staff at each point marking one third of the connecting line (A,B). Measure both staves from each of the instrument stations.

Kukkamäki method



Set up 2 staves (A, B) roughly 20 m apart. First measure these staves from instrument station (1) located midway on the connecting line between the two staves. Then repeat the measurement from instrument station (2) which is located on the elongation of the two staff stations approx. 20 m outside the defined distance.

Japanese method

This method is largely identical with the Kukkamäki method. With this method, however, the distance between the staves should be about 30 m with station (2) being about 3 m behind staff A.

Ambient temperature and sun radiation

☝ 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).

Earth curvature and refraction

☝ Attention!

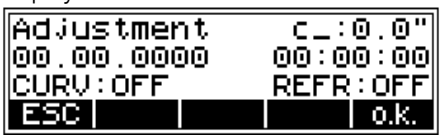
After the selection of the adjustment method, you can change the settings of earth curvature and refraction. This is not possible at another point of the DiNi® menu system. Changes of earth curvature and refraction settings become effective only if you adjust the system afterwards. The line of sight will then be corrected accordingly.

It may become necessary to correct the staff reading for earth curvature, if you must take measurements with different sighting distances and correction is not provided by the evaluation program used. General application of refraction correction is controversial. It is, however, possible on DiNi® instruments. You can change the coefficient of refraction in the **Input** menu. If you set the coefficient to zero, the correction of refraction will be inactive.

Adjustment procedure of the line of sight (electronically)

> ☝ Attention!
>
> Depending on the staves used, the "INP FUNCTION" switch in the "Set Instr. Unit" menu has to be set to m, ft or inch prior to the adjustment to ensure that the nominal value is correctly displayed when the reticule alignment is checked.

After the adjustment program has been called up, the current value of the line of sight correction is displayed



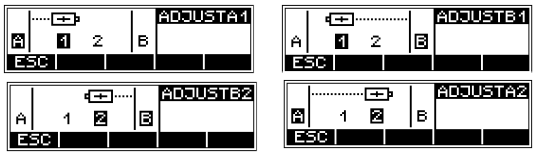
ESC to quit the adjusting menu, to confirm the old values

o.k. to start the adjustment procedure

> ☝ Attention!
>
> If you have started the adjustment procedure with o.k. after the display of the old line of sight correction, an interrupted levelling line cannot be continued later on.

The user prompt requests measurement in accordance with the defined procedure. For this, use either the measurement key on the right side of the instrument or of the control panel. This program is supported by graphics.

Example of adjustment according to Förstner:



MEAS
or
⊙ to start measurement

RPT

Here it is helpful to use the possibility of a multiple measurement with 3 or 5 times for instance. If the multiple measurement option (chapter 5.4) has been selected, measurements of the sighted staff are automatically performed after triggering until the precept number of measurements or the preset standard deviation is reached. In this mode, the continuously computed mean values of staff reading and distance and the standard deviation of the mean staff reading are displayed.

ESC

to stop automatic measurement before the preset number of measurements is reached. (This function is not recommendable due to possible vibrations of the instrument.)

DISP

the values obtained in the last measurement or further results can be called into the display.

Technical Information

After successful completion of the adjustment the new sighting line correction is computed automatically. When the measured values are available, they are checked internally for compliance with the distance requirements. This ensures very effective protection against operating errors. In case of differences an error message appears.

Result:

Rpt to repeat measurement

o.k. to confirm result

To display further information with **DISP**.

Absolute values:

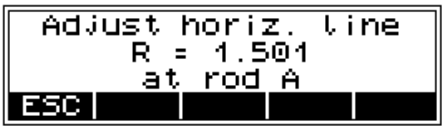
old to confirm the old values

new **to confirm the new value (result is accepted)**

The latest measurement:

Inp **to input of a value estimated by repetion of measurements**

After confirming the new value is adopted and the program requests checking of the reticule alignment (for visual reading).

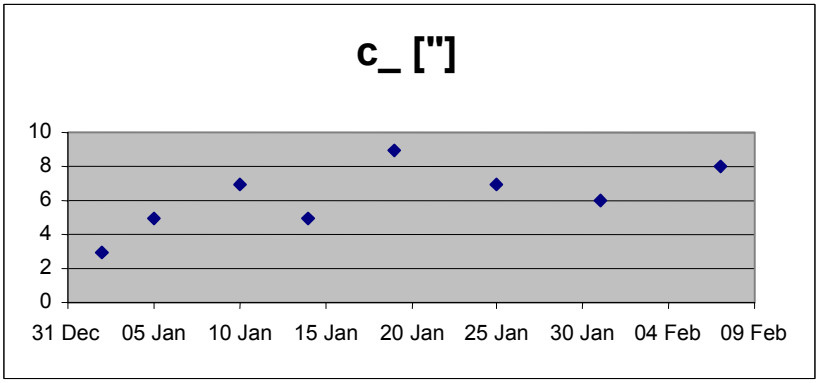


Attention!

The repetion of adjusting measurements and the input of an external computed mean value and also the check of that have to be made very carefully by the user. The instrument cannot check a not meaningful input..

Various adjustments of lines of sight carried out successively should differ only by some seconds. Prerequisites for reaching this result are stability of installation and unchanged environmental conditions. We recommend to prepare a set of chronological statistics including the adjustment values. In case of inexplicable differences within short periods, provided the measuring conditions remained unchanged, a workshop should be consulted.

Example:



Adjustment procedure of the line of sight (optic)

If the new line of sight correction is adopted, the program requests the checking of the reticule alignment (for visual reading). This procedure is very important if electronic and optic measured values are used.

Turn the staff used for the last sighting or replace it by a staff with a metric graduation and compare the reading with the specified value. If the difference exceeds 2 mm, align the reticule position. For this, remove cap (1) and adjust the setting screw below the eyepiece until the actual and nominal readings are identical.

Attention!

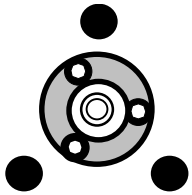
Make sure that cap (1) is fixed again after this procedure.

We recommend to verify the adjustment.

Automatic alignment of the compensator ensures that an inclined line of sight is automatically levelled within the working range both for visual observation and internal electronic measurement. When turning the instrument round the vertical axis, the circular bubble has to remain within the adjustment circle.

In precision measurements, the running centre of the circular bubble has to be in the centre of the adjustment circle. In case of any visible change readjustment is required.

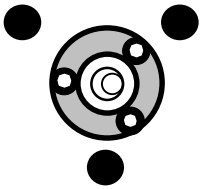
Check the function of circular bubble



1.

- Level the instrument with the 3 tribrach screws until the circular bubble runs centrally to the adjustment circle
  1. position

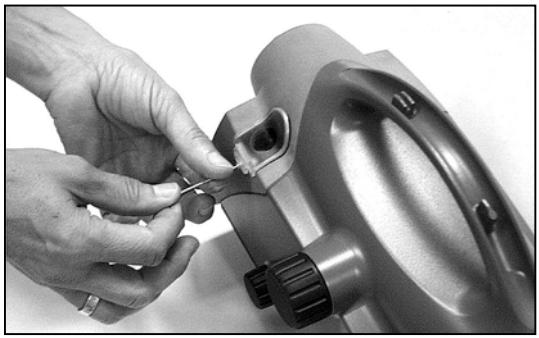
- By turning the instrument 180° round the vertical axis the circular bubble has to remain within the circle
  2. position

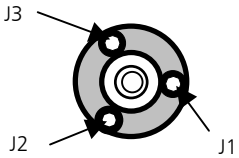


2.

- If the circular bubble left the adjustment circle it is necessary to adjust the circular level.

Adjustment of circular bubble





- Remove the screw (2) of the protection cap with the adjusting tool and detach the protection-cap
- Level the instrument with the 3 tribrach screws, Position1
- Turn the instrument 180° round the vertical axis into position 2
- Eliminate half the residual deviation of the circular bubble by means of the tribrach screw and half by adjusting the circular bubble
- Repeat this procedure and check the residual deviation.
- Fix the protection cap again. Make sure that the rubber joint is placed in the groove.

Key

J1, J2, J3 circular level adjustment screws

8 Annex

The Annex contains a compilation of symbols, keys, formulae and constants as well as explanations of concepts used for the DiNi®.

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

Key Function Overview

MEAS or ◎ (*)	Starting a measurement (*)Additional trigger key located on the right-hand side of the instrument, particularly useful when measuring in the reverse position.
DIST	Triggering a single distance measurement
ON OFF	Switching the instrument on and off
MENU	Calling Menu
INFO	Information of important instrument parameters: Display of battery condition, saving of basic status, total sighting distances
DISP	Switching over to display all existing contents, preselection of data to be displayed
PNr	Input of an individual / consecutive point number
REM	Input of additional information: - Input of point code max. 5 digits, input of text max. 21 digits - In DiNi® 12, 12 T automatic acquisition of date and time
EDIT	Editor for data management: - Display of memory status - Project management - Display and deletion of data lines - Input of height
RPT	Repeat measurements with input of the number of repetitions for staff reading or with input of the maximally admissible standard deviation
INV	Inverted measurement, toggling between normal and inverted measurement

Key Function Overview

INP	Manual input of measured data (optical reading) for height measurements using the centre line and for distance measurements using the lower and upper hair lines or, alternatively, input of a distance.
✱	Switching the illumination of display on and off
Hz	Setting of options for Hz angle measurement **)
◑	Contrast adjustment of display **)
DIST	Triggering a distance measurement
Hz-M	Selecting the Hz measuring mode **)
TS-M	Toggling between levelling, total station and coordinates mode **)
0 9	Numeral keys to input numerical values
+/-	Input of preceding sign
,	Decimal point
▼ ▲	Scrolling the data memory**)

*) DiNi® 12, 22

**) DiNi® 12 T only

Line		Start or continuation of a levelling line
Rpt		Repetition of measurement
IntM		Measurement of intermediate sights (area levelling)
SOut		Staking out heights
ESC		Cancelling a function, quit a submenu
LEnd		Ending or cancelling a levelling line
↑	↓	Selection of the preceding bar menu line or iMEM / project address Selection of the next bar menu line or iMEM / project address
←		Backward deletion of a character (backspace)
MOD		Modification of the displayed value
↑↓		Modification of a setting
YES	**NO**	Acceptance of an option Rejection of an option
o.k.		Acknowledgement of a message
old	**new**	Retention of the old value Adoption of a new value
Text		Input of additional information
Date		Transfer of date to the additional information
Time		Transfer of time to the additional information*)
HD		Direct entry of the distance
DR		Distance measurement by entry of stadia line readings (visual measurement)

Softkey Overview

Disp Del Edt	Display of iMEM / project data Deletion of iMEM / project data Editing of the iMEM / project content
Inp	Entry of data lines for filing in iMEM / project
?	Call up search menu to display data lines
?PNo	Search for: point numbers in iMEM / project
?LNo	Line numbers as a part of the point identification
?Adr	Addresses in iMEM / project
?Cod	Point codes in iMEM / project
? ↓	Continued search using the same criterion
all	Selection of all iMEM / project data lines
Adr1	Selection of the 1st data line / project address
lAdr	Selection of the last address
iPNo	Change to entry of an individual point number
cPNo	Change to entry of a consecutive point number
AM	Entry of an AM time for setting the clock *)
PM	Entry of a PM time for setting the clock *)
R-IS	Recording of the instrument status
←Hz→	Changing the Hz counting direction **)
Set	Setting a given Hz direction **)
→Hz	Setting clockwise counting of Hz direction
←Hz	Setting counterclockwise counting of Hz direction **)

CD	Changing the directory on PC memory card *)
PRJ	Activation of project management *)
NUM	Switching to input of digits
abc	Switching to entry of small letters
ABC	Switching to entry of capital letters

*) DiNi® 12, 12 T

**) DiNi® 12 T only.

Technical Data	DiNi® 12	DiNi® 22
Accuracy as per DIN 18723		
Standard deviation on 1 km of double levelling		
Electronic measurement:		
- invar precision bar code staff	0.3 mm	0.7 mm
- foldable bar code staff	1.0 mm	1.3 mm
Visual measurement		
- foldable staff, metric scale	1.5 mm	2.0 mm
Measuring range		
Electronic measurement		
- invar precision bar code staff	1.5 - 100 m	1.5 - 100 m
- foldable bar code staff	1.5 - 100 m	1.5 - 100 m
Visual measurement		
- foldable staff, metric scale	from 1.3 m	from 1.3 m
Accuracy of distance measurement		
Electronic measurement with a 20 m sighting distance		
- invar precision bar code staff	20 mm	25 mm
- foldable bar code staff	25 mm	30 mm
Visual measurement:		
- foldable staff, metric scale	0.2 m	0.3 m
Least display unit		
Height measurement	0.01 mm//0.0001 ft/ 0.0001 in	0.1 mm//0.001 ft/ 0.001 in
Distance measurement	1 mm	10 mm
Measuring time		
Electronic measurement	3 s	2 s
Telescope		
Magnification	32 x	26 x
Aperture	40 mm	40 mm
Field of view at 100 m	2.2 m	2.2 m
Electronic measurement field at 100 m	0.3 m	0.3 m
Compensator		
Inclination range	± 15'	± 15'
Setting accuracy	± 0.2"	± 0.5"
Levelling		
Circular level	8'/2 mm	8'/2 mm

	DiNi® 12	DiNi® 22
Display screen		
	graphic, with 4 lines of 21 characters each	
Horizontal circle		
Type of graduation	400 grads/360°	400 grads/360°
Graduation interval	1 grad/1°	1 grad/1°
Estimation down to	0.1 grad/0.1°	0.1 grad/0.1°
Keyboard		
	22 keys, incl. 5 variable function softkeys, assignment by menu and dialog techniques	
Measuring programs		
	• Single measurement, Repeat measurement • Line levelling with and without intermediate sighting • Area levelling and staking out • Line adjustment (DiNi® 12)	
Levelling methods		
	BF, BFFB, BFBF, BBFF aBF, aBFFB, aBFBF, aBBFF	BF, BFFB ABF, aBFFB
Measured data correction		
	Compensation of earth curvature and refraction	
Real-time clock		
	Recording of the time of measurement	
Recording		
	• **DiNi® 22:** internal data memory: non-volatile without buffer battery, holds data for at least 1 year, approx. 2000 lines storage capacity • **DiNi® 12:** exchangeable SRAM PCMCIA card, 256 K ... 8 MB • On-line via RS 232C/V.24 interface	
Power supply		
	Internal battery, NiMH 6 V, ≥1.5 Ah, sufficient for	
	3 days	1 week
Temperature range		
	-20 °C to +50 °C	
Dimensions (WxHxD)		
Instrument	125 mm x 235 mm x 295 mm	
Case	220 mm x 295 mm x 420 mm	
Weight		
Instrument / case	3.5 kg / 2.5 kg	3.4 kg / 2.5 kg

Technical Data	DiNi® 12 T
Height measuring accuracy as per DIN 18723	
Standard deviation on 1 km of double levelling	
Electronic measurement:	
- invar precision bar code staff	0.3 mm
- foldable bar code staff	1.0 mm
Visual measurement:	
- foldable staff, metric scale	1.5 mm
Distance measuring accuracy	
Total station mode	
Electronic measurement:	
- invar precision bar code staff	0.5 D x 0.001 m
- foldable bar code staff	1.0 D x 0.001 m
Levelling mode (20 m sighting distance)	
Electronic measurement:	
- invar precision bar code staff	20 mm
- foldable bar code staff	25 mm
Visual measurement:	
- foldable staff, metric scale	2.0 D x 0.001 m
Angle measuring accuracy	
Standard deviation of a direction	2 mgon/6“
Measuring range	
Electronic measurement:	
- invar precision bar code staff	1.5 m to 100 m
- foldable bar code staff	1.5 m to 100 m
Visual measurement:	
- foldable staff, metric scale	from 1.3 m
Least display unit	
Electronic measurement	
Height measurement	0.01 mm/0.0001 ft/0.0001
Distance measurement	1 mm
Angle measurement	1 mgon/5“/0.001°
Measuring time	
Electronic measurement	
Height and distance measurement	3 s
Angle measurement	0.3 s
Telescope	
Magnification	32 x
Aperture	40 mm
Field of view at 100 m (visual)	2.2 m
Compensator	
Inclination range	± 15‘
Setting accuracy	± 0.2“

	DiNi® 12 T
Horizontal circle	
Type of graduation	gon/DMS/DEG
Graduation increment	40 mgon
Reading system	absolut
Levelling	
Circular level with	8'/2 mm
Display	
	graphic, with 4 lines of 21 characters each
Keyboard	
	22 keys, including 5 variable function softkeys, assignment by menu and dialog techniques
Measuring and computing programs	
	• Single measurement, Multiple measurement • Line levelling with and without intermediate sighting • Area levelling and setting out • Hz measuring programs • Measurement of local coordinates • Line adjustment
Levelling methods	
	BF, BFFB, BFBF, BBFF, aBF, aBFFB, aBFBF, aBBFF
Measured data correction	
	Compensation of earth curvature and refraction, entry of offset/addition constant
Real-time clock	
	Recording of the time of measurement
Recording	
	• Exchangeable SRAM PMCIA card, 256 K ... 8 MB • RS 232C interface for external connection
Power supply	
	NiMH battery pack, 6 V, ≥1.5 Ah, sufficient for 3 days
Temperature range	
	-20 °C to +50 °C
Dimensions (WxHxD)	
Instrument	125 mm x 176 mm x 295 mm
Case	220 mm x 255 mm x 420 mm
Weight	
Instrument / case	3.7 kg / 2.5 kg

Electromagnetic Compatibility of DiNi®

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

Attention !

Note on compliance with interference suppression/noise immunity standards: Computers connected to the DiNi® must meet the same requirements regarding electromagnetic compatibility to ensure that the overall configuration complies with the relevant interference suppression standards.

Interference suppression:

as per EN 55011 class B

Noise immunit y:

as per EN 50082-1

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.

Single Battery Charger

Attention !

Make sure that the input voltage switch reading matches the mains voltage at your location!
If you connect the charger to 230V when the voltage selector shows 115V an internal fuse will blow.

If you connect the charger to 115V and it is set for 230V the red charge led flashes.

General

This single battery charger is designed for NiCd and NiMH batteries, 5 or 10 cells. The charger changes the charging parameters depending on a code resistor in the battery.
A micro controller measures the code resistor and the NTC resistor in the battery and changes the maximum voltage and charging time accordingly. It uses the peek voltage method to indicate when the battery is almost fully charged.

To complete the charging it applies a constant top charging current of 100 mA until the maximum charging time timer has run out. Thereafter a pulsating trickle charging current will be applied to the battery as long as it is connected to the charger.

To prevent damage to the battery the charger has the following safety functions:
- A maximum charging time timer
- Max and min temperature stop, if the battery becomes to hot or cold. This function requires a NTC resistor in the battery
- Battery over and under voltage detection

Low battery voltage

If the battery voltage is lower than about 3V (the **Error** LED is turned on) the charger starts the charging with 100 mA current until the voltage increase over 3V. Then normal charging starts. Sometimes battery voltage increase rapidly first and then falls slowly for some time. If this goes on for more then 10 min the charger may interpret this as the battery is already fully charged. The charger stops and has to be restarted.

High battery temperature

The battery is equipped with an NTC resistor. The charger monitors the battery temperature with this resistor and stops if the temperature rise above 45 degrees Celsius and the **Error** led will be turned on. The reason for this may be high ambient temperature or the charger has failed to stop charging and the battery temperature rise due to a fully charged condition.

Charged battery

It is not recommended to restart a charging cycle when the charger has indicated 100%. The charger waits about 10 minutes before it senses the battery condition and repeated restarts can cause a heavy overcharge and damage to the battery.

Worn out batteries

Old and well-used battery has a higher voltage when charged. If the voltage becomes to high a protection mechanism stops the charging and error will be indicated.

Continues connection to charger

A battery should not be connected to the charger for a prolonged time.

Disconnect the charger from main supply if it not will be used for a long time.

Technical Data

INPUT

	Nominal	Comments
Voltage	~115 Vac; 50/60 Hz	90V to 127V
	~230 Vac; 50/60 Hz	190V to 250V
Power	20 W	

OUTPUT

Reverse polarity protection	Max 30 V	

CONTROL

High temperature stop	45 °C	The charger must be restarted to continue charging
Low temperature stop		The charger begins charging when temperature becomes higher then 0 °C

Charging the battery

Safety Notes

Attention !

Only charge rechargeable Nickel Metal Hydride (NiMH) and Nickel Cadmium (NiCd) chemistry battery packs. Attempts to charge other types of battery may results in explosions.

LED indicator

No bat.	No battery connected
Error	Error see text
Charg	Fast charging
100%	Battery charged

Connect the appropriate power supply cable to the charger and insert it in the power outlet The yellow **No Bat** led will be turned on.
Chose an appropriate battery cable and insert it at the charger's battery connector. Finally connect the cable to the battery. The yellow **No bat** led will now be turned off and the red **Charge** led will be turned on. The charging process has now started and will continue until the charger detects a fully charged battery and the green **100%** led turns on.
The charging time for the DiNi – Battery is approximately 2 hours and 30 minutes. The charger will time out in 4 hours and 15 minutes.

Correction of Staff Reading and Sighting Distance

$$L = L_o \pm Lx - K_1 + K_2 - K_3$$

$K_1 = E^2 / (2 * R)$ earth curvature correction

$K_2 = rk * E^2 / (2 * R)$ refraction correction

$K_3 = c\_ * E / 206265''$ line of sight correction

where:

L_o	uncorrected staff reading
E	sighting distance
c_	line of sight correction in ["]
Lx	staff offset (+ Lx in normal measurement, - Lx in inverse measurement)
R	earth radius, R = 6380 000 m
rk	refraction coefficient

$$E = E_o + A$$

where:

E_o	uncorrected sighting distance
A	distance addition constant

Computation of the Line of Sight Correction

$$c\_ = ((L_{a2} - L_{b2}) - (L_{a1} - L_{b1}))/((E_{a2} - E_{b2}) - (E_{a1} - E_{b1})) * 206265 ["]$$

If refraction and/or earth curvature correction are activated prior to adjustment, the staff readings are corrected first (corrections K_1 and/or K_2).

Station Difference in Multiple Back- and Foresights

$$dL = | (Lb_1 - Lf_1) - (Lb_2 - Lf_2) |$$

Basis of Calculation for Line adjustment

Line adjustment is always based on the measured and computed data recorded during levelling line measurement. Before the line adjustment, it is possible, however, that you enter the reference heights (start/end), if they had not been known in the measurement.

The heights of staff stations in line levelling and those of intermediate sights are modified proportionally to the passed distance as follows. For station n, the following equations apply:

Foresight:

$$E_n = E_{n-1} + E_b + E_f \qquad Z_f = Z_{fu} + \frac{E_n \cdot \Delta_Z}{S_b + S_f}$$

Intermediate sight:

$$E_n = E_{n-1} + E_b + E_i \qquad Z_Z = Z_{iu} + \frac{E_n \cdot \Delta_Z}{S_B + S_F}$$

n	Number of station
E	Sighting distance
E_b	Backsight distance
E_f	Foresight distance
E_z	Intermediate sight distance
S_B	Total of all backsight distances of the line
S_f	Total of all foresight distances of the line
ΔZ	Line closing difference
Z_{fu}	Uncorrected height of foresight
Z_{iu}	Uncorrected height of intermediate sight

In the project, the values of Z_{fu} or Z_{iu} are overwritten by Z_f or Z_i.

Error Messages	That is to do
BATT Change battery	Before change the battery the DiNi® having to be switched off.
BATT Change backup battery	The measurement in progress can be completed. Then call the service immediately .
1 ROM error **2** RAM error **8** NV-RAM error	Call the service. Measurement cannot be continued. All basic settings of the instrument may have been changed.
202 Compensator out of range	Correct the levelling of instrument. Otherwise call the service.
320 run –/time - error	Repeat the measurement
321 Change of brightness too great	Repeat the measurement
322 Out of measuring range	Staff cannot be readed, keep the staff within the measured section free
323 Staff cannot be read	Check the conditions of measurement process : - Is the setting for norm./inver. measurement correct ? - Is the focusing correct? - Has the graduation been correctly sighted? - Is the graduation unconcealed? - Is the sighting distance within the admissible range? - Is sufficient light available?
324 Staff cannot be read	Change the conditions of measurement process because they are not sufficient (for instance vibrations, not sufficiently light)
325 tandard deviation out of range	Repeat the measurement

326 Staff section too small	The staff section is not sufficient for measurement in the total station/coordinates mode. Try to perform the measurement in the levelling mode. If all requirements are met, repeat the measurement with a slightly modified sighting angle.
327 Staff section asymmetrical	The staff section is not symmetrical for measurement . Check the conditions of measurement process. See Chapter 5 Page 8.
070 Angle measurement error	Remove the disturbing influences (vibrations)
4AX Project address not found	- check the data line entered - save the data - Format PCMCIA Card
4MV PC card full	- transfer all data and than delete the data - take a new card
460 Wrong acknowledgement from PC card **461** PC Card - Time Out **470** PC card data transfer error **471** PC card data transfer error	- switch the instrument off and on again - if the error is still present make an update of DiNi® software
350 All marking lines in project are used	– create a new project
4RD Read error **4RW** Write error	- switch the instrument off and on again - if the error is still present save the data and reinitialise the PC card
491 PC card is write protected	- check the write protection and/or cancel it

492 PC card was changed	- new card inserted? Quit with the ESC key
493 PC card system error	- save the data and reinitialise the PC card
494 PC card battery power is low **489** PC card battery empty	- Save the data - change the battery or load - be sure to comply with the PC card manufac - turer hints
495 Erroneous project name	- check the configuration file of the PC card
496 Directory full	- read out the data files or use a new card
498 PC card system error **41X** PC card system error	- repeat the formatting procedure, e.g. with PC - change the PC card
499 Erroneous project name	see code **495**
401 PCMCIA interface ROM defective	- save data and reinitialise the PC card - if the error is still present contact the service
4NV Directory full	see code **496**
4NX Function not executable	see code **493**
4AX Addr. in iMEM not found	Data deleted beforehand?
4MV iMEM full	read out the data; than delete all data
410 iMEM not initialised !	initialise iMEM and read out data

411 System sector defective **412** System sector defective **413** System sector defective, reading still possible **415** iMEM read error **416** iMEM write error	- repeat the recording again - if the error is still present the data read out and reinitialise the memory
581 I/O receiving error **584** I/O time-out **585** I/O time-out **586** Error in REC500 protocol **587** I/O time-out **588** Error in REC500 protocol	- repeat recording - if the error is still present check the interface parameters, the cables and the recording program of the remote station.

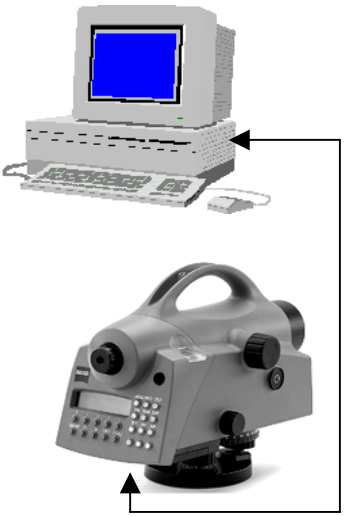
Furnishing of Updates

Software updates are offered by the manufacturer on Internet sites with reservation as to extensions of the functional range. Surf to our Web sites. The dealer will be pleased to communicate the Internet site names, when required.

The updates offered contain the following functions:
- Update of the instrument computer
- Update of the interface computer (DiNi® 12 and DiNi® 12T only)
- Loading of an additional language (four languages can be loaded)

The files loaded from the Internet sites have to be unpacked and copied on a floppy disk.

What has to be observed in any case ?



DiNi ® ↔ PC cable:
Order number 708177-9470.000

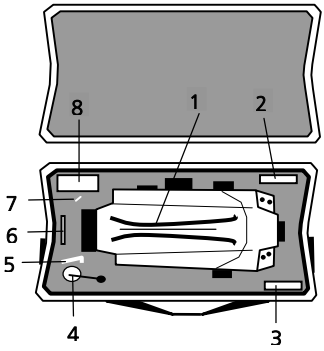
For the update processes , the operating system DOS has to be used in any case.

Additionally to the files required for the update process, the update instructions have to be loaded from the Internet in any case and have to be observed strictly. No liability will be assumed for claims resulting from the non-compliance with the specification.
In these instructions, all steps are described in detail. They may contain and explain commands that differ from the description given here.

Instructions for Maintenance and Care

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

Insert the measurement system in the case



Instrument case of
DiNi® 12,
DiNi® 12 T,
DiNi® 22

1	Handle of DiNi®
2	Protection hood
3	Clean cloth
4	Plummet (only for DiNi® 12 T)
5	Tool for tripod legs
6	PCMCIA Card (only for DiNi® 12,12 T)
7	Tools for adjustment of sighting line and circular bubble
8	Space for battery .

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