Geodimeter®

Software & Data communication

Ver. 10 Publ.No. 571 700 001

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Tenth Edition

Printed in Sweden 03.99. Publ.No. 571 700 001, Arkitektkopia AB.

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Welcome to Geodimeter Software & Datacommunication

This manual will describe the different softwares that can be installed in Geodimeter system 400, 500, 4000 and 600.
It will also describe how the memory is built up, which memory units that are available and how to transfer data between them.
Since Geodimeter System 400, 500, 4000 and 600 have the same flexible design it is possible to upgrade software, memory units and other accessories. The various softwares makes it possible to customize your Geodimeter system to your own way of working.
The built in two-way serial communication enables you to connect external memory units and computers to the instrument.

About this manual

The contents of this manual are as follows:

Part 1 - Memory Structure
describes how the memory is built up and how data is stored.

Part 2 - Memory Units
describes the internal memory and the external memory, Geodat 500.

Part 3 - Data Communication
contains instructions on how to transfer files between e.g. Geodimeter and Geodat. This part also describes the different serial commands that are available.

Part 4 - Software
includes the available softwares and contains step by step instructions on how to use each software. The softwares are divided into three main groups; Data Collecting, Edit & View and Field Calculations.

If you or your colleagues have any comments on this manual, we would be grateful to hear from you. Please write to:

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1

Memory Structure

Introduction

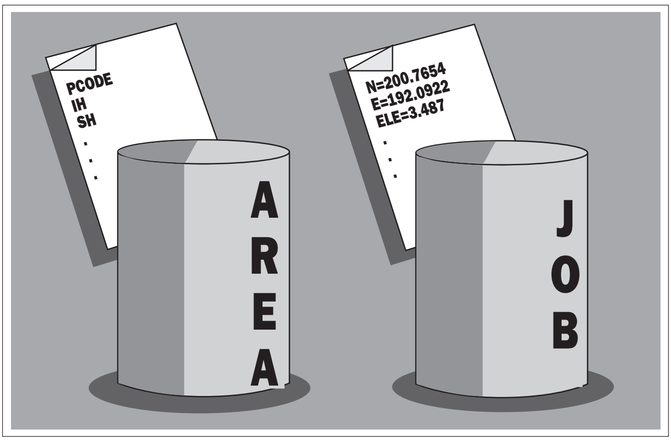
All Geodimeter memory devices have the same memory structure. This part will describe how the memory is structured and what happens when data is stored in and collected from the memory.

Memory Structure

The memory structure of all Geodimeter memory units makes it is easy to check and identify the stored data after registration.

The memory is divided in two separate files which are called Job- and Area-file. Both these files are fully flexible according to number and size. The only limit is the total storing capacity available in the memory.

The memory can be used to store two types of data: survey measurements (Job-files) and known coordinates (Area-files). These Job- and Area-files consist of separate expansive memories which means that they can be updated individually at any time without affecting other Job- and Area-files. The total number of files is limited only to the total capacity of the memory. The more raw data stored in Job-files, the less known coordinate and elevation data that can be stored in Area-files and vice versa.



Job files

In order to permit later identification of Job files, they are given a numeric, alpha or alphanumeric title by the user. All survey data are stored in a Job file. Even field calculated coordinate and elevation data are stored in these files. When complete, these files can be transferred separately to a computer while the unfinished files can remain in Geodat/Geodimeter Internal Memory.

New Job file

F

50

Label 50
Job No

When you run most of the field calculation programs to Geodimeter the program asks you to name the Job file in which you wish to store the measxurement data. Job no=0 does already exist. If you wish to create a new Jobfileoutside the field programs you enter label 50 (F50) and key in the new Job number.

The next time you registrate a measurement the data will be stored in this Job file.

```
STD P0    14:32

Job no=0_
```

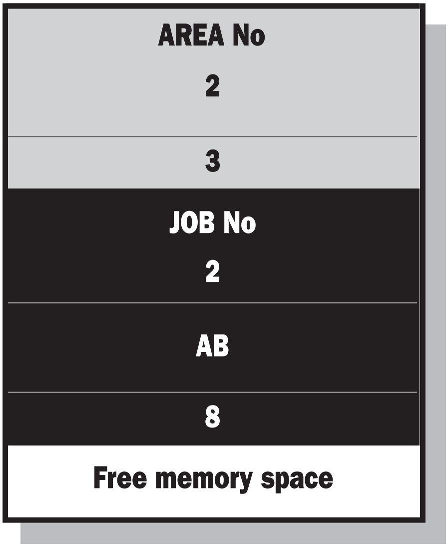
Area files

Known coordinates and elevations can be stored by manual keying in (P43), or by transfer from computer.

Area-files, which are used during setting out survey, can be accessed by giving the name/number of the file in which the set out data is stored. By doing this, the search for the point is limited to just that particular file. Several different Area files can be prepared in advance of the survey job e.g. surveyors often know that they will be working in more than one single area during the course of a week. All known data for particular sites can therefore be stored in different Area files. This is especially advantageous if several points have the same numbers. Area no=0 does already exist.

Edit file

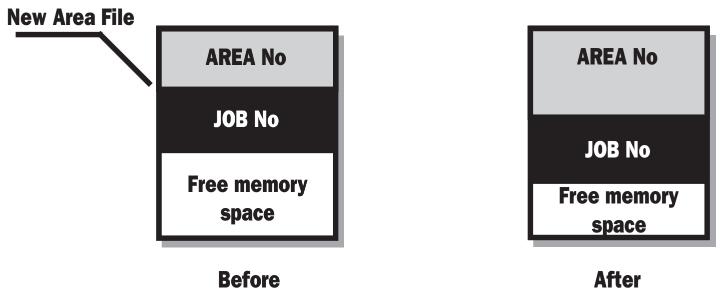
Any Area- or Job-file can be edited with the program Edit. With this program you can view and change the contents of the file after registration.



This is how the memory is structured. The more data that is stored in the Area file the more the Job file will be "pushed down in the memory" and the more the free memory space will decrease.
In the above example the three files 2, AB and 8 represent different survey jobs.
It is possible to continue in an existing Job file. If you return to the survey site to update the job 2 the new data will be appended on the old file and the files AB and 8 will be "pushed a little further down".

File transfer
When you transfer a Job file or an Area file the files are not erased from the device in which they were originally stored. They are infact copies of the data files which are transferred to the other device.

When using Program 54 (See Part 3, Data communication) it is sometimes faster to transfer a Job file than an Area file. That is because when transferring an Area file all data in the Job file of the target unit must be pushed down first in order to create room for the new Area file.



The possibility also exists for deleting Job and Area files from a computer or a total-station. This would be done e.g. to create more room in the Geodimeter Memory Device, see Part 3, Data communication.
The operation should be carried out only after a successfull transfer to a computer or another device.

2

Memory Units

Introduction

Geodimeter totalstations includes an internal memory for data storage. When there is a need of more memory capacity, Geodimeter offers an external memory unit, Geodat 500. This unit can be connected to the instrument during the survey work and/or when finished the measuring operations. The external memory unit enables you to transfer data to e.g. a computer without having to bring your instrument with you.

This part of the manual will describe the internal memory and the external memory unit Geodat 500.

Note! ☞ *Backup your memory*

Note!
As a safety measure always backup your memory to protect yourself from memory loss. It is easily done with Program 54 which enables you to transfer Job- and Area-files between the different Geodimeter units. See Part 3, Datacommunication for more information.

Memory Units

Unit description

Geodimeter Total Stations are equipped with an internal memory for the storage of raw data, point information and calculated coordinate data. The memory volume is completely self supportive and can be used separately without the need of having other external memory devices connected. The total memory capacity can be enhanced by connecting a external memory device such as Geodat 500.

Unit capacity

The internal memory of Geodimeter has a capacity of appr. 32Kb or 900-10.000 points if storing of only Pno, HA, VA and SD. Data can be stored in an unlimited number of files. All Field Data=survey point information plus angles, distances and calculated coordinates, are stored in a Job File and all Known Data=survey site control point and traverse point coordinates and elevations are stored in an Area File as described in part 1, Memory Structure.

Program 54 - File Transfer

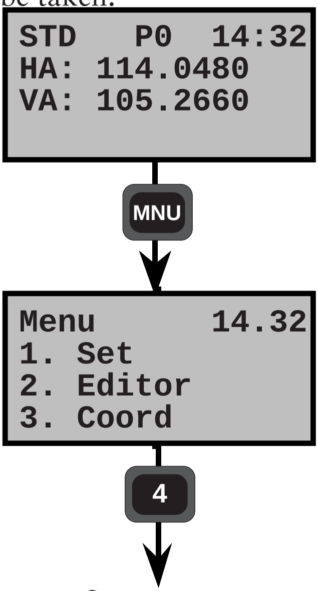
Program No 54 is included with Internal Memory. This program is designed for transferring Job-, Area- and U.D.S-files between different units. Internal transfer is also possible within each unit. See part 3, Data communication for more information about data transfer and program 54.

Edit

With the program Edit installed in the Geodimeter it is possible to view and change data that has been collected and stored in the internal memory. Edit is described in part 4, Software.

Setting up the Internal memory as an active memory device

When you are using most of the programs to your Geodimeter you will be prompted to select an active memory device in which you can registrate your measurements.
If you wish to setup the internal memory as an active memory device outside any program the following steps must be taken.



First step to the main menu by pressing the MNU key.

In order to choose 4 Data comm. Press 4.

See next page

From previous page

```
Data com   14:32
1. Sel. device
2. Create table
```

Choose option 1 Select device.

1

```
Menu        14:33
1. Geodat
2. Serial
3. Xmem
```

Choose 4 Imem (Internal memory)

4

```
Imem        14.33

Imem ON?
```

Press YES to continue or No to interrupt.

YES

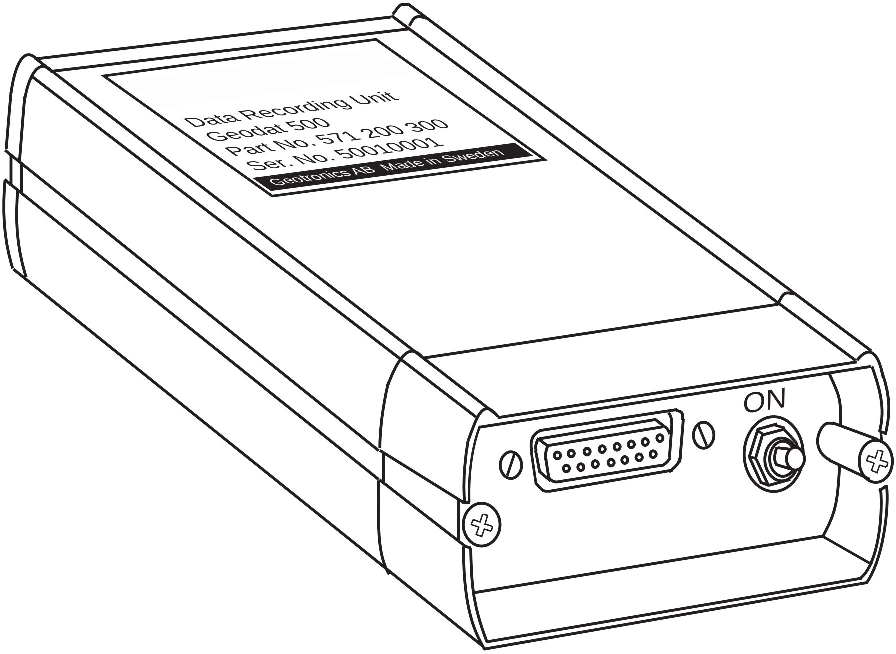
```
Imem        14.33

Table no=
```

Select output table number (0-5 depending on instrument) and then press ENT.

ENT

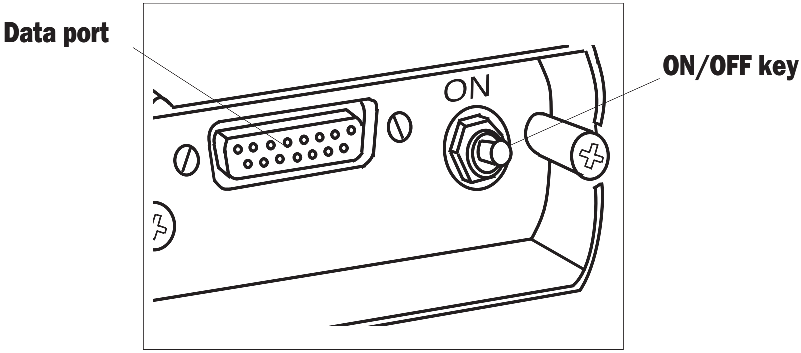
```
Imem        14.33

REG key?
```

Control of the output can be done by pressing the REG key of the instrument (REG key?) or continous (Slave?). Choose REG by answering YES or press NO to be able to choose Slave.


Data Recording Unit
Geodat 500
Part No. 571 200 300
Ser. No. 50010001
Geotronics AB Made in Sweden
ON

Geodat 500 - Unit description

Geodat 500 is a new member in our family of data recorders. It is designed for use with Geodimeter Total-Stations (except the series 100) and Control units for both storage and transfer of raw and calculated survey data either in the field or in the office.



Unit Capacity

Geodat 500 has a storage capacity of approximately 64Kb or 3000 survey points or 4500 points if storing only Pno, HA, VA and SD.
Geodat 500 contains an internal battery for data-hold= approximately 2 years without the need to recharge. After that you should leave the instrument to authorized service where the internal battery is replaced.

Transfer Parameters

The protocol can be changed in order to suit the computer used for data transfer while the format is fixed. The protocol can be set up directly from the keyboard of Geodimeter using the program P51, (Set Protocol) or transferred from a computer. Program 51 are now contained in the software within the instrument.

Memory Structure

The memory can be used to store two types of data: survey measurements (Job-files) and known coordinates (Area-files). These Job- and Area-files consist of separate expansive sub-memories which means that they can be updated individually at any time without affecting other Job- and Area-files. The total number of files is limited only to the total capacity of the memory. The more raw data stored in Job-files, the less known coordinate and elevation data that can be stored in Area-files and vice versa.

Program 54 - File transfer

Program No 54 is included with Internal Memory. This program is designed mainly for the transfer of Job-, Area- and U.D.S.-files between different units, e.g. Geodat or personal computer. Transfer is also possible within each unit. See more about program 54 in part 3, Data communication.

Info messages

No	Message
20	Illegal label number
21	Parity error
22	No or wrong device is connected 22.3 means Xmem error
23	Time out normally seen after attempt to transfer data from device
26	Backup battery to old
30	Syntax error
32	Not found (Files, points and/or programs)
34	Wrong data-record separator
35	Data error (Label not containing any value or text, i.e 5=)
36	Memory device is full
37	Protocol error
39	Overrun error
45	Incompatible device (e.g. when trying P50)
50	System error - contact your nearest Geodimeter service shop !

Data Communication

Computer as controller
When using RS 232C, the command shall be sent as a normal ASCII string ending with the ETX sequence. In this case Protocol is always assumed to be 0.

Geo / L Syntax Construction
O = Output data from memory
L = Load data into memory
K = Erase memory
M = Available memory

File Types
M = Job file
I = Area file
D = Protocol

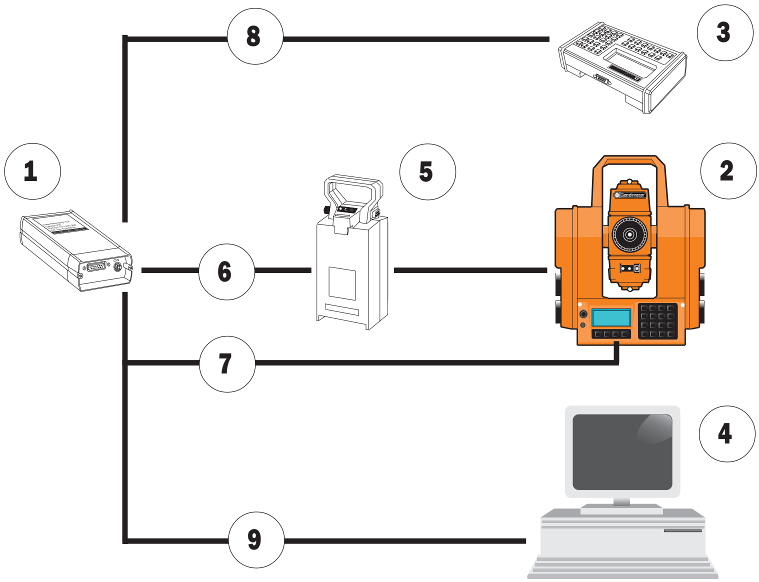
Commands
Output / Input / Kill + File Type = Job No / Area No

Examples

OM=1	Output of Job No 1 from Geodat to computer
LI=2	Load data into Area 2 from computer to Geodat
KM=SITE2	Erase Job No SITE2 from Job file
O*C	Output of all catalogues from Geodat to computer
K*	Reinitializes the Geodat after System error (Error 50), erases all memory

For more information see part 3, Data Communication!

Connecting Geodat with other devices



DEVICES
1. Geodat 500
2. Station Unit
3. Control unit
4. Computer
5. External Battery

CABLES
6. Cable (571 136 754)
7. Cable (571 136 752)
8. Cable with charger:
   115V (571 181 354)
   220V (571 181 352
9. Cable with charger:
   115V (571 136 876)
   220V (571 136 874)

Setting up
Geodat as an active memory device

When using most of the programs to your Geodimeter you will be prompted to choose in which memory device you wish to registrate your measurements.
If you wish to setup the memory of Geodat outside any program the following steps must be taken.
Connect the Geodimeter to the Geodat and place Geodimeter in the Theodolite Mode by going through the start procedure, P0.

```
STD P0    14:32
HA: 114.0480
VA: 105.2660
```

You begin with calling upon the main menu. Press MNU

MNU

```
Menu      14:32
1. Set
2. Editor
3. Coord
```

In order to choose 4 Data comm. Press 4.

4

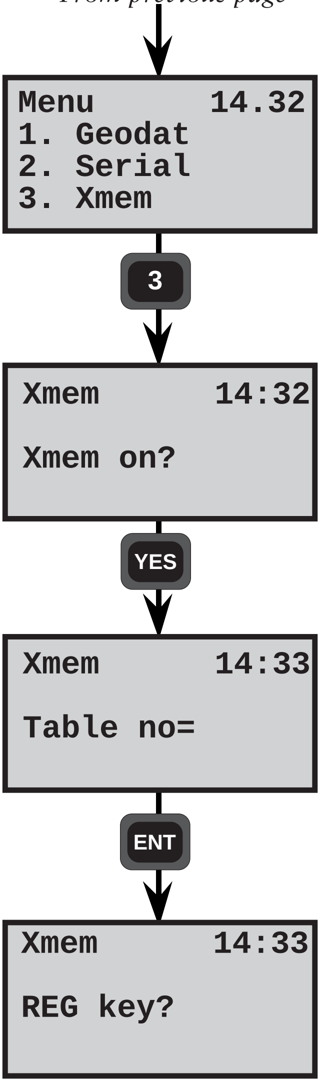
```
Data com  14:32
1. Sel. device
2. Create table
```

Choose option 1 Select device. Press 1.

1

See next page

From previous page



Choose option 3 Xmem. Press 3. If you wish to record into the Internal Memory of Geodimeter press 4. Imem.

Press YES to select or NO to interrupt.

Select output table number 0-5 (depending on instrument) and then press ENT.

Control of the output can be done by pressing the REG key of the instrument (REG key?) or continous (Slave?). Choose REG by pressing YES or press NO to be able to choose Slave.

3

Data Communication

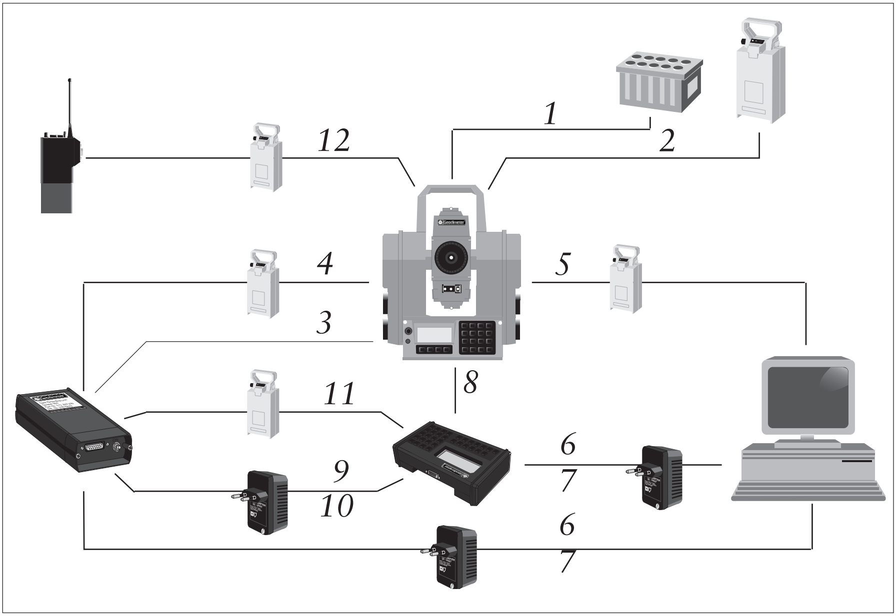
Introduction

Geodimeter totalstations can be connected to external devices such as Geodat as described in part 2, Memory units. There is also possible to connect a computer to the instrument or connect e.g. the control unit with the station unit and transfer data between the different units. The data can thereafter be edited or used e.g. in a CAD-program.

This part of the manual will describe how to connect the different units and how to transfer data between them.

Data Communication

How to connect the different Geodimeter devices



No	Cable (Part no)
1.	*Adapter Cable (571 125 140)*
2.	*Battery Cable (571 136 750)*
3.	*Cable Geodimeter-Geodat (571 135 752)*
4.	*Cable Geodimeter-Battery-Geodat (571 136 754)*
5.	*Cable Geodimeter-Battery Computer (571 126 756)*
6.	*Cable Geodat/Control Unit-Computer with charger 115V (571 136 876)*
7.	*Cable Geodat/Control Unit-Computer with charger 220V (571 136 874)*
8.	*Cable Geodimeter-Control Unit (571 181 350)*
9.	*Cable Geodat-Control Unit with charger 220V (571 181 352)*
10.	*Cable Geodat-Control Unit with charger 115V (571 181 354)*
11.	*Cable Geodat-Battery-Control Unit (571 181 356)*
12.	*Cable Geodimeter-Battery-Radio (571 181 068)*

Data Transfer

Any Geodimeter total station can be connected to an external device via a built in serial interface. This part of the manual will describe how to transfer data from and to the Geodimeter instrument.

Station unit ←→ Geodat

Connect the Station unit and the Geodat to a battery via the cable 571 136 752/754. Turn on both instruments and enter program 54 at the Station unit.
Choose (From Xmem, To Imem) if data are to be transferred from the Geodat to the Station unit or choose (From Imem, To Xmem) if data are to be transferred in the other direction. See more about program 54 on page 3.6.

Control unit ←→ Geodat

Connect the Control unit and the Geodat to a charger via the cable 571 181 352 (220V), 354 (115V). Instead of a charger you can connect a battery via the cable 571 136 754. Turn on both units and follow the Station-Geodat instructions above for file transfer between the two units.

Note! ☛ **Note !**

To be able to transfer data from or to the RPU´s internal memory the Control unit has to be detached from the RPU.

Control unit ←→ Personal Computer

Connect the Control unit and the computer to a charger via the cable 571 136 874/876. Instead of a charger you can connect a battery via the cable 571 136 754 and turn on both units. There are two ways to transfer data between these units:

1. with Program 54

Enter program 54 at the control unit and choose (From imem, To serial) to transfer files from the control unit to the computer or choose (From serial, To imem) to transfer files in the other direction. In the second case the transfer is initiated by copying the file from the computer to the communication port. See more about program 54 on page 3.6.

2. with RS-232 commands

By sending the appropriate commands from the computer you can transfer data between the control unit and computer. Look at page 3.9 for more information about serial communication.

Station unit ⟷ Personal Computer

Connect the Station unit and the computer to a battery via the cable 571 136 756 and turn on both units. Then follow the Control unit-Personal Computer instructions above for file transfer between the two units.

Control unit ⟷ Station unit

Connect the Station unit and the Control unit to a battery via the cable 571 181 350. Turn on both units and enter program 54. First choose (From Serial, To Imem) at the unit that are to receive data then choose (From Imem, To Serial) at the unit that are to send data. See more information about program 54 at page 3.6.

Personal Computer ⟷ Geodat

Connect the Geodat and the Personal Computer to a charger via the cable 571 126 874/876. By sending the appropriate commands from the computer you can transfer data between the two units. Look at page 3.9 for more information about serial communication.

PRG

54

Program 54 - File transfer

Connect the two units with the appropriate cable and switch them on. The instructions below describes how to transfer files from the Control unit to the Station unit´s internal memory:

Operation at the source unit

P54

Choose program 54

```
From        16:12
2. Imem
3. Serial
```

Choose from which device you want to transfer files.
In this example we choose 2 Imem.

2

```
File        16:12
1. Job
2. Area
3. U.D.S
```

Here you can choose what type of file you want to transfer:
1. A jobfile 2. A areafile or 3 A U.D.S-file. In this example we choose 1. A jobfile.

1

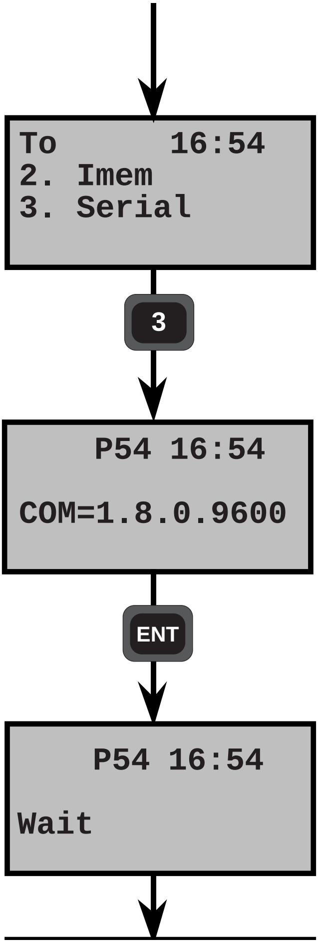
```
           16:12

Job=
```

Key in the name of the file.
In this example we key in Job=1

1

See next page

From previous page



To which device are you going to send the chosen file/s from the source unit.
Here we choose 3. serial.

Enter new serial parameters or accept the current.
Here we accept the current with enter.

Note! ☛

Note !
Prepare the target unit before accepting the serial parameters for a successfull file transfer.

The file/s are sent via the cable and the display shows "Wait" during the transfer and you will then exit program 54.

See next page

Note! ☛

Note - Info 19
If info 19 appears during a file transfer that means that the file transfer was not successfull. In that case you should run the file transfer again and look for where it fails, that is when info 35 (Data error) will show. Then check your file for any errors and if possible correct them with the editor.

PRG

54

Operation at the target unit

P54

Choose program 54

```
From      16:12
2. Imem
3. Serial
```

From which device are you going to send files to the target unit.
In this case it is 3. Serial.

3

```
    P54 16:54

COM=1.8.0.9600
```

Enter the serial parameters which must be same as the serial parameters at the source unit.
In this example we accept the current with ENT.

ENT

```
To         16:54
1. Job
2. Area
3. U.D.S
```

What type of file should the transferred files be saved as:
1. Job, 2. Area or 3. U.D.S.
In this example we choose 1. Job since we are transferring a Jobfile.

3

```
To         16:54

Wait
```

The unit is now ready to receive. Start the transfer from the source unit.

Serial Communication

This part of the manual describes the communication language that is used when the Geodimeter, Control Unit or Geodat is communicating with a personal computer.

In order to meet Geotronics new standard for data transfer., the protocol parameters must be set as described at page 3.14, if you want to use Geodimeter Surveying Tool (GST) which is a software package for data transfer, pre-processing and data management. The suggested protocols are also recommended for users who makes their own programs.

Description of the command instructions

This part of the manual describes the syntax for communication via the RS232 serial communication port in Geodimeter System 400/4000/500/600.

Not all commands apply to all devices, information about this is given in the command description. Some of the commands are new and other have additions which will not apply to older versions of the software in the devices.

Bold characters, O, must be written as given.

Text within hooks, <..>, is to be replaced with appropriate characters.

Items within square brackets, [..], is optional and need not to be entered.

Text within brackets, (..), is an ASCII control character, e.g. (CR) is equal to ASCII 13 Carriage Return). The hooks and the brackets shall not be written.

All commands must be ended with a carriage return, the line feed is not necessary. Syntax for End of Command is: (CR) [(LF)]. In the following text this End of Command sequence is omitted. The instructions contains the following information:

Purpose: Description of what the command does.

Syntax: <The syntax> {devices for which the com mand is valid}

Comments: Description of arguments etc.

Return: Description of what is returned from the receiver of the command. <status> is equal to the messages given in the info list. Status is not always returned. However the prompt <eot> is always returned.

Details: Special information.

Examples: Some typical examples.

Abbreviations

<lbl>	Label, the tag which identifies the data
<dta>	Data, the data itself
<cmd>	One character command
<dev>	One character device, which can be a directory in the memory or device.
<arg>	One or more arguments, all arguments are one character long. If two arguments are given which are contrary to each other the last one is taken.
<dir>	<dev>
<file>	Name of the file to be up- or down-loaded.
<etx>	End of text. Used to separate data posts from each other. When transfer from Stn, <etx>=(CRLF). When input to Stn, <etx>= (CR) or (CRLF).
<eot>	End of transmission. Tells the receiver that transfer is completed.
<status>	Message. Tells if an error condition occurs, or gives the status of requested system parameter.
,	Separates arguments from label.
=	Separates label from data.
(CR)	Carriage return terminates the command.
(LF)	Line feed.

Devices

Stn	Station unit
CU	Control unit
Gdt	Geodat

Arguments

'I'	The Area directory
'M'	The Job directory
'U'	The U.D.S program directory
'*'	All directories
'D'	Protocol directory (Geodat)

Geodimeter Language (Geo/L) syntax structure

The Geodimeter language is developed in order to create a standard for communication between devices in Geodimeter Systems. The basic Geodimeter data structure is data tagged with a label.

<lbl>=<dta>

e.g. 7=254.3496 Horizontal angle 254.3496

From this is the language developed by addition of commands and arguments in order to be able to direct data to and from a destination.

<cmd><dev><arg>...,<lbl>=<dta>(CR)[(LF)]

e.g. WG, 67=24572.358 Setout coordinate North set to 24572.358

Command types

There are two types of commands, one that requests data from the device, and on that sends data to set the device. Common for both types is that <eot> always is sent when the command is executed and the system is ready for a new command.

Sender:	<complete command>(CR)
Receiver:	[<status><etx>] [<lbl>=<dta><etx>]... <eot>

The status consists of 1 to 3 digits and is recognized in that no equal sign (=) is found before <etx>.
A request type command always gives a response with status and/or data posts. While a set type command only responses with status when an error condition occurs.
The meaning of the status number is equal to the normal messages given in the info list.

When file are transferred:

Sender:	<cmd><dir>=<file>(CR)[(LF)]
Sender or receiver:	<lbl>=<dta><etx> • <lbl>=<dta><etx> <eot>

Commands when starting up the communication

Break <alt><b>	to start the Geodimeter
PV,20	to start compenstor calibration
PV,21	to switch off the Geodimeter

Return signals from the Geodimeter

@	the compensator is displayed
!	Geodimeter awaits answer, Y(es) or N(o).

Protocol

Standard protocol for Station unit, Control unit and Geodat

Station unit	From program 582-04
Control unit	From program 588-01
Geodat	From program 594-01

		Set	Meaning
Baud rate	(F78):	9600	
Parity	(F78):	0	None
Character length	(F78):	8	8 bits
Stop bits	(F78):	1	1 bit
Time out:		-	10 sec
Software flow control:		-	Always on (Geodat)
Xon character:		-	DC1 (17)
Xoff character:		-	DC2 (19)
End of transmission (F79):		62	>

See next page for more information about how to set protocol.

PRG

51

Program 51 - Set Protocol

P51

Choose program 51.

```
Sel device 10:28
1 Xmem
```

1

Select the device for which you want to change the protocol.

```
       P51 10:28
Set protocol 0
1:Baud=9600_
```

ENT

Here you enter the baudrate (50-19200). Standard baudrates are e.g. 300, 1200, 2400, 4800, 9600, 19200. Press ENT.

```
       P51 10:28
Set protocol 0
2:Parity=0_
```

ENT

Enter the parity.
No parity=0
Odd parity=1
Even parity=2
Press ENT.

```
       P51 10:28
Set protocol 0
3:Char. len=8_
```

ENT

Enter the character length (7 or 8) and press ENT.

See next page

PRG

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From previous page

```
      P51 10:28
Set protocol 0
4:Stop bits=1_
```

Enter the number of stop bits and press ENT.

ENT

```
      P51 10:28
Set protocol 0
5:Time out=10_
```

Enter time out in seconds and press ENT. Time out is a parameter that determines the time after which a serial operation is interrupted if the transfer have been halted or if no device is found when trying to transfer. E.g. if trying to transfer data between a personal computer and a Geodat and the Geodat is not turned on the operation will be interrupted after the number of seconds that the time out parameter is set to.

ENT

```
      P51 10:28
Set protocol 0
6:Hardw. Hs=0_
```

Switch hardware handshake on=1 or off=0. When the parameter is activated the transmitting instrument will check that the receiving instrument is ready for transfer before it starts to send and during a transfer.

ENT

```
      P51 10:28
Set protocol 0
4:Softw. Hs=1_
```

Switch software handshake on=1 or off=0. If the receiving instrument is receiving to much data at a time and the parameter is activated, the transfer is paused until the already send data has been handled, the transfer will then continue.

ENT

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```
     P51 10:28
Set protocol 0
16:EOT=1.62
```

Enter end of transmission. That is the sign which is sent when the transfer is ready. The value is ASCII (62=>).

ENT

```
     P51 10:28

Ready ?
```

Press YES or ENT to step to program 0 or press NO to reenter the protocol parameters. In this case we press ENT.

ENT

```
     P0  10:28

Temp=20.0_
```

You return to program 0, P0.

Directory

Purpose: List of file catalog in memory.

Syntax: O<dir>C {Stn, Gdt, CU}

Comments:

<dir> Is the dir argument. 'I', 'M', 'U' and '*' are used. If <dir> is set to '*' the file catalog for all directories is output.

Return:

<lbl>=<file><etx>
•
•
<lbl>=<dta><etx>
<eot>

or

<status><etx>
<eot>

Examples:

OMC File catalog of all Job files in the JOB-directory.

O*C File catalog of all files in the memory.

Kill

Purpose: Delete files in memory.

Syntax: K<dir>[=<file>] {Stn, Gdt, CU}

Comments:

<dir> Valid directories for all devices are M, I and U. For Geodat is also D valid. If the file is omitted all files in the directory will be deleted.
If the directory is given a wildcard * the entire memory will be deleted.

<file> The file entry is the name of the specific file to be deleted.

Return: <eot>

or

<status><etx>
<eot>

Examples:

K* Delete entire memory.

KI Delete all area files.

KM=LOT Delete JOB named LOT.

Load

Purpose: Load Memory. Data according to the standard format can be loaded into the memory device.

Syntax:

L<dir>=<file>	{Stn, Gdt, CU}
L<dir><prot>=<file>	{Stn, CU}
LD	{Gdt}

Comments:

<dir> Is the dir argument. 'I', 'M', and 'U' are used.

<file> Is the name of the file (max 15 characters). The file name is case sensitive.

<prot> Is the protocol number.

Return:

<*> When this is received transmission of data can start.

or

<status><eot> If an error occurs.

Details: The transmission can start after the command is sent and the prompt <*> is send back from the device. The data shall be in the Geodimeter standard format. The transmission is ended by the EOT character. The EOT is given in F79 for Geodimeter and CU, and as protocol parameter 16 in Geodat.

Examples:

LI=LOT6 The area file LOT6 is created and can be loaded when the prompt * is received from the device.

LU=15 U.D.S program 15 will be loaded into GDM or CU.

LD Loads the protocol file into Geodat.

Memory

Purpose: Check for free memory.

Syntax:

M[G]	{Stn, Gdt}
M[R]	{CU}

Return: <number of bytes left><etx>
<eot>

or

<status><etx>
<eot>

Examples:

Command	Return	
M	31654	Bytes left in memory
MG	31654	

Mode

Purpose: Change measuring mode.

Syntax: PG,3=<arg> {Stn}

Comments:

<arg>	0	STD-mode
	1	TRK-mode
	2	D-bar mode
	3	FSTD-mode
	4	D-bar mode, high resolution

Return:

<eot>

or

<status><etx>
<eot>

Details: The command will work whether the instrument is locked on a target or not.

Examples:

PG,3=0	Change to STD-mode
PG,3=1	Change to TRK-mode
PG,3=2	Change to D-bar mode
PG,3=3	Change to FSTD-mode
PG,3=4	Change to D-bar mode, high resolution

Output

Purpose: Output from memory.

Syntax:

O<dir>=<file>	{Stn, Gdt, CU}
O<dir><arg>	{Stn, Gdt, CU}
O<dir><prot>=<file>	{Stn, CU}
OD	{Gdt}

Comments:

<dir> Is the dir argument. 'I', 'M', and 'U' are used.
<file> Is the name of the file (max 15 characters). The file name is case sensitive.
<prot> Is the protocol number.
<arg> Is the argument field. One argument can be used, 'C'. The 'C' argument will give an output of the file catalog.

Return:

<lbl>=<dta><etx>
•
•
<lbl>=<dta><etx>
<eot>

or

<status><etx>
<eot>

Examples:

OM=A45 Job file A45 is send out.
OU=3 U.D.S program no 3 is output.

Position

Purpose: Position the Station unit with servo.

Syntax: WS=<servo command> {Stn}

Comments:

<servo command>
The servo command is divided in the following parts:
<cmd><ang><tol>[<ang><tol>]

<cmd>	P	Tells Geodimeter to perform a position task, to given angles in horizontal and/or vertical. The angles can be given either via the instrument keyboard or by the serial command **Write** (**WG**). Enter the labels 26 and 27 with the correct values and then use the WS command to perform the positioning.
<ang>	H	Horizontal positioning
	V	Vertical positioning
<tol>	nn	Positioning tolerance, given in cc (0-99). Tolerance=0 means no tolerance given, typical accuracy is 2cc if set to 0.

Return: <eot>
or
<status><etx>
<eot>

Examples:

WS=PH05V10	Position horizontal with 5cc accuracy and vertical with 10cc accuracy.
WS=PH01	Position horizontal with 1cc accuracy.
WS=PV15	Position vertical with 15cc accuracy.

Read

Purpose: Read Station unit or Control unit. Read of measured data or data in specific labels.

Syntax:

RG=[<arg>][,<lbl>] {Stn}
RR=[<arg>][,<lbl>] {CU}

Comments:

<arg>
- [S] Standard output
- N Name output
- D Data output
- V Numeric output item by item
- T Test if signal from target. 300 is returned if NO signal. 301 is returned if signal.

<lbl> If a label is given, the contents of that label is returned. When omitted measured data is returned.

Return:

<status><etx> Standard output
<lbl>=<dta><etx>
e.t.c....
<eot>

or

<status><etx> Name output
<lbl name>=<dta><etx>
e.t.c....
<eot>

or

<status><etx> Data output
<dta><etx>
e.t.c....
<eot>

or

<status><etx> Numeric output
<lbl><etx>
<dta><etx>
e.t.c....
<eot>

or

<status><etx>	Message or
<eot>	Meas signal test

or

<lbl><dta>	Specific label
<eot>	

or

<lbl name><dta><etx>	Specific label
<eot>	with name

or

<dta><etx>	Specific label
<eot>	only data

or

<lbl><etx>	Specific label
<dta><etx>	numeric
<eot>	

Details: When read of measure data, the output is dependent on how the output table in the Geodimeter is set. See Geodimeter User Manual for detailed information.

Examples:

Command	Return	Command	Return
RG	0 7=10.2345 8=101.1005 9=145.324	RGN,5	Pno=104
RGD	0 10.2345 101.1005 145.324	RGN	0 HA=10.2345 VA=101.1005 SD=145.324
RGT	301	RGV	0 7 10.2345 8 101.1005 9 145.324
RG,5	5=104		

Trig

Purpose: Start of distance measurement in Station unit

Syntax: TG[<arg>] {Stn}

Comments:

<arg> Is the argument for short range '<' or long range '>' measure. The '<' is default and need not to be entered.

Return: <eot>

or

<status><etx>
<eot>

Examples:

TG or TG< Start of short range measure

TG> Start of long range measure

Write

Purpose: Write data into the Station unit or Control unit. All labels that can be set by the function key in the system can be written.

Syntax:

WG,<label>=<data> {Stn}
WR,<label>=<data> {CU}

Comments:

<label> 0-99
<data> Maximum 9 digits for numeric type labels, and maximum 16 characters for ASCII type labels.

Return: <eot>

or

<status><etx>
<eot>

Examples:

WG,5=10 Label 5 set to 10 in Station unit.

Status description

Value	Description
0	Instrument operating correctly, all required data are available.
3	The measured distance has already been recorded. A new distance measurement is required.
4	Measurement is invalid and recording not possible.
5	Recording is not possible with the selected mode setting of the Geodimeter instrument.
10	No device connected
20	Label error. This label cannot be handled by the instrument.
21	Parity error in transferred data (between Geodimeter and interface).
22	Bad or no connection, or wrong device connected.
23	Time Out
24	Illegal state to execute command. Occurs when trying to communicate in C2-position.
30	Syntax error.
35	Data error.

4

Software

Introduction

Geodimeter totalstations can be equipped with a number of different softwares in order to make the surveying work more efficient. This part of the manual will describe the different softwares that are available, how they are operated and what you can achieve by using them.

Choose program

Both the numeric- and the alphanumeric keyboard are equipped with a program key, hereafter referred to as the PRG-key.

Program key

By pressing this key you can start any program that are installed in your instrument.
There are two ways to choose a program; short press and long press on the PRG-key. On the next side we will describe the two different methods.

Short press

With a short press on the PRG-key you will get the following display appearance:

```
STD   P0  10:16

Program=20
```

Key in the desired program number and press enter to confirm the choice, e.g. 20 ENT will enter program number 20, Station Establishment.

Long press

With a long press on the PRG-key you step to the program menu. Here you can display all the available programs. Any program that are available but not installed in your instrument is displayed with two brackets,( ).

```
PRG   P20  10:16    <-- Current library and program no
460 582-09          <-- Instrument model and program ver
Stn establ.         <-- Current program name
Dir <-- --> Exit    <-- Key functions
```

Key functions:

Dir:	Step between the U.D.S- and PRG-library
<-- -->	Step backward / forward in the chosen library.
Exit/MNU:	Exit without starting any program
ENT:	Start the chosen program

Note ! ☞ **Note - arrowkeys**

If the arrowkey is held depressed you will automatically step to the next/previous program without having to press the key repeatedly.

User defined storage of control data in the field calculation programs

It is possible to define what results to be stored in the JOB file using the field calculation programs.
In some programs you can only add information and in some you can define data all by yourself.

See page 4.6 for a complete list of the programs that can be configured.

When you start any of these programs by the program library you will get the following display appearance:

```
      P23 14:17    <-- Current program no and time
1 Run              <-- Start program without any config.
2 Config           <-- Configure program
```

Choose 1 Run to start the program without any configuration or press 2 to configurate the program.
Press the CL-key to exit from this menu and step to the current program.

Configurate the user defined output table

When you press 2 you will get the following display appearance:

```
      P23 14:17    <-- Current program no and time
1 Exit             <-- Step to the previous menu
2 View table       <-- View the current output table
3 Enter user tbl   <-- Configure table
```

Note! ☛ When pressing the PRG-key on the control unit in local mode you can only access this menu.

ENT

See next page

Choose one of the alternatives (press ENT for more) or press 1 or the CL-key to step to the previous menu.

From the previous page

```
      P23 14:17
4 Clear user tbl      <-- Clear the current user table
```

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2 View table

If you press 2 you will view the current output table:

```
      P23 14:17       <-- Current program no and time
Def. tbl pos 1        <-- Table position
Label : Pno           <-- Label
more ?                <-- View more ?
```

This is position 1 in the output table. Press YES or ENT to view the next position or step to the previous menu with NO. When all positions in the output table are viewed you will return to the previous menu.

3 Enter user table

If you press 3 you will enter the output table:

```
      P23 14:17       <-- Current program no and time
User tbl pos 1        <-- Table position
Label no=_            <-- Label
```

This is position 1 in the output table. Enter the first label no and press ENT. Press only ENT when you are finished. The new output table will be default.

4 Clear user table

If you press 4 you will get the following display appearance:

```
      P23 14:17

Clear user tbl
Are you sure ?
```

Press YES or ENT to delete the current output table or press NO to cancel.

Note !

When you delete the output table the standard output table will be default.

Which data can be stored in a specific program ?

On the next page is a list over the labels that are always stored in a specific program (Always) and which labels that the operator can choose whether to include or not (Standard). E.g. in program P24, RefLine, the Reference point data (labels 5, 37, 38...) are always stored. The operator can by configu-rating the program via the configuration menu at startup choose whether to include any of the standard labels or not, e.g. measured point data (5, 6, 37...). As default when no configuration has been made, all standard will be stored.

Program configuration list

Always=cannot be changed
Standard=can be changed

SetOut - P23
Always: None
Standard: 5, 40, 41, 42*

RefLine - P24
(Measure)
Always: (5, 37, 38, 39, 5, 37, 38, 39, 44)¤
Standard: 5, 6*, 37, 38, 39*, 72, 73, 42*

(SetOut with Radofs/RTofs)
Always: (5, 37, 38, 39, 5, 37, 38, 39)¤
Standard: 5, 72, 73, 42*

(SetOut with coordinates)
Always: (5, 37, 38, 39, 5, 37, 38, 39)¤
Standard: Same as P23, modified by config P23.

DistOb - P26
Always: 5, 5, 7, 11, 10, 14
Standard: None

Obstructed Point - P28
Always: 20, distBC, Pno, 37, 38, 39, 7, 11, 10, 14
Standard: Data for point A and B

RoadLine - P29
(SetOut)
Always: None
Standard: 80, 83, 40, 41, 42*, 39*

(Measure)
Always: None
Standard: 80, 83, 4, 37, 38, 39*

** These labels (height) are only stored if height measurement has been included in the station establishment.*
¤ These labels are only stored if using a known reference line.

Data Collecting

U.D.S - In general

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In general

U.D.S will allow the operator to create own User Definied Sequences for the registration and display of measurement, coding and administrative data. Creation of the sequences is carried out directly from the keyboard of the instrument or transferred from an external device via the serial port.

What advantages can be gained with U.D.S

- It is possible to create and store up to 20 U.D.S´s in the instrument.
- The existence and use of a buffer memory in the instrument allows data to be stacked, which leads to simplified and accelerated data registration.
- It is possible to create and store up to 16 user definied labels (No 84-99) in the instrument.
- Measurement status is always under complete operator control with the help of the automatic display of program prompts in the instrument.
- All labels and values can be duplicated, incremented or decremented automatically. This means that the labels can be registered in a Geodimeter Memory Device (GMD) without even seeing them in the display and without the need to press the ENT key for duplicating and incrementing/decrementing.

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In general

Program 40 - Program Generation

Program 40 must be selected in order to create an U.D.S. Once the sequence has been created it is not necessary to run the program 40 in order to access the UDS. It is stored in the memory of the instrument and can be directly accessed by choosing the UDS program number. It will also remain within the instrument until it is deleted or changed by the operator. Program 0-19 are reserved for UDS´s. The sequence is generated by specifying the program No, the order of the desired labels=program prompts and label types. Finally, the label No 79=End must be used to either terminate, loop or link the U.D.S to another U.D.S.

Creation of U.D.S's

On the next page is a list of Standard Labels. In addition, user definied labels can be set with Program 41 which is described on page 4.1.17. The list and table of label types is not sufficient to explain how and when certain labels and label types are displayed in the instrument during the creation of your U.D.S's.
You simply key in the label's corresponding number and type in the desired order. In the event of making a mistake during the creation of the U.D.S, the opportunity of correcting the mistake is given by the program asking you to confirm the choice of both label and label type. Your choice of labels and label types is more easily understood when you start to create your own U.D.S's together with the help of the following examples.

Geodimeter Standard Labels

The label list containing Label 0-83 possess certain functions in Geodimeter operation. While creating U.D.S's, the operator can change the prompt text (P41) but the function of the label will remain the same. Labels 84-99 are reserved for arbitrary use by the user and can be definied with the program 41, Set Label. Due to the flexibility of the system, almost all label types can be used with all labels. In P0 the only types valid are 2, 6, 7, 8. Info 41 is shown if a wrong label type is used.

Note ☛ Info 41

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Label types

Label types

The label type determines the function of the label.

No	Label Type	Description
0	**Registration**	Collect values directly from the Geodimeter.
1	**Prompting label**	Enter data manually.
2	**Set ***	Set values directly in the Geodimeter.
3	**Duplicating (auto. or man.)**	Display both prompt and the last registered value.
4	**In-/decrementing (auto. or man.)**	Automatic in-/decrementation of the previously stored value.
5	**Loop/repeat END ***	Return the U.D.S to the first program step.
6	**Single Program END ***	Return the U.D.S to P0.
7	**Link Program END ***	Link the present U.D.S to another U.D.S.
8	**View label ***	View a value.
9	**Call U.D.S-program ***	Start another U.D.S inside the current U.D.S as a subroutine.
10	**Logon ***	Choose memory unit and Job file.

*** Can not be stored**

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Label types

0 - Registration
Registration of raw and/or calculated values from the Geodimeter. This type of label is chosen when measured and calculated values can be collected directly from the Geodimeter, e.g. HA, VA, SD, N, E, ELE, HD, VD.

Note ☛ For label 21 the only label types that can be used are 1&2

1 - Prompting label
Enter data manually after the prompt. The default value of the label will not be displayed.

2 - Set
These pre-set values e.g. Label 21=Hor.ref. angle can be set directly in the Geodimeter

3 - Duplicating (automatically or manually)
This label type is used for displaying both the prompt and the last registered value (e.g. SH=0.75). This value can be changed by overwriting or accepted by depressing ENT. The first time you key in the label when you run the U.D.S you are able to choose if the duplication should be automatic or not. If so the next time you enter this program step the label is automatically stored without being displayed.

Note ☛ If the same label and type exists in an UDS that are linked or called upon, the duplication, in-/de-crementation remains.

4 - Incrementing/Decrementing (automatically or manually)
The previously stored value belonging to the same label e.g. Pno=3 is automatically incremented/decremented and can be accepted and stored into GDM either manually or automatically. Displayed values can be overwritten and/or accepted. The first time you key in the label when you run the U.D.S you are able to choose if the incrementation/decrementation should be automatic or not. If so the next time you enter this program step the label is automatically incremented/ decremented and stored without being displayed.

Note ☛

Note - when using Autodup or Autoincr/decr
Sometimes you are able to change the "invisible" values during a U.D.S sequence by using the function key and enter a new value for the label, e.g. F6, ENT, SH=1.0, ENT.

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Label types

5 - Loop/repeat END

Choice of this label type will automatically return the U.D.S to the first program step after registration of the last data items in the measurement sequence.

6 - Single Program END

Choice of this label type will return the U.D.S to program 0 after registration of the last data items in the measurement sequence.

7 - Link Program END

Choice of this label type will link the present U.D.S to another U.D.S of the operators choice, allowing the field operation to be registered as one complete sequence. Note that in the linked U.D.S the logon procedure will not be run.

8 - View Label

This label type is used when you wish to look at certain values without changing them. Useful if you have Auto dup./ Auto inc. Note that the values will only show if you have a measured distance. Change any value with the function key.

9 - Call U.D.S

If you choose this label type you are able to start another U.D.S program as a subroutine. When the subprogram is finished you return to the next step in the original U.D.S. You can call upon U.D.S's in max. 4 levels, otherwise you will get Info 47. Note that the linked U.D.S. must end with type 6 (Single program END).

Note! ☛ **Note !**

The labels that are unique in the subprogram will not be reset when you restart the original U.D.S program.

10 - Logon

Choose in which unit and in which Job file you wish to store the data when you make a registration. This label type can only be accessed when starting the U.D.S from computer. In order to register anything a logon step must be run through otherwise Info 10 will appear when trying to register, link or call.

Is this how you would like to set up your own program ?

Prog. No	Prompts used in U.D.S	Label No	Label Type	Remarks
1				**Program generation of general project/Job data program**
	Logon		(10)	YES
	Operat	53	3	Value seen, accept or key in new
	Date	51	3	Value taken directly from GDM.
	Time	52	3	-"-
	Temp	56	1	Prompted for and keyed in
	Press	74	1	-"-
	End	79	6	Single program, return to P0
2				**Program generation of inst.stn/Ref.Obj data program**
	Logon		(10)	YES
	Stn	2	1	Prompted for and keyed in
	IH	3	1	-"-
	RefObj	62	1	-"-
	HA ref	21	1	-"-
	End	79	7	Link this program to Prog. 3.
3				**Program generation of survey point data program**
	Pno	5	4	Incr/decr value seen, accept or key in new.
	Pcode	4	3	Duplicated value seen, accept or key in new
	SH	6	3	-"-
	HA	7	0	Value taken directly from GDM
	VA	8	0	-"-
	SD	9	0	-"-
	END	79	5	Prog. loops back to first step in this sequence=Pno

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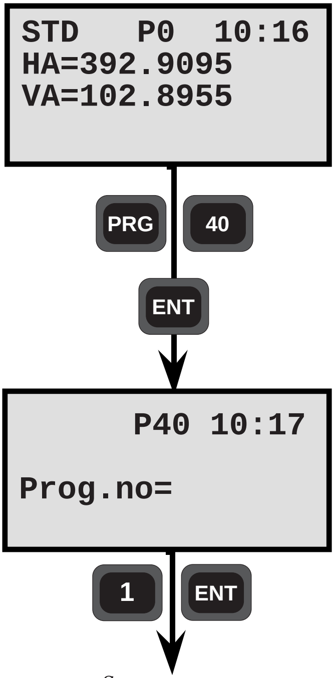
How to use

The programs (sequences) on the previous page are only examples of how you could design your field data recording sequences. Normally the surveyor is aware of the different types of projects in which he or she shall be involved and it is therefore possible to design in advance those programs which he or she may need and store them in Geodimeter. In the event of some unusual survey task turning up for which time is no stored program, it is a case of just entering the required sequence into Geodimeter directly in the field.

How to use



Select program 40 (U.D.S).

You are now ready to begin with creation of the U.D.S's 1, 2 and 3 on the previous page. First key in 1 and ENT.

See next page

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How to use

From previous page.

```
       P26 10:17
P1
Name=_
```

Enter a name for the U.D.S -program. Press the ASCII-key to enter an alphanumerical name (max 16 characters). Press ENT when ready.

ENT

Note ☛

```
      P26 10:17

Prog.no=1
View ?
```

Note !
If the program already exists this question appears. Press YES to view the program or NO and YES to delete it.

```
       P40 10:16

Logon?
```

Press YES or ENT to put logon first in the program. (See page 4.1.14 for information about logon).

YES

```
       P40 10:16
P1 Step no 1
Label no=_
```

Step 1 is Label No for operator. Key in 53 and ENT.

53

```
       P40 10:16
P1 Step no 1
Label :Operat
Type = _
```

Label type=duplication type (3) as it is often same operator who uses the instrument daily. Key in 3 and press ENT. If you leave the line blank you will return to the previous menu.

3 ENT

See next page.

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How to use

From previous page.

```
     P40 10:16
P1 Step no 1
Dup:Operat
Ok?
```

Here you have a chance to change your mind e.g. if you made a mistake with either label choice and/or label type. In this example we press YES.

YES

```
    P40  10:17
P1 Step no 2
Label no=_
```

Label no for Date. Key in 51 and ENT.

51

```
     P40 10:17
P1 Step no 2
Label :Date
Type = _
```

This value will be taken directly from GDM as you have chosen label type 0, you will not need to key in the date.
Key in 0 and ENT.

0 ENT

```
     P40 10:17
P1 Step no 2
Meas:Date
Ok?
```

Press YES to accept the label.

Carry on in this manner using the filled in example on page 4.1.7. If you loose track as to where you are in your sequence you can easily see this by checking on the step No.

YES

See next page.

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How to use

From previous page.

When you come to step No 6 which is the point at which you wish to terminate the sequence, do as follows:

```
     P40 10:21
P1 Step no 6
Label no=_
```

This is equivalent to choosing Label No 79=END. Press only ENT.

ENT

```
     P40 10:21
P1 Step no 6
Label :Special
Type =
```

This is the label type for a single non-linked sequence. Key in 6 and ENT.

6

```
     P40 10:21
P1 Step no 6
Single
Ok?
```

Key in YES to accept the label.

YES

```
STD   P0  10:21
HA:32.9960
VA:48.9088
```

You are automatically returned to the program 0. In order to be able to continue with sequence creation it is necessary to choose Program 40 before starting with Program 2.

PRG

40

U.D.S examples

U.D.S Examples

The design of U.D.S's is of course dependent on how your existing software accepts data recorded in Geodimeter Recording Devices. Formatting possibilities must exist within the system so as to be able to present the recorded and transferred data in a suitable lay out. This may entail some small changes to existing data transfer programs or even the necessity to create some new ones.

Recording of raw data

Prog 1 - General

Label	Text	Type
	Logon	10
53	Operat	3
51	Date	3
52	Time	3
56	Temp	1
74	Press	1
79	END	6

Prog 2 - Stn Est

Label	Text	Type
	Logon	10
2	Stn	1
3	IH	1
62	RefObj	1
21	HAref	1
79	END	7

Prog 3 - Survey with heights

Label	Text	Type
5	Pno	4
4	Pcode	3
6	SH	3
7	HA	0
8	VA	0
9	SD	0
79	END	5

Prog 4 - Survey with no heights

Label	Text	Type
5	Pno	4
4	Pcode	3
7	HA	0
8	VA	0
9	SD	0
79	END	5

PRG

40

U.D.S examples

Prog 5 - Survey

Label	Text	Type
5	Pno	4
7	HA	0
8	VA	0
9	SD	0
79	END	5

Prog 6 - Survey

Label	Text	Type
7	HA	0
8	VA	0
9	SD	0
79	END	5

Recording of raw data and coordinates

Prog 8 - Survey with heights

Label	Text	Type
4	Pcode	3
5	Pno	4
6	SH	3
7	HA	0
8	VA	0
9	SD	0
37	N	0
38	E	0
39	ELE	0
79	END	5

Prog 9 - Survey with no heights

Label	Text	Type
4	Pcode	3
5	Pno	4
7	HA	0
8	VA	0
9	SD	0
37	N	0
38	E	0
79	END	5

Prog 10 - Survey without heights and Pcode

Label	Text	Type
5	Pno	4
7	HA	0
8	VA	0
9	SD	0
37	N	0
38	E	0
79	END	5

PRG

40

Create a subroutine

Choice of storage unit

If you press YES or ENT at the question "Logon?" when you create your U.D.S- program , you will be able to choose in which memory unit and in what Job-file all data will be stored when registering.

Note !

If this logon routine is not included Info 10 is shown and no registration can be done even if pressing the REG-key.

Create a subroutine

Look at page 4.1.12. Program 1 is a general U.D.S-program that are useful whenever you want to start a U.D.S sequence. Instead of manually initiating this program you can call upon this program from any of your other U.D.S programs. Simply press ENT and choose type 9, Call (Program 1), at the second step in your U.D.S-program. This means that when you start your U.D.S program, e.g. Program 2, the program automatically initiates program 1, the general U.D.S-program. When the general program is run through you are returned to the next step in program 2.

```
    P40 10:21
P2 Step no 1
Label no=_
```

Enter program 40 and choose to create program 2. Answer YES to logon. At step 1 press ENT.

ENT

```
    P40 10:21
P2 Step no 1
Label : Special
Type =_
```

Choose label type 9, Call, and press ENT.

9

See next page

PRG

40

Create a subroutine

From previous page

```
      P40 10:21
P2 Step no 1
Label : Special
Call=_
```

Here you enter the program you want to call. In this example we choose program 1 and press YES (ENT).

1 YES

```
      P40 10:21
P2 Step no 2
Label no=_
```

Accept the first program step with YES or ENT. Press NO to reenter. Continue with the following program steps.

Now lets start program 2 and see how it works.

```
STD   P0  10:21

Program=_
```

Start program 2.

2

```
UDS   P2  10:21

Job no=3_
```

First the program runs through the logon procedure and you choose in which Job file you wish to store the data.

ENT

PRG

40

Create a subroutine

From previous page

```
UDS    P2   10:21
1:Xmem off
2:Imem off
3:Serial off
```

Choose in which memory unit you wish to store the data.

2 ENT

```
UDS    P1   10:21
Step:2    Store
Date=1992.0211_
```

Now the program calls upon program 1. Enter the general parameters...

YES

```
UDS    P1   10:21
Step:5    Store
Instno=69000_
```

This is the last step in program 1. When you press ENT you will return to step 2 in program 2.

ENT

```
UDS    P2   10:21
Step:2    Store
Stn=_
```

The program will continue step by step to the end of the program.

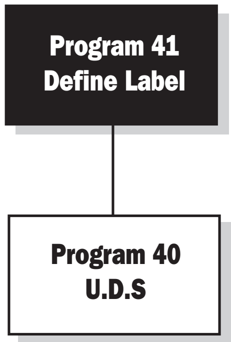
Define Label - In general

PRG

41

In general

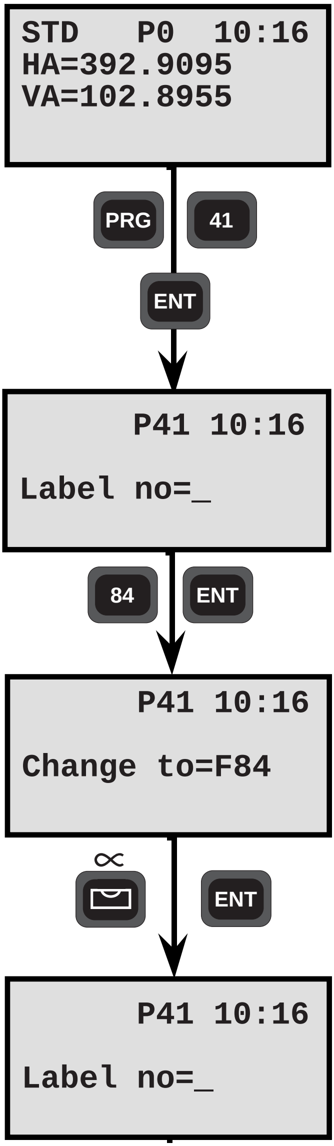
With program 41 you can define label no 84-99.
Program 41 - Define Label is included in the following program:



How to use

Turn the instrument on and disengage the dual-axis compensator with function 22.

In general



Select program 41 (Define Label).

Choose any label between 84-99. In this example we choose 84 and press ENT.

Here you can see any old definition that may exist. Press the ASCII-key to adopt ASCII-mode and use the ASCII table and key in the approp-riate characters, e.g. 71 68 84 32 78 79 (GDT NO) and press ENT.

When you are ready press only ENT instead of keying in a label no. You will now return to program 0.

Enter Coordinates - In general

PRG

43

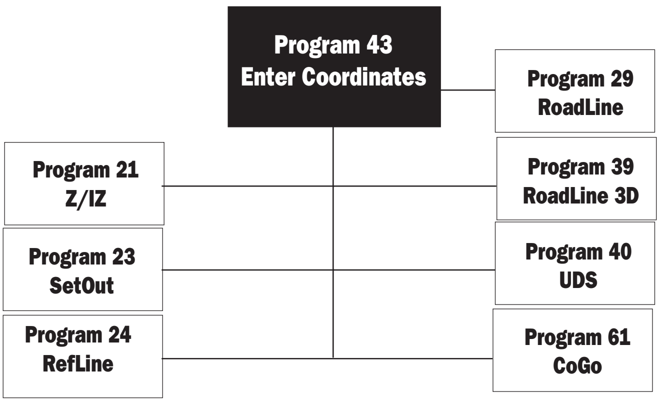
In general

With program 43 you can carry out storage of known coordinates. These known values are stored in an Area file. The data contained in these AREA files will take the format Pno, Pcode, Northing, Easting and Elevation and must be keyed in manually. Coordinates are entered with up to 7 positions and 3 decimals.

Transfer of point coordinates and elevation data banks between computer and the different Geodimeter units is carried out with program 54, File transfer, or by sending serial commands. See part 3, Data communication for more information.

As the total number of Area files is unlimited (device memory capacity is only limitation), the same point numbers can be used as long as they are stored in different Area files. Same point numbers can be stored in the same Area file, however, it is always the point nearest the beginning of the file which is recalled for use in Station Establishment -P20 and SetOut - P23 calculations. If a particular point has to be updated in an Area file, this can be done with Edit, if the software is installed in your instrument.

Program 43 - Enter coordinates is included in the following programs:



How to use

PRG

43

How to use

Switch on the instrument and go through the Start procedure until the instrument is in theodolite mode.

```
STD   P0  10:16
HA=392.9095
VA=102.8955
```

Select program 43 (Enter Coordinates).

PRG 43

ENT

```
Sel device10:17
1 Imem
2 Xmem
```

In which device do you want to store the point coordinates. In this example we choose 1 Imem.

1

```
      P43 10:16

Area=_
```

Key in the name of the Area file in which you wish to store the point coordinates and height values. In this example we key in 25 and ENT.

25 ENT

```
      P43 10:16

HT measure ?
```

Do you want to store heights? In this example we choose to do so. Press YES (ENT) to accept or NO to cancel.

YES

PRG

43

How to use

From previous page.

```
      P43 10:17
Pno=
```

Key in the first point number you wish to store in the Areafile. In this example we key in 1 and ENT.

1

ENT

```
      P43 10:16
Pno=1
Pcode=_
```

Here you have an opportunity to enter a Pcode for the point. The program will propose the last Pcode entered. Accept it, key in a new or leave it blank.

1 ENT

```
      P43 10:16
Pno=1
Pcode=1
N=3456789.012
```

Key in the Northing value of point number 1 and press ENT.

ENT

```
      P43 10:16
Pno=1
Pcode=1
E=1234567.789
```

Key in the Easting value of point number 1 and press ENT.

ENT

See next page.

PRG

43

How to use

From previous page.

```
       P43 10:16
Pno=1
Pcode=1
HT=123.890
```

Key in the height of point number 1 and press ENT.

ENT

```
     P43  10:17
Pno=1
Pcode=1
Store ?
```

Press YES to store point number 1 or press NO to cancel. In this example we press YES.

YES

```
       P43 10:17
Pno=_
```

Key in the next point number or press only ENT when you are finished. In this example we press ENT.

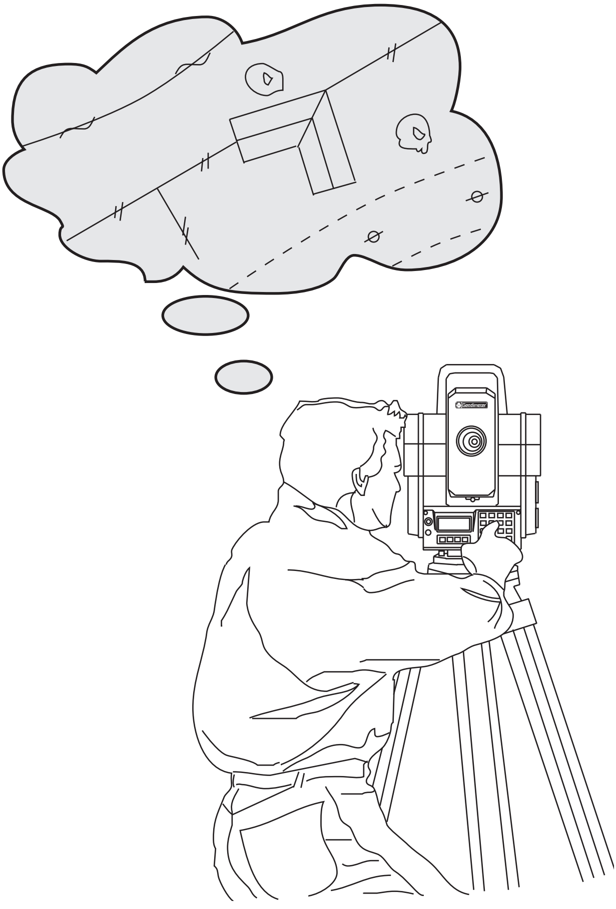
ENT

```
       P0  10:17

Temp=20.0_
```

You are now returned to program 0.

PRG

45



Pcode - In general

PRG

45

In general

Pcode provides the operator with the opportunity of calling upon a point code library which can be directly created from the instrument keyboard. After Pcode library creation and keying in of the Pcode number, the appertaining Pcode name will be displayed either for acceptance or rejection and thereafter recording.

How do I create my very own point code library

This is done simply by choosing the program No 45=Pcode. It then simply becomes a task of keying in the numerical value of the point code followed by its equivalent alpha or alpha-numerical title. The instrument automatically adopts the ASCII mode for this purpose and you consult the ASCII table in your instrument user manual for the keying in of the alpha/alpha-numerical codes. Pcode numbers range from 1-250; if Nos above this range are chosen INFO 31 is displayed. The equivalent alpha point code can contain up to 16 characters; in cases where 16 characters are required, the prompt "Text=" will disappear from the display during the creation of the point code.

Note ! ☚ Info 31

Maximum of stored points

The maximum number of characters which can be stored in the point code library is limited to 800. In other words if all the point codes stored in the library have a maximum number of characters of 16, there would be enough room for 50 point codes. However, as most point codes are abbreviated, the storage room of 800 characters should provide the operator with enough storage place for all point codes her or she will require for storage of detail point code numbers during e.g. a tacheometric exercise.

Note ! ☚

Note!

If using Geodat or an external memory device, the numeric value of the point code is stored, not the title.

PRG

45

In general

Activation/deactivation of Pcode

After the installation of Pcode in the instrument, it can be activated or deactivated with the help of menu 16-Switches.

```
Set          10:16
Targ.test     on?
AIM/REG      off?
Pcode         on?
```

MNU 16

Menu 16 - Switches

This means that if Pcode is set to ON the keying in of a numerical point code in e.g. an U.D.S, will automatically result in the equivalent alpha/alpha-numerical point code being displayed in the instrument; its correctness is confirmed by pressing ENT. If wrongly keyed in the point code can be overwritten without having to clear the wrongly chosen one with the CL-key.

There are however some occasions where operators are very experienced and have been working with only numeric Pcodes on field cards for years. On this occasion the Pcode switch can be switched off. The instrument will always adopt the last chosen ON/OFF mode at switch on. The status of the switch can also be seen when keying in one´s first point code number in a U.D.S, i.e. if the point code's equivalent alpha title is seen in the display after keying in the numeric code and pressing ENT, then the switch is set to ON.

Note ! ☛

Note!

In order to correct any wrongly keyed in point code alpha title, so that it corresponds with its numerical point code value, it is necessary to recreate it with the help of Pcode.

The changing and deletion of wrongly keyed in data and the insertion of a new can of course be carried out with EDIT, if you have access to this software in the instrument.

PRG

45

In general

Auto dup, auto incr/decr label types

When using the Auto dup/auto incr/decr feature with Pcodes in U.D.S's, wrongly keyed in values can be changed without the prompt and its respective value being duplicated in the recording device. This is done by using the F4 function; this function must of course be used before pressing the REG key. In cases where ordinary Dup and incr/decr label types are used, use of F4 function will result in the Prompt and its respective data being added to the already in-buffer memory recorded data. In other words, the point code data will be duplicated. This can of course be erased and corrected with EDIT later, if you have access to that particulary software. This of course applies to all data which has been wrongly recorded while using the Auto dup, Incr/Decr in the connected recording device. So even if you have pressed the REG key, it is never to late to erase and/or change and correct wrongly recorded point code data. Correction of wrong and entry of new Pno and SH values can be treated in the same manner.

PRG

45

How to use

How to use

Switch on the instrument and go through the Start procedure until the instrument is in theodolite mode.

```
STD   P0  10:16
HA=392.9095
VA=102.8955
```

The instrument's station has been established. Select program 45 (Pcode).

PRG 45

ENT

```
      P45 10:17
Pcode=_
```

Choose the numerical value of the pcode to which you wish to give an alpha title. In this example we choose 1 and press ENT.

1

```
      P45  10:17
Pcode=
Text=
ASCII=
```

The instrument adopts the ASCII mode, key in the complete alpha title or abbreviated alpha title of the point code. In the example we key in 87 65 76 76=W A L L (see the ASCII table).

ENT

```
      P45 10:16
Pcode=2
```

Continue to create your Pcode library in this way until you have stored all the alpha titles you need. When you are finished, press ENT to return to P0.

PRG

45

How to use

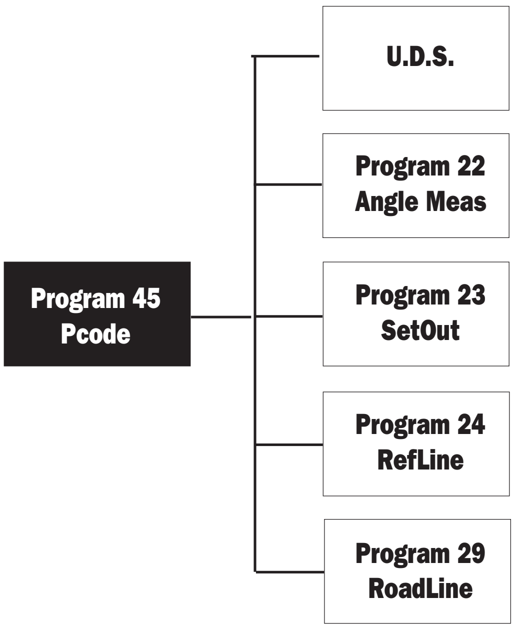
Pcode in U.D.S and other programs

You have now stored, in the memory of the instrument, the necessary alpha titles of most types of survey detail you require to survey in during your tacheometric task. As soon as you have established your instrument over the survey station at which the survey measurements shall be carried out you can take advantage of the alpha and alpha-numerical Pcodes stored in your Pcode library. When in the U.D.S, the sequence prompts for the point code corresponding to the type of survey detail which is to be measured and stored, all you do is key in the relevant Pcode's numerical value. After its display, confirmation of its correctness is done by pressing ENT on the instrument keyboard. Storage into Geodat or any other external device is finalized by pressing the REG key of the instrument after the point has been measured.

Note ! ☞ **Note!**

If using a Geodat or an external memory device, the numeric value of the point code is stored, not the title.

Pcode can be entered directly in the following programs:



Edit & View

In general

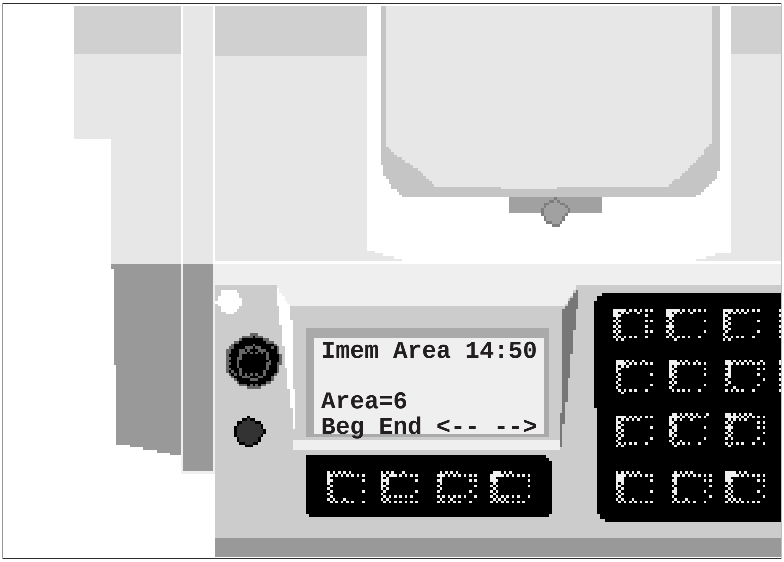
MNU

2

In general

With EDIT installed in your Geodimeter, it is possible to carry out editing of the data within the recording device, External memory or Geodat, directly from the keyboard of the Geodimeter instrument. Viewing of the data, before editing, can be done with the help of VIEW, which is automatically included in EDIT software additional option.

You can step through files, search for, delete, insert and change data. EDIT is selected directly from the main menu of the instrument, option 2 - EDITOR. This option is directly linked to a sub-menu which allows you to edit data in either the external memory (Geodat) or the internal memory. The editing features of this software option are menu driven with the command options show on the bottom line of the display, which are in turn directly placed above the relevant operating key of the small keyboard.
The various operations are selected by pressing the relevant key. The keyboard is reconfigured to the actual chosen mode and when the bottom line is not visible, the key continues to operate with its original function.

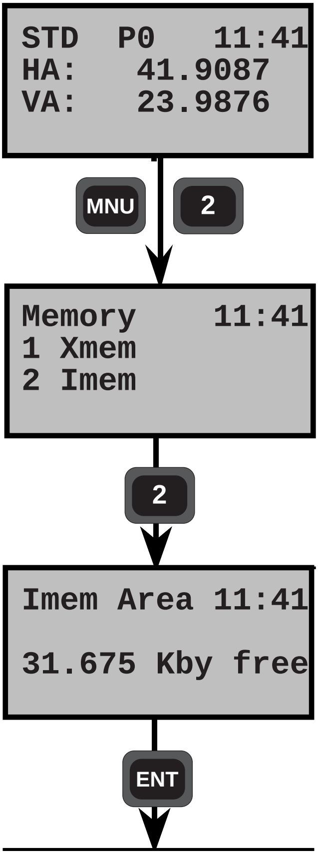


How to use

MNU
2
How to use

The program consists of three modes of operation, each with its own menu. The modes are 1 View, 2 Edit and 3 Directory.
To enter the editor, follow the instructions below.

Startup



Enter the program via menu 2.

In which memory unit do you want to work, 2-the internal memory or 1-an external memory.

You are now displayed the remaining memory capacity (total number of Kbytes free). Press ENT to step further.

See next page

MNU

2

View mode

View

In this mode you can select which file you want to view. Here you can also use the view functions to step forward or backwards in the file.

```
Imem Area 14:50

Area=6
Beg End <-- -->
```

<-- Current memory unit and file type

<-- Current file number

<-- Command line

Beg

Jump to the beginning of the file.

End

Jump to the end of the file.

<- -

Step to the previous line in the file.

- ->

Step to the next line in the file.

Note! ☛ **Note - arrowkeys**

If the arrowkey is held depressed you will automatically step to the next / previous line without having to press the key repeatedly.

ENT — Press this key to step to the next mode = EDIT.

MNU — Press this key to return to the main menu.

MNU

2

Edit mode

Edit

In this mode you can find, change, insert and delete data in the file you have chosen.

```
Imem Area 14:50      <-- Current memory unit and file type

Area=6               <-- Current file number
Del Ins Chg Find     <-- Command line
```

Del

Delete current label and prompt or complete file.
Deletion of complete files can be executed when the prompt is a filename e.g. Job No. To avoid accidental file deletion a "yes/no" prompt must be answered.

Ins

Insert a label and prompt in front of the one displayed.

Chg

Change data relating to displayed label.

Find

Search for label or label and prompt.
When the data value for a prompt is keyed in, the first prompt with that value is displayed.

ENT Press this key to go to the next mode = DIRECTORY

MNU Press this key to return to the main menu

MNU

2

Directory mode

Directory

In this mode you can select what type of file you want to view, Area- or Job-file.

```
Imem Area 14:50

Area=6
Dir <- -> Exit
```

<-- Current memory unit and file type

<-- Current file number

<-- Command line

Dir: Switch between the Job and the Area file directory

<--: Show name of the file following the one now displayed

-->: Show name of the file in front of the one now displayed

Exit: Exit to the main menu

Note! ☛ **Note - arrowkeys**

If the arrowkey is held depressed you will automatically increase/decrease the file number without having to press the key repeatedly.

ENT Press this key to go to the next mode = VIEW
If the current file is not visible in the display a prompt for change to file ? is seen. In the case of answering YES the old file is closed and the new is opened. Answering NO will lead you back to VIEW without file change.

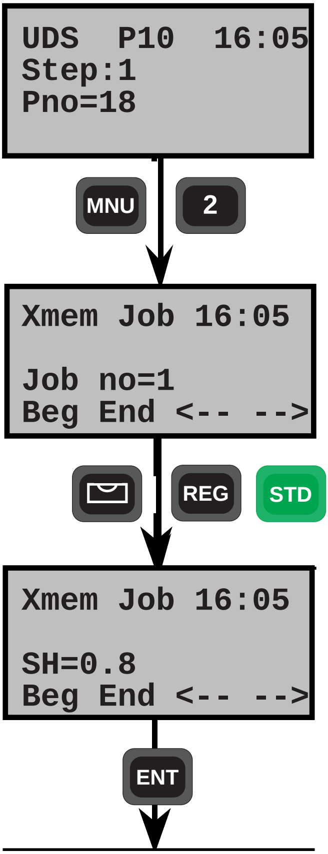
MNU Press this key to return to the main menu

Examples

Examples

In order to fully appreciate the operating flexibility of EDIT, we will now run through a few examples. It is assumed that before you start the editing examples you should prepare the instrument as follows: Set up the instrument, connect Geodat and survey in a few points using one of your own specially designed UDS´s and store them in Geodat. Instead of using a Geodat you can save the points in your internal memory and use the internal memory instead of the external memory in the example below.

Change data / Replace with new data



After registration of a point you realise that the last SH of 0.8m for Pno 17 was wrong. First follow the startup instruction described on page 4.2.3. In this example we choose the external memory.

As you know that it was the last point you first press End to go to the end of the Jobfile. Then you can use the <--=(REG-numeric keyboard or STD-alfanumeric)to step back to the wrong SH.

Now press the ENT key to step to the EDIT mode.

See next page

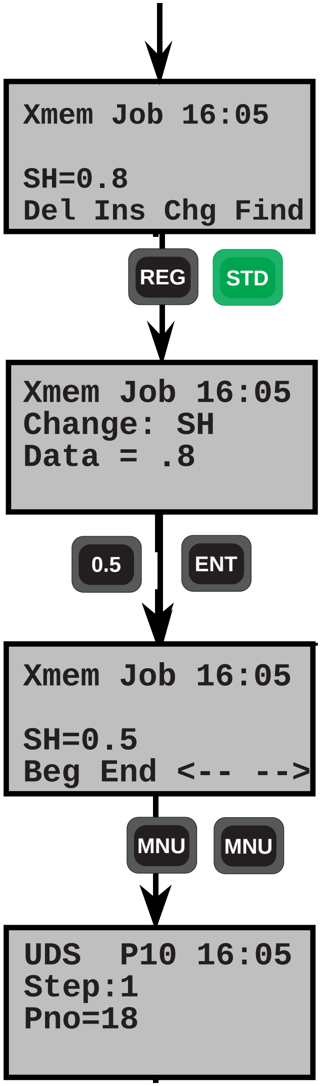
MNU

2

Change/ Replace

Change data / Replace with new data (cont.)

From previous page



You are now in EDIT mode and you want to change the SH value from 0.8m to 0.5m. Press therefore the CHG key =(REG-numeric keyboard or STD-alfanumeric).

Key in 0.5 to overwrite the wrongly stored value of 0.8 and accept with ENT. Press only ENT if no change is to be made.

In order to see that the changed SH value has been stored in the correct place use the arrowkeys.

Press MNU twice to return to the UDS-sequence.

MNU

2

Find and Change

Find and Change data

```
STD P0 17:55
HA: 355.3245
VA: 101.4252
```

Follow the startup instruction described on page 4.2.3. In this example we choose the external memory.

MNU 2

```
Xmem Job 16:05

Job no=12
Beg End <-- -->
```

You are now in the VIEW mode. Press ENT to go to the EDIT mode.

ENT

```
Xmem Job 16:05

Job no=12
Del Ins Chg Find
```

You wish to find the point No 204 to change its SH to the correct value 1.7. Press the FIND key=(A/M-numeric keyboard, TRK-alfanumeric).

A/M TRK

See next page

Note! ☛

Note - Find

If wishing to find data try always to be at the front (top) or back (end) of the data file before the search begins. If you go past a value and try to find it, an error will be given, i.e. INFO 32.

If wishing to find data which belongs to one particular label, the find routine will jump consecutively through the file from that particular label No. to the next one, jumping the other labels in between.

MNU

2

Find and Change

Find and Change data (cont.)

From previous page

```
Xmem Job 16:05
Find
Label=
```

In order to first find the point No you first have to choose the label No for Pno. Key in 5 and ENT.

5 ENT

```
Xmem Job 16:05
Find: Pno
Data=_
```

Here the Pno is being asked for. Key in 204 and ENT.

204 ENT

```
Xmem Job 16:05

Pno=204
Beg End <-- -->
```

You know that in the UDS you are using SH lies 2 steps after Pno 204. Press the --> key (A/M-numeric keyboard, TRK-alfanumeric) twice or keep it depressed until SH is found.

A/M TRK

```
Xmem Job 16:05

SH=.5
Beg End <-- -->
```

In order to change the SH from .5 to 1.7 press the CHG-key=(REG-numeric keyboard, STD-alfanumeric).

REG STD

See next page

MNU

2

Find and Change

Find and Change data (cont.)

From previous page

```
Xmem Job 16:05
Change: SH
Data=.5
```

Overwrite the shown data. Key in 1.7 and ENT.

1.7

```
Xmem Job 16:05

SH=1.7
Beg End <-- -->
```

The correct SH is now stored in the memory device.

MNU MNU

Press MNU twice to return to the theodolite mode.

```
STD  P0  16:05
HA: 355.3245
VA: 101.4252
```

MNU

2

Delete/ Insert

Delete / Insert

```
STD P0 17:55
HA: 355.3245
VA: 101.4252
```

Follow the startup instruction described on page 4.2.3. In this example we choose the external memory.

MNU 2

```
Xmem Job 16:05

Job no=12
Beg End <-- -->
```

Your general data lies at the beginning of your Job data file, so you need only use to depress --> until you come to DATE=1993.0506

A/M TRK

```
Xmem Job 16:05

Date=1993.0506
Beg End <-- -->
```

You wish to delete this completely and replace it with time. Press ENT to step to the EDIT mode.

ENT

See next page

MNU

2

Delete/ Insert

Delete / Insert (cont.)

From previous page

```
Xmem Job 16:05

Date=1993.0506
Del Ins Chg Find
```

Now delete Date by pressing DEL.

```
Xmem Job 16:05

Stn=101
Beg End <-- -->
```

Your next prompt is now displayed. Return to the EDIT mode by pressing ENT.

ENT

```
Xmem Job 16:05

Stn=101
Del Ins Chg Find
```

Now insert in front of Stn=101. Press INS.

```
Xmem Job 16:05
Insert
Label=_
```

You shall insert time first. Label No. for time is 52. Key in 52 and ENT.

56

See next page

MNU

2

Delete/ Insert

Delete / Insert (cont.)

From previous page

```
Xmem Job 16:05
Insert:Time
Data=_
```

The temp. which you wish to record was the temp. at the time of the actual measurements. Key in 16.05 and ENT.

16.05

```
Xmem Job 16:05

Time=16.05
Beg End <-- -->
```

To check that the inserted time data has been inserted into the correct place press the arrow keys.

REG TRK

```
Xmem Job 16:05

Stn=101
Beg End <-- -->
```

Make shure you have Stn=101 in display before inserting the pressure label. Then press ENT to step to the EDIT mode.

ENT

```
Xmem Job 16:05

Stn=101
Del Ins Chg Find
```

Now choose the Ins function to insert the missing pressure data. Press Ins.

See next page

MNU

2

Delete/ Insert

Delete / Insert (cont.)

From previous page

```
Xmem Job 16:05
Insert
Label=_
```

The label No. for pressure is 74. Key in 74 and ENT.

74

```
Xmem Job 16:05
Insert: Press
Data=755
```

The pressure at the time of the measurements was 755 mmHg. Key in 755 and ENT.

755

```
Xmem Job 16:05

Press=755
Beg End <-- -->
```

Temp. and Pressure values are now stored in the memory device before Stn.name in the Job no file. Use the arrowkeys to check the position of the prompts and their values.

MNU

2

Change file

Changing from one file to another

Follow the startup instruction described on page 4.2.3. In this example we choose the external memory. Then enter the DIRECTORY mode.

```
Xmem Job 16:05

Job no=12
Dir <- -> Exit
```

Here you can page through your Job/ Area files. At the moment you are in the Job file directory. Press <- or -> to page through your list of stored Job files.

```
Xmem Job 16:05

Job no=13
Beg End <-- -->
```

When you come to the next Job No file you are looking for, press ENT.

ENT

```
Xmem Job 16:05
Change to this?
Job no=13
```

Is this the file to which you want to change? Answer YES or NO to confirm. Press YES.

YES

```
Xmem Job 16:05

Job no=13
Beg End <-- -->
```

You are now in the VIEW mode at the top (beginning) of Job file No. 13. Press ENT if you want to EDIT or use the arrowkeys to view the file.

The above example can of course be done with Area files if you had pressed the Area option in the first display shown on this page.

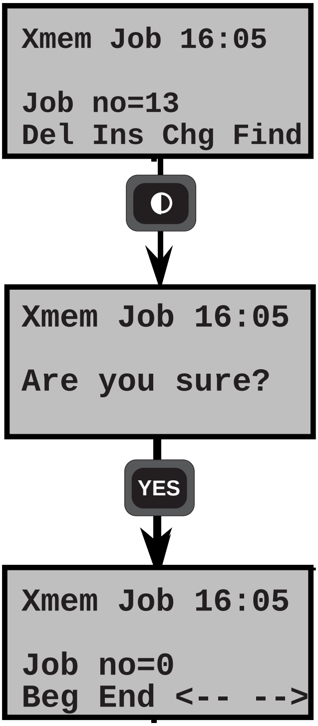
MNU

2

Clear memory

Clear memory

Follow the startup instruction described on page 4.2.3. In this example we choose the external memory. Then enter the EDIT mode.



In order to delete Job no 13 from the memory press DEL.

Here you have a chance to change your mind about total erasure of the file. Press YES or NO.

Job no 13 is now deleted from the memory.

View

MNU

2

View

View enables you to retrieve and check data stored in either the external memory (Geodat) and / or the internal memory of Geodimeter. Checking of data is limited to the Job No. file in which you are presently working. To view Job files other than the one in which you are presently working, see Directory, page 4.2.6.

The program consists of two modes of operation, 1 View and 2 Directory, which are described on page 4.2.4 and 4.2.6. To step between the two modes use the ENT-key. To start the program follow the startup instruction on page 4.2.3.

Station Establishment - In general

PRG

20

In general

Station Establishment (P20) is a basic software package for all Geodimeter System 400/500/600/4000 field calculation programs. This program is used to calculate and store instrument setup data which is required for some of the field calc. programs. The programs that follow P20 today are SetOut, RoadLine and RefLine (see Fig. 3.5). If you try to activate any of these programs without first establishing your station, you are taken directly to P20.

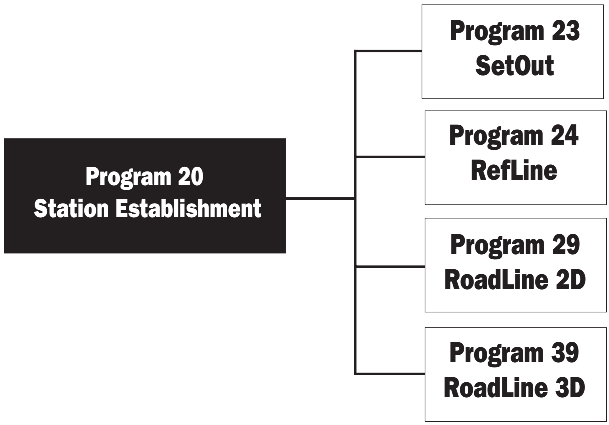


Fig. 3.5. Station establishment is necessary for running the above programs

Program 20 Station Establishment

The program is divided into three main functions:

1. Known station	– for station establishment when the coordinates of your station point and reference object are known.
2. Free station	– for free station establishment using 2-10 points whose coordinates are known.
3. Known station+	– for station establishment when the coordinates of your station point and up to ten reference objects are known.

PRG

20

In general

1&3 Known Station

When establishing a station at a known point, you will only need the point numbers for your station point and reference object. The instrument will then calculate bearing and distance automatically. To increase the accuracy of the bearing a new routine called "Known Station+" has been implemented in the instrument. By using this function you can measure to up to ten reference objects and also obtain a standard deviation (S_dev). See more about this routine on page 4.3.12.
When running Known Station in P20, you decide whether or not elevations are to be used in other calculation programs. Here you also indicate in what Job file station data and possibly other data to be calculated later will be stored, and in what Area file the coordinates are stored.
See on page 4.3.22 what is stored in the selected Job file when a Known Station has been established.

Preparations

Before station establishment can take place, the coordinates and point numbers must be stored in an Area file — either in the internal memory or in an external memory such as Card Memory or Geodat — using P43 (Enter Coordinates) or downloaded from a computer. These coordinates are then used in P20 when you retrieve the correct Area file and Pno.

2. Free Station

You choose free station establishment when the station point is unknown — that is, N, E and possibly ELE will have to be calculated. This function allows free establishment in which several different combinations of objects, angles and distances can be used. The calculation is a combination of resectioning and triangulation. If you make several measurements, you obtain not only the mean value but also the standard deviation (S_dev). The calculation is done according to the least square adjustment method. If good

PRG

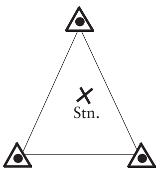
20

In general

results are to be obtained using this method, it is important that the traverses and networks are of high quality. For this reason we have provided the Free Station routine with a function called Config. (configuration). This allows you to use factors such as the scale factor (stored under label = 43), weight factors to weight your points with regard to the distance from your free station to the known point (used mainly in Germany), and also to create a point list in which all measured data for each individual measured point can be made available for editing and possible recalculation. In the example on page 4.3.24 we have chosen not to use Config. but to treat it separately on page 4.3.38.

Free station establishment can be done with a large number of different combinations of points, angles, and distances (see Fig. 3.6)

Note ! ☚ If only 3 angles are used, try to establish within the "triangle" in order to avoid the "dangerous circle".



With free station establishment using 3-10 known points, the following combinations are possible:

1. Angles and distances
2. Only angles. But note that three points alone will not provide enough data to be able to calculate an optimal solution — that is, they will not give a standard deviation.

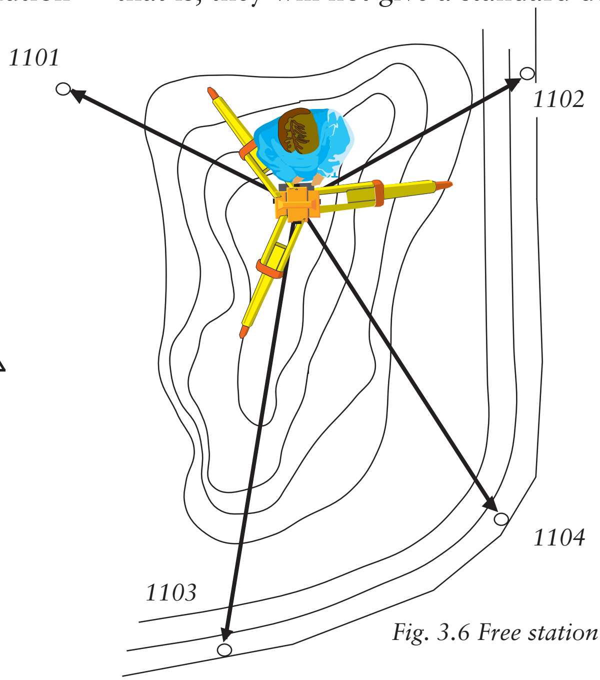


Fig. 3.6 Free station establishment

PRG

20

In general

In free station establishment with two known points, the following is valid:
1. Angles and distances.

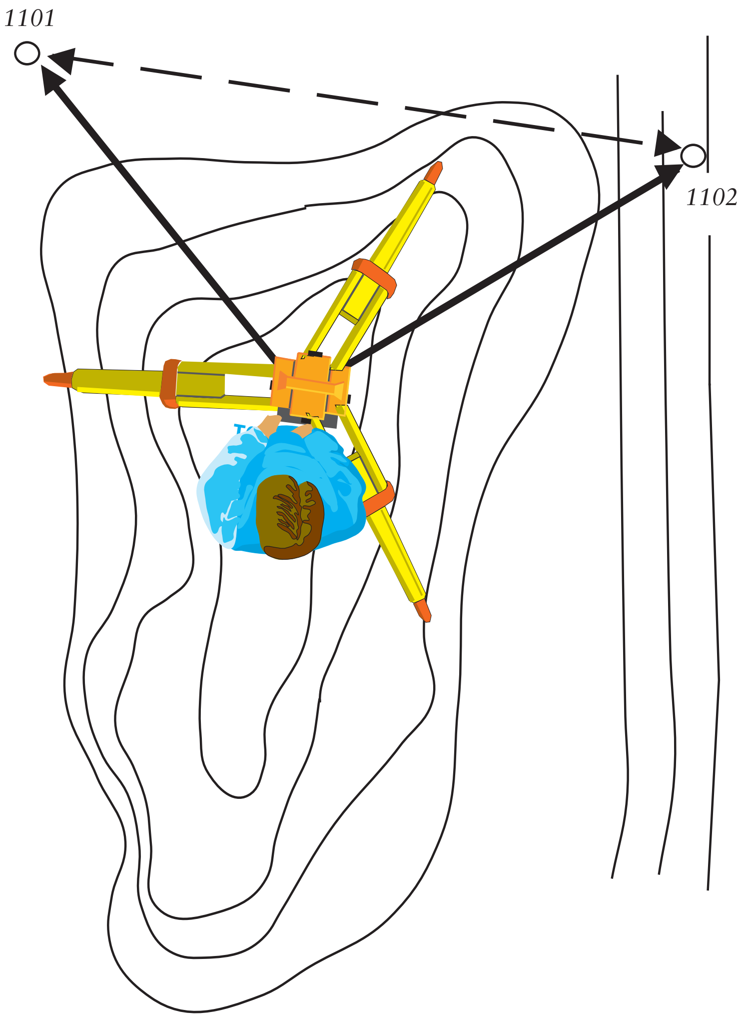


Fig. 3.7. Free station establishment with 2 known points

How to use

PRG

20

How to use

The examples that follow deal with three kinds of station establishment: Known Station, Known Station+ and Free Station. It is assumed that you are familiar with the operation of your Geodimeter instrument.
Switch on the instrument and go step by step through program 0 until you are in theodolite position — that is, HA and VA are shown on the display.

1 Known station

```
STD   P0  10:16
HA:    234.5678
VA:     92.5545
```

The instrument is now in theodolite position. Select P20 (Station Establishment).

PRG

20

ENT

```
Stn.estab 10:16
1 Known station
2 Free station
3 Known station+
```

In this first example we will establish a station with a known point and reference object. These are stored as Pno and coordinates in an Area file, using P43 (Enter Coordinates). Pno 1101 is our station point and Pno 1102 is our reference object, as in the example on page 4.3.7.
Now we will select option 1, Known Station.

N.B. ☛ An example of free station establishment is found on page 4.3.24.

1

See next page

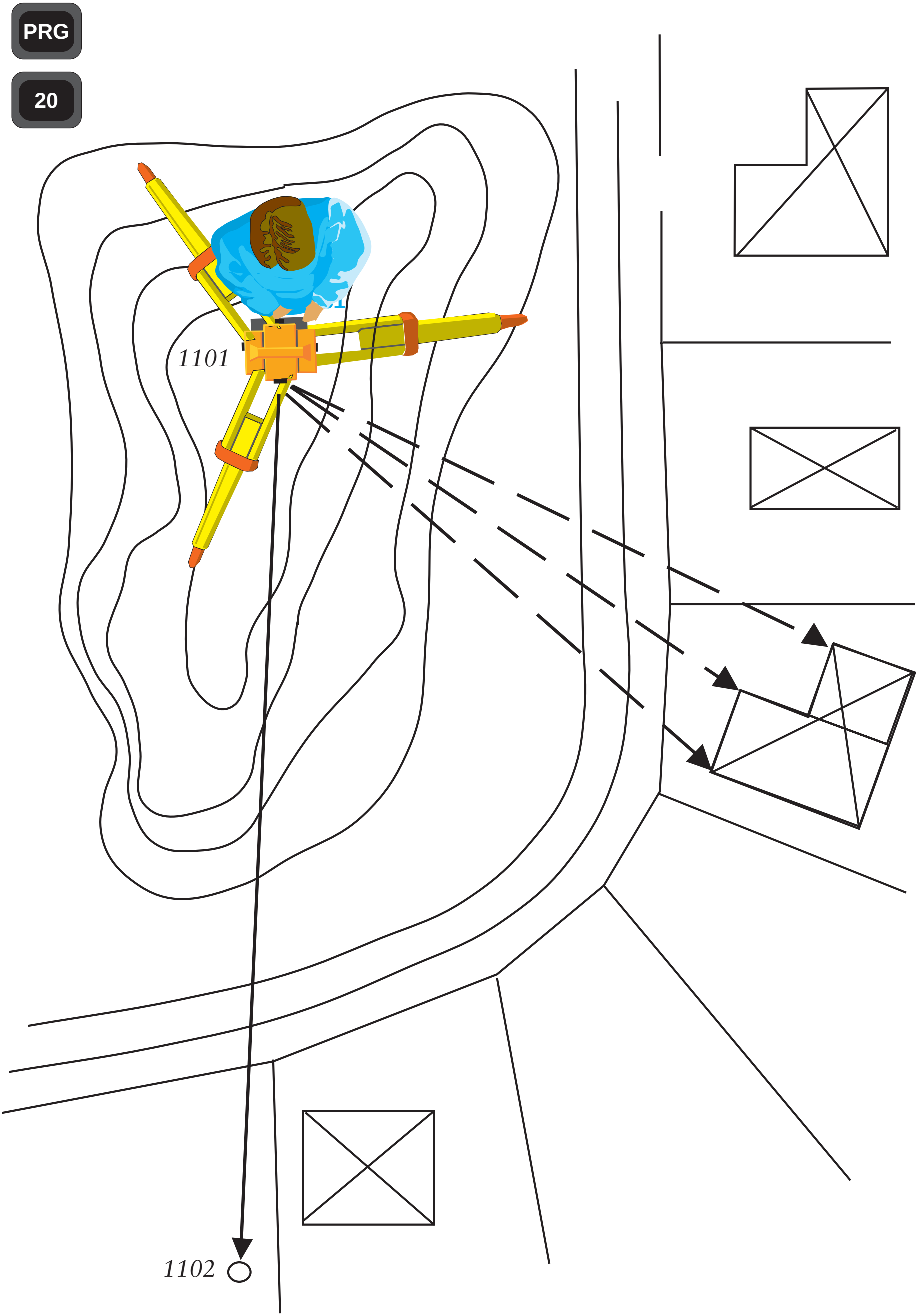


Fig 3.8. Station establishment with a known station and one reference object

PRG

20

Known Stn.

Station establishment with a known station

```
P20 10:16

Job no=_
```

Here you key in the number or name of the Job file in which you wish to store data from your station establishment. A list of data stored in the selected Job file can be seen on page 4.3.22. Select, for example, Job no = 2.

2

ENT

```
P20 10:17
1:Imem off
2:Xmem off
3:Serial off
```

Where will you store your Job file? Choose a suitable memory unit by indicating 1, 2 or 3 for activation/ deactivation. Then press ENT. Here we have chosen to work with the internal memory.

1

ENT

```
P20 10:17

Stn=_
```

Key in your station number.

1101

ENT

Note ! ☛ See note on 4.3.26.

```
P20 10:17

Area=_
```

Key in the name of the Area file in which you have stored your station point and your reference object.
If you leave the line blank you are able to enter the coordinates manually.

See next page

PRG

20

Known Stn.

From previous page

1 ENT ENT

```
Sel device10:17
1 Xmem
2 Imem
```

In which memory unit is the Area file stored? In this example we are using the internal memory (Imem).

2

Note ! ☛ Enter the coordinates manually.

```
Coord      10:17
N=xxxx
E=xxxx
ELE=xx
```

Enter the coordinates manually

Enter your station coordinates. Leave the ELE blank for no height establishment. (This display will only appear if you have left the Area file line blank.

ENT

```
Stn ok?    10:17
N=xxxx
E=xxxx
ELE=xx
```

Are your coordinates correct? Press Yes (ENT) to accept them. If you press NO you will return to the question about STN= and Area=. If the coordinates have to be changed, use Edit or P43 (Enter Coordinates). In this example we will continue by accepting them.

ENT

Note ! ☛ Only shown if your coordinates includes ELE.

```
           10:17

HT measure?
```

Are you going to measure heights? Accept this question by pressing ENT (Yes). If you decide not to measure heights (press No) it means that the instrument height (IH) and signal height (SH) will be ignored.
In this example, we will be measuring heights. Press ENT.

See next page

PRG

20

Known Stn.

From previous page

```
         10:18
ELE= x.xxx
Replace Z?
```

This is your old station ground elevation. Press ENT (Yes) if you want to replace the old elevation with the new or press NO to cancel it. In this example we press ENT. (This display will only appear if the ground elevation has already been determined).

Note ! Only shown if your coordinates includes ELE.

ENT

```
         10:18

IH=
```

Enter your instrument height (IH). For example, 1.75.

Note ! Only shown if your coordinates includes ELE.

1.75 ENT

```
         10:18

Refobj=
```

Key in the Pno of your reference object. For example, 1102.

1102 ENT

```
         10:18

Area=
```

Key in the name of the Area file in which you have stored your reference object. If you leave the line blank you will have the opportunity to enter the coordinates manually in the same way as for the station coordinates.

1 ENT

```
Ref ok ?
N=xxxx
E=xxxx
ELE =xx
```

Are your coordinates correct? Press ENT to accept them. If you press NO you return to the question Refobj=. If they have to be changed, use Edit or P43 (Enter Coordinates). We will continue by accepting them.

PRG

20

Known Stn.

From previous page

ENT

```
        10:18

Aim to refobj.
Press A/M
```

Aim at your reference object. Then press the A/M key.

A/M

```
STD   P20 10:18
HA ref: xx.xxxx
HA:   : xx.xxxx
Reg=Exit
```

HAref is the calculated bearing between the station point and the reference point.
If you wish to check the distance to the reference object, press ENT.
Otherwise press REG to store the station establishment.

ENT

```
STD   P20 10:18
SHD:    xxx.xxx
HD :
Reg=Exit
```

If the reference object is marked with a reflector, you can also check the horizontal distance by pressing the A/M key.
Otherwise press REG to store the station establishment.

A/M

```
STD   P20 10:19
SHD:    xxx.xxx
HD :    xxx.xxx
Reg=Exit
```

Here you can compare the calculated distance with the actual measured distance. Press REG to store station establishment in the Job file you have chosen (see page 4.3.22).
Note !
The REG key must always be used if you want to store the station establishment.

REG

Note ! ☞
PRESS REG

PRG

20

3 Known station+ (known station with 1-10 reference objects)

```
STD    P0  10:16
HA:     234.5678
VA:      92.5545
```

The instrument is now in theodolite position. Select P20 (Station Establishment).

PRG

20

ENT

```
Stn.estab 10:16
1.Known Station
2.Free Station
3.Known Station+
```

In this first example we will establish a station with a known point and reference objects. These are stored as Pno and coordinates in an Area file, using P43 (Enter Coordinates). Pno 1101 is our station point and Pno 1102, 1103 and 1104 are our reference objects, as in the example on page 4.3.13.
Now we will select function 3, Known Station+.

Note ! ☛ An example of free station establish-ment is found on page 4.3.24

3

See next page.

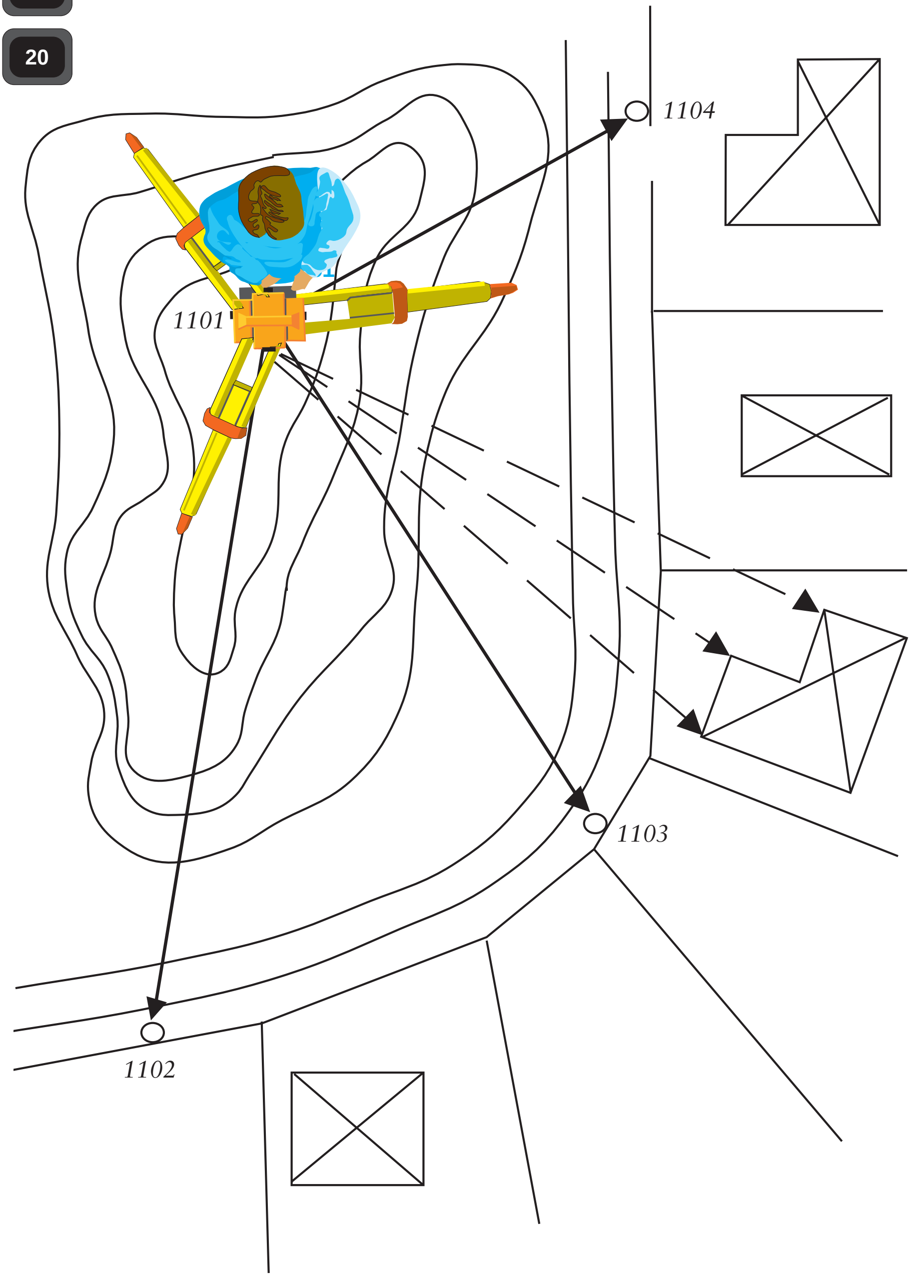


Fig 3.9. Station establishment with a known station and 1-10 reference objects

PRG

20

Known stn+

Station establishment with Known station+

```
      P20 10:16

Job no =
```

2

ENT

Here you key in the number or name of the Job file in which you wish to store data from your station establishment. A list of data stored in the selected Job file can be seen on page 4.3.22. Select, for example, Job no = 2.

```
      P20 10:17
1. Xmem off
2. Imem off
3. Serial off
```

2

ENT

Where will you store your Job file? Choose a suitable memory unit by indicating 1, 2 or 3 for activation/ deactivation. Then press ENT. Here we have chosen to work with the internal memory.

```
      P20 10:17

Stn =
```

1101

ENT

Key in your station number.

```
      P20 10:17

Area =
```

Key in the name of the Area file in which you have stored your station point and your reference object.
If you leave the line blank you are able to enter the coordinates manually.

See next page.

PRG

20

Known stn+

From previous page

1 ENT

```
Sel device10:17
1 Xmem
2 Imem
```

In which memory unit is your Area file stored? In our example, we are using the internal memory (Imem).

2

From previous page

Enter the coordinates manually

Note ! ☚ Enter the coordi-nates manually

```
Coord      10:17
N=xxxx
E=xxxx
ELE=xx
```

Enter your station coordinates. Leave the ELE blank for no height establishment.

ENT

```
Stn ok ?
N=xxxx
E=xxxx
ELE=xx
```

Are your coordinates correct? Press Yes (ENT) to accept them. If you press No you will return to the question about Stn= and Area=. If the coordinates have to be changed, use Edit or P43 (Enter Coordinates). In this example we will continue by accepting them.

YES

Note ! ☚ Only shown if your coordinates includes ELE.

```
           10:17

HT measure ?
```

Are you going to measure heights? Accept this question by pressing ENT (Yes). If you decide not to measure heights (press No) it means that the instrument height (IH) and signal height (SH) will be ignored.
In this example, we will be measuring heights. Press YES.

See next page.

PRG

20

Known stn+

Note ! ☛ Only shown if your coordinates includes ELE.

From previous page.

YES

```
          10:18
ELE= x.xxx
Replace Z?
```

This is your old station ground elevation. Press YES (ENT) if you want to replace the old elevation with the new or press NO to cancel it. In this example we press YES. (This display will only appear if the ground elevation has already been determined).

YES

Note ! ☛ Only shown if your coordinates includes ELE.

```
          10:18

IH =
```

Enter your instrument height (IH). For example, 1.75.

1.75 ENT

```
Pno =
```

Key in the Pno of your reference object. For example, 1102.

1102 ENT

```
Area =
```

Key in the name of the Area file in which you have stored your reference object. If you leave the line blank you will have the opportunity to enter the coordinates manually in the same way as for the station coordinates.

1 ENT

```
Ref ok ?
N=xxxx
E=xxxx
ELE =xx
```

Are your coordinates correct? Press YES to accept them. If you press No you return to the question Refobj=. If they have to be changed, use Edit or P43 (Enter Coordinates). We will continue by accepting them.

PRG

20

Known stn+

Note ! ☛ Only shown if height should be determined

From previous page

YES

```
        10:18

SH: 0.000_
```

Enter the signal height (SH) and press ENT

ENT

```
STD  P20 10:18*
HA:xxx.xxxx
VA:xxx.xxxx
```

The instrument is now in theodolite position and is ready to measure. Aim at the chosen target. Press the A/M key if distance is to be measured, otherwise REG.

A/M

```
STD  P20 10:18*
HA:xxx.xxxx
VA:xxx.xxxx
SD:xxx.xxx
```

The instrument displays HA, VA and SD for your first point. Your measurement can now be registered. Press the REG key.

REG

Note ! ☛ Diff HD is shown only if distance has been measured

```
Result
Diff HD: -0.003

Ref ok?
```

Here the difference between measured and theoretical horizontal distance (HD) is shown. Press YES to accept or NO to redo the measurement or select another reference point.

YES

PRG

20

Known stn+

From previous page

```
       10:19

more?
```

Are you going to use more points for your station establishment, or are you satisfied with only one? In our example we will measure and register two more points (maximum number = 10). Press YES.

YES

```
       10:19

Pno = xxxx
```

Enter the next Pno to be used for your known station (the display here shows the most recently used Pno). Then press ENT.

Note ! ☛

Note!
The points selected for your station establishment can be measured in any order.

ENT

```
Ref ok?
N=xxxx.xxx
E=xxxx.xxx
ELE=xxx.xxx
```

Are your coordinates correct? Press YES or NO. If they have to be changed, use Edit or P43 (Enter Coordinates). In this case, we'll answer YES.

YES

```
       10:20

SH=0.000
```

Enter the signal height (SH). In this case 1 and press ENT.

Note ! ☛ *Only shown if your coordinates include ELE.*

1 ENT

PRG

20

Known stn+

From previous page

```
STD        10:20*
HA:xxx.xxxx
VA:xxx.xxxx
```

Aim towards your target, then press the A/M key to measure.

Note! ☛ If you are using a servo instrument press the ✣ *key to position to point 2-10. Fine adjust manually.*

A/M

```
STD        10:20*
HA:xxx.xxxx
VA:xxx.xxxx
SD:xx.xxx
```

The instrument has now measured angles and distance to the second point of your known station establishment. Press REG to register your measured data.

REG

```
Result
Diff HD:0.003
Diff HA:0.0032
Ref ok?
```

Diff HD is the difference between measured and theoretical horizontal distance to the second point. Diff HA is the difference between theoretical and measured angle between point 1 and 2.Press YES to accept or NO to redo the measurement.

Note! ☛ ***Note! If more than 2 points have been measured, Diff HA will be replaced by S_dev HA, i.e the standard deviation of the horizontal angles.***

YES

```
STD        10:21

more?
```

Are you going to use more points for your station establishment, or are you satisfied with two? In our example we will measure and register one more point (maximum number = 10). Press Yes.

YES

PRG

20

Known stn+

Note! If you are using a servo instrument press the key to position to point 2-10. Fine adjust manually.

From previous page.

```
            10:22

Pno =
```

Key in the third point to be used, and repeat the procedure described above. In this example, we have measured and stored a total of three points whose coordinates are known for our known station.
Assuming that these have been measured and registered, let us continue directly to the question "more?" after storing the last point.

```
STD         10:22

more?
```

All points to be used for our known station establishment are now stored. Answer "more?" with NO. The program immediately calculates your station coordinates.

NO

```
Select      10:22
1 Exit
2 Point list
3 Recalc
```

Now you're taken to the Select menu. Here you can choose to either exit P20, edit the point list, recalculate the point data or add more points. (You can switch between the two pages by pressing the ENT button).In this example we choose to edit the point list. Press 2.

ENT

```
Select      10:22
4 Add point
```

2

PRG

20

Known stn+

From previous page.

```
On?
Pno: xx
Diff HD: -x.xxx
Diff HA: x.xxxx
```

Here you can choose which points you want to use in the point list. Choose On, Off or Delete by pressing the NO button, then accept with ENT.

ENT

```
Result
List:3   Used:3
S_dev HA:x.xxxx
Press ENT
```

When you have choosen your points for the point list and accepted with ENT, calculation automatically starts and the result is shown in the display. Press ENT to exit to the Select menu.

ENT

```
Select    10:23
1 Exit
2 Point list
3 Recalc
```

Now you're taken back to the Select menu. Here you can choose to either exit P20, edit the point list once again, recalculate the point data (i.e se the result once again) or add more points.

(Switch between the pages with ENT).

ENT

```
Select    10:23
4 Add point
```

Press 4 if you want to add points to improve the result. In this example we're satisfied with the result. Press 1 to exit P20.
Note that the current instrument direction is stored as HA_ref.

1

PRG

20

Store data Known Stn

Job File (1 ref point)		Job File (2-10 ref points)	
Job File		Stn	2
Stn	2	Stn Coordinates	37,38,(39)
Stn Coordinates	37,38,(39)	RefObj	5
RefObj	62	SH	6
RefObj Coords	37,38,(39)	RefObj Coords	37,38,(39)
HA_ref*	21	Raw data	7,8,(9)
HD	11	Weight =s/1 if OFF	0
IH	3	Info: Diff HA or S_dev HA	0
		Info: Point list	0
		RefObj	5
		Delta HD (if available)	76
		Delta HA	45
		Stn	2
		Stn Coordinates	37,38,(39)
		RefObj=Blank	62
		RefObj Coords=0.000	37,38,(39)
		HA_ref*	21
		HD=0	11
		IH	3

Here are the data that can be stored in the Job file you have choosen.

* *HA_ref for Known Station = calculated and Set HA,*
HA_ref for Known Station+ = Current instrument direction when exiting P20.

PRG

20

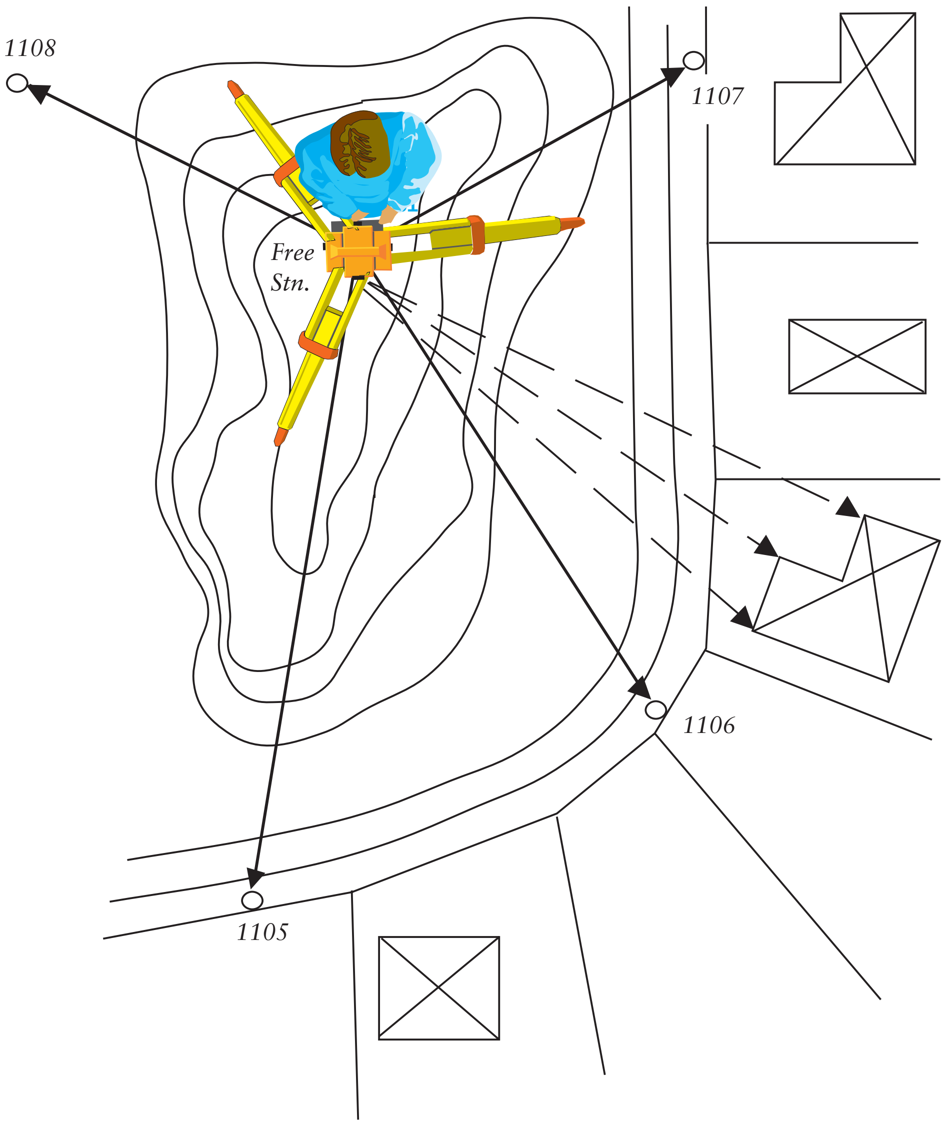


Fig 3.10. Free station establishment

PRG

20

Free stn

Free station establishment

PRG 20 ENT

Select Program 20.

```
Stn estab.10:19
1.Known Station
2.Free Station
3.Known Station+
```

In this example, we will establish a free station. The known points we will be using have been stored as Pno and coordinates in an Area file using P43 (Enter Coordinates).
We'll choose function 2, Free Station.

2

```
      P20 10:19

Job no =
```

Here you key in the number or name of the Job file in which you wish to store data from your station establishment. A list of data stored in the selected Job file can be seen on pages 4.3.35, 37. Select, for example, Job no = 20.

20 ENT

```
      P20 10:19
1. Xmem off
2. Imem off
3. Serial off
```

Where will you store your Job file? Choose a suitable memory unit by indicating 1, 2 or 3 for activation/deactivation. Then press ENT.

2 ENT

See next page.

PRG

20

Free stn

From previous page

```
    P20 10:20
Stn =
```

Here you enter a name/number for your free station. You decide this for yourself.

ENT

```
    P20 10:20
 HT Measure?
```

Are you going to measure heights? Accept this question by pressing YES (ENT). If you decide not to measure heights (press No) it means that the instrument height (IH) and signal height (SH) will be ignored. In this example, we will be measuring heights. Press YES.

YES

See next page.

PRG

20

Free stn

Note ! ☛

Only shown if height should be determined.

From previous page.

```
      P20 10:20

IH=0.000
```

Enter your instrument height (IH). For example 1.75

1.75

ENT

```
      P20 10:20

Area =
```

Key in the name of the Area file in which you have stored your known Pno and coordinates. Then press ENT.

ENT

```
Sel device10:20
1. Xmem
2. Imem
```

In which memory unit is your Area file stored? In our example, we are using the internal memory (Imem).

Note ! ☛
Info 32

Note !
If you get Info 32 when selecting a memory unit, it may be due to one of the following:
1. You have chosen the wrong memory unit.
2. The Area file you are looking for is not located in the memory you have selected.
3. The Stn (Pno) which you are looking for is not stored in the Area file you have selected.
The program will then return to the question "Area =" so that you can enter another Area file number or point number.

2

See next page.

PRG

20

Free stn

From previous page.

```
                10:21

Pno =
```

Enter the number of the first point you want to aim at. Then press ENT.

ENT

```
Pno ok?
N = xxxxx.xxx
E = xxxxx.xxx
ELE = xxx.xx
```

Are your coordinates correct? Press YES (ENT) to accept them. If they have to be changed, use Edit or P43 (Enter Coordinates). In this example we will continue by accepting them.

YES

```
                10:21

SH = 0.000
```

Enter the signal height (SH). For example 2.1 and press ENT.

Note ! ☛ Only shown if height should be determined.

2.1

ENT

See next page

PRG

20

Free stn

From previous page.

```
STD          10:21*
HA:xxx.xxx
VA:xxx.xxx
```

The instrument is now in theodolite position and is ready to measure. Aim at the chosen target. Press the A/M key if distance is to be measured, otherwise REG.

Note! ☛

A/M

Note !
Distance measurement must be carried out when measuring heights.

```
STD          10:21*
HA:xxx.xxx
VA:xxx.xxx
SD:xxx.xx
```

The instrument displays HA, VA and SD for your first point. Your measurement can now be registered. Press the REG key.

REG

```
               10:21

Pno  =xxxx
```

Enter the next Pno to be used for your free station (the display here shows the most recently used Pno). Then press ENT.

Note !☛

ENT

Note !
The points selected for your station establishment can be measured in any order.

See next page.

PRG

20

Free stn

```
Pno ok?
N=xxxx
E=xxxx
ELE=xxx
```

Are your coordinates correct? Press YES or NO. If they have to be changed, use Edit or P43 (Enter Coordinates). In this case, we'll answer YES.

YES

```
          10:21

SH=0.000
```

Enter the signal height (SH). In this case 3 and press ENT.

Note ! ☛ Only shown if your coordinates include ELE.

3

ENT

```
STD       10:21*
HA:xxx.xxx
VA:xxx.xxx
```

Aim at your target. Then press the A/M key to measure distance.

A/M

```
STD       10:21*
HA:xxx.xxx
VA:xxx.xxx
SD:xx.xx
```

The instrument has now measured angles and distance to the second point of your free station establishment. Your measured data can now be registered.

REG

See next page.

PRG

20

Free stn

From previous page.

```
STD          10:21

more?
```

Are you going to use more points for your station establishment, or are you satisfied with only two? Note! If complete measurements have been carried out — that is, angles and distances — two points will suffice. If, on the other hand, only angles have been measured, at least three points are needed. This is not an optimal solution, and the display warns you with the message "Not Optimized". In our example we will measure and register two more points (maximum number = 10). Press YES.

YES

```
             10:22

Pno =xxxx
```

Key in the third point to be used, and repeat the procedure described above. In this example, we have measured and stored a total of four points whose coordinates are known for our free station.
Assuming that these have been measured and registered, let us continue directly to the question "more?" after storing the last point.

Note! If you are using a servo instrument press the key to position to point 3-10. Fine adjust manually.

```
STD          10:22

more?
```

All points to be used for our free station establishment are now stored. Answer "more?" with NO. The program immediately calculates your station coordinates.

NO

See next page.

PRG

20

Free stn

From previous page.

```
STD          10:22
N: xxxxx.xxx
E: xxxxx.xxx
S_dev: x.xxx
```

These are your new station coordinates plus any standard deviation there may be. To see the standard deviation in N and E plus the scale factor used, switch the display by pressing the ENT key.

ENT

```
STD          10:22
S_devX:xxx.xxx
S_devY:xxx.xxx
SF = 1.00000
```

This is the standard deviation in N and E plus the scale factor used (scale factor = 1.0000 if it is off.) Press ENT.

ENT

```
STD          10:22
ELE = xxx.xxx
S_devZ= x.xxx
```

Here is your calculated station elevation shown if you have chosen to measure heights.
Here you can also see the standard deviation based on all observations. If the standard deviation or difference in elevation (in the case of 2 points) is to large redo the measurement again without storing the actual.

ENT

Note ! ☛ Pointlist OFF, see page 4.3.36

Note !
On the following pages we will describe how to use the point list. See page 4.3.36 if you have deactivated the point list.

See next page.

PRG

20

How to use - Pointlist ON

How to use the point list

In this example we will take a closer look at the point list which is obtained after you have established your free station (here we assume that the point list has been activated under "Config.").

```
Free Stat.10:16
1. Pointlist
2. Recalc.
3. Exit
```

The point list allows you to look at, and deactivate, any deviations there may be for each point. The deviations are displayed as "dev. =" (radial deviation) and "RT.ofs/Radofs" (right offset and radial offset). We'll select point 1.

1

```
Free Stat.10:16
1. dev.
2. RT.ofs/Radofs
```

Here you can look at 1 (dev = radial deviation). If there is a major radial deviation, you can make a more detailed analysis by selecting 2 (RT.ofs/Radofs).

1

2

```
Pno = 1
RT.ofs=x.xxx on
on=1       off=0
```

This is the difference in distance — that is, how much to the left (- value) or right (+ value) your theoretical point lies relative to your measured point (see Fig. 3.11, page 4.3.39). Select activation/deactivation and then press ENT.

```
STD          10:16
Pno = 1
Diff = x.xxx
```

Here the radial error is displayed for point no. 1. For an explanation of "dev", see page 4.3.39. By pressing ENT you can check the radial errors for all the points.

ENT

```
Pno = 1
Radofs=x.xxx on
on=1       off=0
```

This is the difference in distance between your measured point and the theoretical point, along the line of measurement. A minus sign indicates that the measured point lies beyond the theoretical point. A plus sign indicates that it is ahead of that point.

See next page.

See next page.

PRG

20

How to use - Pointlist ON

From previous page.

ENT

This page is shown for all points that have 2 coordinates and one measured distance. Any one of these points can be used for calculation of the station height. The displayed value is the difference between the calculated average height and the height, calculated from this point only.

From previous page.

ENT

```
Pno = 1
dELE = XXX on
on=1    Off=0
```

```
Free Stat.10:16
1. Pointlist
2. Recalc.
3. Exit
```

After going through the point list and possibly deactivating one or more parameters of your points, you will have to recalculate using the coordinates you want for your free station establishment. Do this by selecting function 2, Recalc.

2

```
STD          10:16
N: 61732.568
E: 21806.327
S_dev: 0.002
```

These are your new station coordinates together with the resulting standard deviation in N and E. To see the standard deviation in N and E plus the scale factor used, switch the display by pressing the ENT key.

ENT

```
STD          10:16
S_devX:
S_devY:
SF = 1.00000
```

This is the standard deviation in N and E plus the scale factor that has been used (scale factor = 1.0000 if it is Off). Press ENT.

ENT

See next page.

PRG

20

How to use - Pointlist ON

From previous page

```
STD           10:16
ELE = xxxx.xxx
S_devZ = x.xxx
```

Here is your calculated station elevation shown if you have chosen to measure heights.
Here you can also see the standard deviation based on all observations.
If the standard deviation or difference in elevation (in the case of 2 points) is to large redo the measurement again without storing the actual.

ENT

```
Free Stat.10:16
1. Pointlist
2. Recalc.
3. Exit
```

Here you select function 3, Exit.

3

```
STD           10:16
ELE= xxx.xxx
Replace Z ?
```

This is your old station ground elevation.
Press YES (ENT) if you want to replace the old elevation with the new or press No to cancel it. In this example we press YES.
(This display will only appear if the station ground elevation has already been determined).

YES

```
STD           10:16

Store ?
```

Now the instrument is orientated.
Do you want to store the point in an Area file answer this question with YES (ENT).
Note that the current instrument direction is stored as HA_ref.

YES

See next page

PRG

20

Store data

From previous page.

```
     P0  10:16

Area =
```

Key in the name of the Area file in which you want to store the point. Then press ENT.

ENT

```
Sel device10:16
1. Xmem
2. Imem
```

In which memory unit is your Area file to be stored? In our example we are using the internal memory (Imem).

2

Note ! ☛ Data that can be stored in the selected Job or Area file.

Pointlist ON

Job File			**Area File**	
Pno		5	Pno (Stn)	5
SH		6	N	37
Coord		37,38,(39)	E	38
Raw data		7,8,(9)	S_dev	46
Scale factor	=1 if OFF	0	ELE	39
Weight	=s/1 if OFF	0	Info: S_dev_Z	0
dHA*		45		
S_dev		46		
Info: S_dev_Z		0		
Info=Point list		0		
Pno		5		
Used raw data (Ang, Dist, Height)		0		
dN		40		
dE		41		
dELE		42		
Stn no		2		
Stn coordinates		37,38,(39)		
RefObj= Blank		62		
RefObj coordinates=0.000		37,38,(39)	* dHA=correction value of	
HA_ref		21	the calculated bearing	
HD=0		11	(orientation), which is	
IH		3	normally a low figure.	

Note ! ☛ Only if Point List is on in con-figuration

Here are the data that can be stored in the Job or Area file you have chosen, if you have activated the point list in the configuration routine.

PRG

20

Free stn Pointlist OFF

From page 4.3.31

```
      10:21
ELE = x.xxx
Replace Z?
```

This is your old station ground elevation.
Press YES (ENT) if you want to replace the old elevation with the new or press No to cancel it. In this example we press ENT. (This display will only appear if the ground elevation has already been determined).

YES

```
Store ?
```

Now the instrument is orientated. Do you want to store the point in an Area file answer this question with YES (ENT).
Note that the current instrument direction is stored as HA_ref.

YES

```
    P20   10:21

Area =
```

Key in the name of the Area file in which you want to store the point. Then press ENT.

ENT

```
Sel device10:21
1. Xmem
2. Imem
```

In which memory unit is your Area file to be stored? In our example we are using the internal memory (Imem).

Note ! ☛

Note !
See next page for a list over the data that can be stored in the selected Job or Area file.

2

See next page

PRG

20

Store data

Note ! ☛

Data that can be stored in the selected Job or Area file.

From previous page

Pointlist OFF

Job File			**Area File**	
Pno		5	Pno (Stn)	5
SH		6	N	37
Coord		37,38,(39)	E	38
Raw data		7,8,(9)	S_dev	46
Scale factor	=1 if OFF	0	ELE	39
Weight	=s/1 if OFF	0	Info: S_dev_Z	0
dHA*		45		
S_dev		46		
Info: S_dev_Z		0		
Stn no		2		
Stn coordinates		37,38,(39)		
RefObj= Blank		62		
RefObj coordinates=0.000		37,38,(39)		
HA_ref		21		
HD=0		11		
IH		3		

* dHA=correction value of the calculated bearing (orientation), which is normally a low figure.

Here are the data that can be stored in the Job or Area file you have chosen, if you have deactivated the point list in the configuration routine.

PRG

20

How to use - Config

How to use "Config." in Free Station

In this example, we will describe in greater detail the routine in the free station establishment program called "Config.". This option can only be accessed when starting the program with a long press on the PRG-key, see page 4.2.

```
     P20  10:15
1 Run
2 Config
```

Press 1 to start the program or select 2 to configurate the program. In this example we press 2. Config.

2

```
     P20  10:15
1 Exit
2 Options
```

Press 1 Exit to return to the previous menu or press 2 options to start the configuration. In this example we press 2.

2

```
     P20  10:15

Scalefactor  on
on=1      off=0
```

1 ENT

See next page.

Here you are given an opportunity to activate/deactivate a scale factor. The scale factor for free station establishment is calculated and defined based on the internal relation between your known points.

The following applies for the scale factor:

- *Scale factor = 1.0000 if it is not activated (Off).*
- *If a UTM scale factor (F43) has been given, this value is multiplied by the scalefactor calculated for free station establishment.*
- *The scale factor that has been used is displayed after calculation of your free station (see page 4.3.31).*

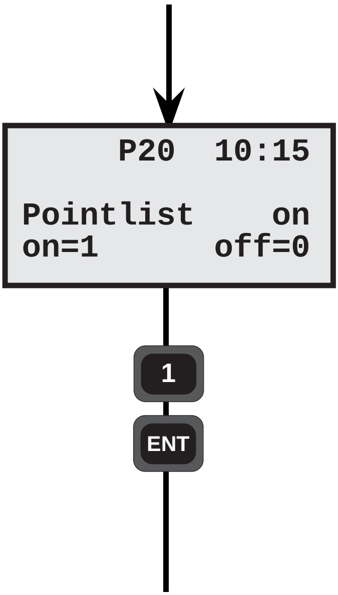
In this example, we will activate the scale factor.

PRG

20

How to use - Config

From previous page..



Here you can activate/deactivate a point list. In the list you will be able to analyse and alter any deviations for each point. The deviations are displayed as "dev" (radial deviation) and "RT.ofs/Radofs" (right offset and radial offset). See Fig. 3.11 below.

Note !
For a more detailed explanation of how to work with the point list, see page 4.3.32.

See next page.

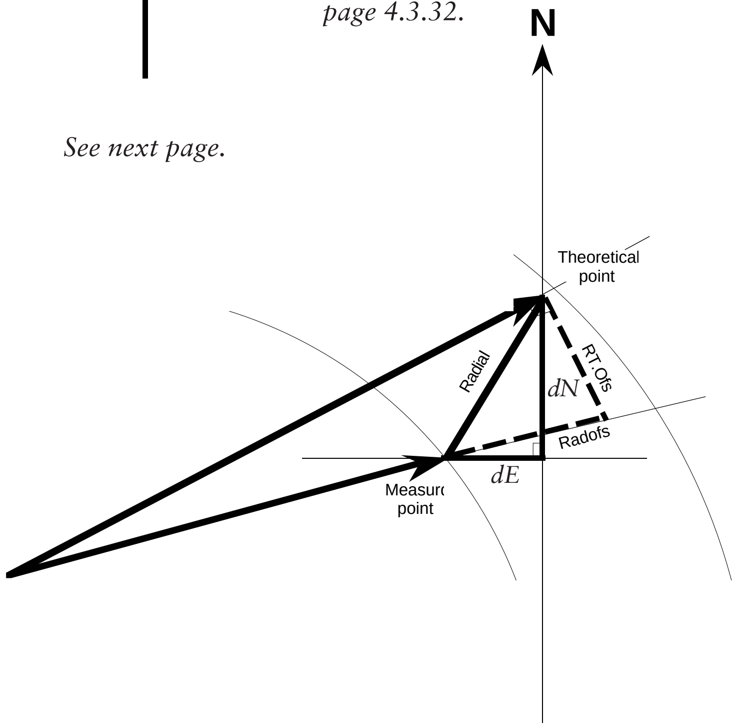


Fig. 3.11. Definition of deviations presented in the point list

PRG

20

How to use - Config

Note ! ☛
Formulas for calculating the weight factor (for the German market).

100/S

```
     P20 10:15
Weightfactor
100/s  off
on=1    off=0
```

$1000/S^{3/2}$

```
     P20 10:15
Weightfactor
1000/s**3/2off
on=1     off=0
```

$1000/S^{2}$

```
     P20 10:15
Weightfactor
1000/s**2 off
on=1    off=0
```

From previous page.

```
      P20 10:15
Weightfactor
s/1    on
on=1      off=0
```

By using a weight factor you can give priority to your known points with reference to distance. To put it simply, points that are further from your free station have a lower priority than the points that are closer. This function is used mostly in Germany. Normally no weight factor is used when the network is of good quality. This means that you should choose the weight factor that is defined as s/1.
By pressing the ENT key in steps you can produce three different bases of calculation for the weight factor (see the margin, left). These are intended mainly for Germany, and are not used otherwise. Since we will not be using this function and since weight factor s/1 is the default in position ON, you need press only ENT until the display shows...

```
      P20 10:15
1 Exit
2 Options
```

Here you can choose to continue with your free station establishment, or repeat your configuration. If you continue with free station establishment, press 1 and then choose 1 Run to start the program. See page 4.3.24 for instructions.

Z/IZ - In general

PRG

21

In general

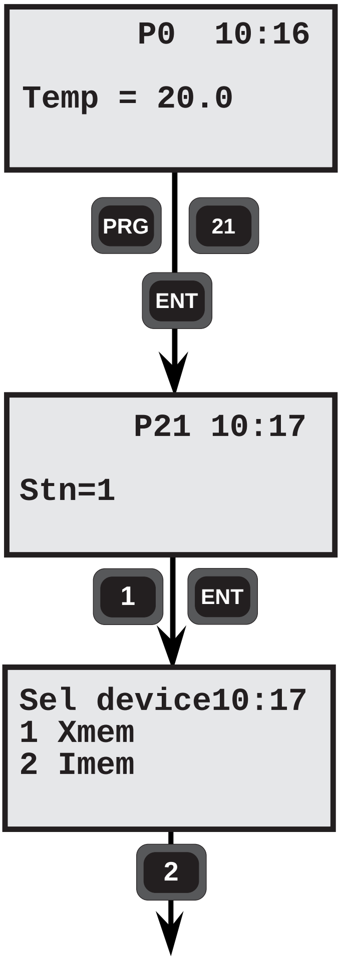
Z/IZ is a program for calculating instrument elevation. It will provide several results, such as the ground point elevation or the instrument point elevation. These are obtained by measuring the vertical angle and length of slope to one or more points of known height. This field calculation is also called ”instrument point elevation resection”, as the mean height and standard deviation are calculated from all the observations.

Z/IZ can be used in a number of applications. For example, it is naturally advantageous to combine Z/IZ and Station Establishment /Free Station when having established your station point in only two dimensions (N and E). By combining these two programs, the three-dimensional coordinates of a point can be calculated and stored in the same Area file and under the same point number in the memory unit you select. In such cases, free station establishment shall be carried out before measuring elevation. Z/IZ also includes P43 (Enter Coordinates).

How to use

How to use

One application for which Z/IZ is ideal is to determine the height of a point whose coordinates are known — that is, in combination with P20 (Free Station function). In the example below, we have chosen to carry out this kind of measurement and calculation. It is assumed that you have already established your station (P20, see page 4.3.2) and that the points whose coordinates are known are stored in an Area file. However, P21 can also be used independently for height calculation.



The instrument's station has been established. Select program 21 (Z/IZ).

Key in your station number and press ENT.

In what memory unit is your Area file stored? In this example, we are using the internal memory (Imem).

PRG

21

How to use

From previous page.

```
STD   P21 10:17
Area =
```

Key in the number of the Area file in which we have stored the points whose coordinates are known, which we shall be using to determine the height of our free station. In this example, these are located in Area = 2. ***If you leave the Area file blank you will be able to manually key in point elevation later on.***

2

ENT

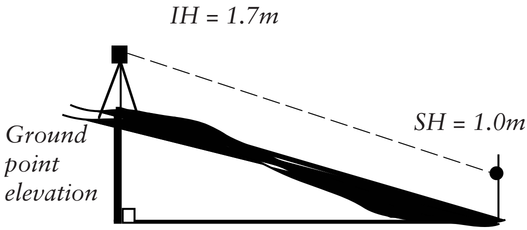
```
      P21 10:17
IH =
```

Note ! ☛ Important

Here you decide whether you want to measure instrument point elevation or ground point elevation. If IH is given, the ground point elevation will be calculated. If no instrument height is given, the instrument point elevation will be calculated. In this example, we assign IH = 1.7 m. Consequently the ground point elevation will be calculated.

1.7

ENT




```
      P21 10:17
Pno =
```

Give the point number for the first reference point stored in the Area file. ***This display will not be shown if you have left the Area file blank above.***

ENT

See next page.

PRG

21

How to use

From previous page.

```
STD   P21 10:17

ELE =
```

The elevation is shown for the reference point selected. ***If you left the Area file blank earlier you are able to manually key in point elevation.***

ENT

```
     P21  10:17

SH =
```

Here you give the signal height (SH). This must be given whether the instrument point elevation or ground point elevation is to be calculated.
In this example, SH = 1.0 m.

1.0

ENT

```
STD   P21 10:17
HA:xxx.xxx
VA:xxx.xxx
```

Now you can begin to measure your first reference point. Aim and then press the A/M key.

A/M

```
STD   P21 10:17*
HA:xxx.xxx
VA:xxx.xxx
SD:xx.xxx
```

The display shows HA, VA and SD to Pno 1. Your measurement is now ready to be registered. Press the REG key.

See next page.

PRG

21

How to use

From previous page.

REG

```
        P21 10:18

more?
```

Will you use several points for your height calculation or will one point be enough? Note the following:
Your result will indicate a mean elevation. This is presented as a difference if two points are included in the measurement. If, on the other hand, you use 3 or more points, a standard deviation (S_dev) is obtained, based on all the observations.
In this example we shall measure two additional points whose heights are known. Therefore answer the question with Yes (ENT).

YES

```
        P21 10:18

Pno =
```

Give reference point 2, which is to be used for height determination, and repeat the instruction above.
In this example we have also measured and stored a third point. We assume now that these measurements are concluded and we continue directly to the question "more?" after storing Pno 3.

```
        P21 10:19

more?
```

All the points to be used for height determination are now stored. Answer the question "more?" with No. The program now immediately calculates any standard deviation.

NO

See next page.

PRG

21

How to use

From previous page.

```
      P21 10:19
S_dev = x.xxx
S_dev ok ?
```

This is the standard deviation based on all the observations. If the standard deviation or difference in elevation (in the case of 2 points) should be too large, answer the question (Diff ok?) S_dev ok? with No, and perform the measurements again.

YES

```
STD   P21 10:19

ELE = xx.xxxx
```

This is the ground point elevation of your free station. Press ENT.

ENT

```
      P21 10:19

Store?
```

If the result of your calculation is to be used, the point must be stored in an Area file. Answer the question with Yes (ENT).

YES

Note ! ☛

Note !
If no instrument height was given (see page 4.3.43) and the instrument point elevation was calculated, the question "Store?" will not appear. However, the instrument will retain the elevation data until it is switched off.

See next page.

PRG

21

How to use

From previous page.

```
      P21 10:20

Area =
```

In this example, we wish to store the elevation coordinates for our station point in the same Area file as the station coordinates for your free station. Select the same Area file in which your free station establishment is stored.

ENT

```
      P21 10:20

Replace Z?
```

If an elevation already exists for the station point you are given the question "Replace Z?". Press Yes or ENT to store the new Z or press No to keep the old one.

YES

The program now returns to PO and you can select the next program.

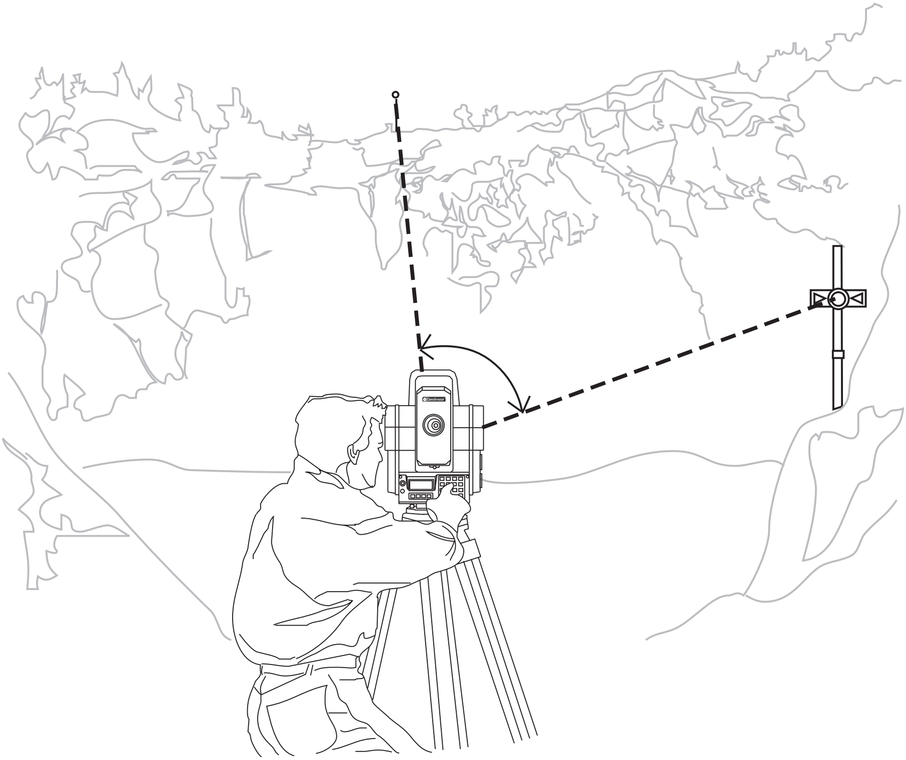
Note ! ☛ Data stored in the selected Area file.

Area file
Pno(Stn)=
ELE=

Here are the data stored in the Area file you have selected.

PRG

22



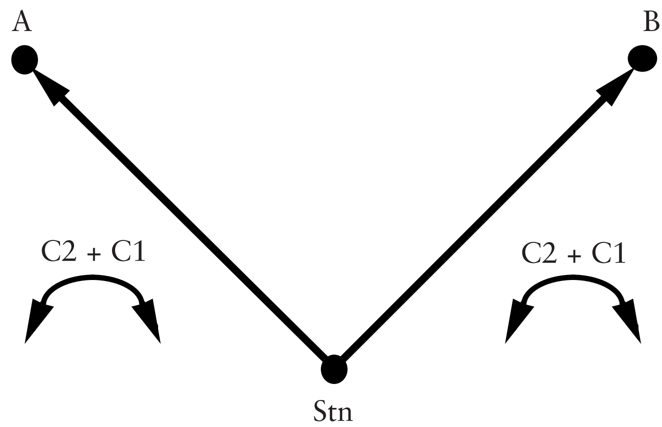
Angle measuring - In general

PRG

22

In general

When using program 22, all you need to do is to locate the targets one time in C1. When all targets are located and stored in your internal or external memory, you are able to select the measuring mode in which you want to work: Standard or D-bar mode. Now the instrument's servo motors will do the rest. The instrument will rotate and point directly in CII against the first registered target, you will then make the necessary fine adjustments and registrations by pressing the A/M-key in front. For rotation to CI, depress the A/M key for a couple of seconds.
Note that this program can only be used when using the station unit as a total station.



How to use

PRG

22

How to use

```
STD    P0   13.38
HA:     310.8390
VA:      98.1720
```

The Geodimeter is now in program 0 (P0). Choose program 22 - Angle Measurement.

PRG

```
STD    P22   13.38

Job no:
```

The program name "Ang. Meas." is seen very briefly on the display followed by request of which Job file you want to store your angle measurements in. Key in, for example, 16......

ENT

Note! ☛ See part 2, Memory Units

```
STD    P22   13.38
1: Xmem off
2: Imem off
3: Serial off
```

Here you select which memory device you wish to store the Job file in by choosing the appropriate number 1 or 2. In this example we will select No. 2: Imem.

2

ENT

```
STD    P22   13.38

Stn =
```

Key in the Stn. point name / number– e.g 1000. Press ENT.

See next page

PRG

22

How to use

From previous page

```
STD   P22   13.38

HT measure?
```

If heights are to be measured the next question would be IH (instrument height). In this example we will press NO, which means that instrument and signal height is not taken into account.

NO

```
STD   P22   13.39

Pcode ?
```

Here you have the opportunity to choose the numerical value of the Pcode (Pcode is additional software). We will answer NO ...

NO

```
STD   P22   13.39

Pno =
```

Key in the number of the first target at which you wish to begin your angle measurement, e.g. 200 ENT...

ENT

```
STD   P22   13.39

Aim to point
Press REG
```

Make a coarse aiming towards the first target, then press REG......

REG

See next page

PRG

22

How to use

From previous page

```
                 13.39

more ?
```

In this example we will continue to measure towards more targets. Press YES.....

YES

```
STD   P22   13.39

Pno =
```

Key in the second target number – e.g., 201 ENT....

ENT

```
STD   P22   13.39

Aim to point
Press REG
```

Make a coarse aiming towards the second target, then press REG......

REG

See next page

PRG

22

How to use

From previous page

```
          13.39

more ?
```

Repeat the instructions above for your following targets. When all your targets are stored you will answer no to this question. Press NO.....

NO

```
Select mod 13.39
1 Std.
2 D bar.
```

The program gives you the opportunity to select in which measuring mode you want to work. In this example we will select No. 2= D-bar mode....

2

The instrument starts to rotate to C2 position, aiming at target No. 200.

The number of sightings is entirely up to you, the operator, and will depend mainly on the visibility conditions and the type and required accuracy of the survey work. In this example we have chosen to make two sightings in C2. Approach the target from the other direction using the motion screws and press A/M...

C2:I — *Press* ● *in front*

C2:II — *Press* ● *in front*

After pressing A/M the second time, the mean of angular C2 values is stored in the memory of the instrument. The rule when measuring angles in this mode is that the same number of sightings must be made in both C2 and C1. Rotate the instrument to C1 position by depressing the A/M key in front for approx. 2 sec.

Press ● *in front*

See next page

PRG

22

How to use

From previous page

```
D      P0   13:40
HA:      123.9965
VA:      102.2230
II:2          I:1
```

Approach the target from the other direction using the motion screws. Press A/M.

A/M

The second C1 angle measurement and indication of completion (i.e., II:2) is very quickly shown on the display..

```
D      P0   13:40
HA:      123.9965
VA:      102.2223
dH:05       dV:03
```

However, the values now seen on the display are the final mean horizontal and vertical angle values of the mean of the angles measured in both faces. The dH & dV values displayed are the amounts by which the angles have been adjusted – i.e., half the sum of the remaining horizontal and vertical collimation and pointing errors.
Now it is time to measure the distance. Press A/M or REG if length is not to be measured.

A/M

```
D      P0   13:40*
HA:      123.9965
VA:      102.2230
SD:        33.114
```

Distance is continually measured and updated while mean angular values are frozen.
To view the HD and VD to the point, press ENT....

ENT

See next page

PRG

22

How to use

From previous page

```
D      P0  13:40*
HA:     123.9965
HD:       33.095
VD:       -1.155
```

To view the N, E and ELE of the point.....

ENT

```
D      P0  13:40*
N:      5188.555
E:      2148.186
ELE:     397.851
```

To continue, press the REG key and the instrument will aim at the next target in C2 position. Repeat the instructions above.

REG

Note! ☛

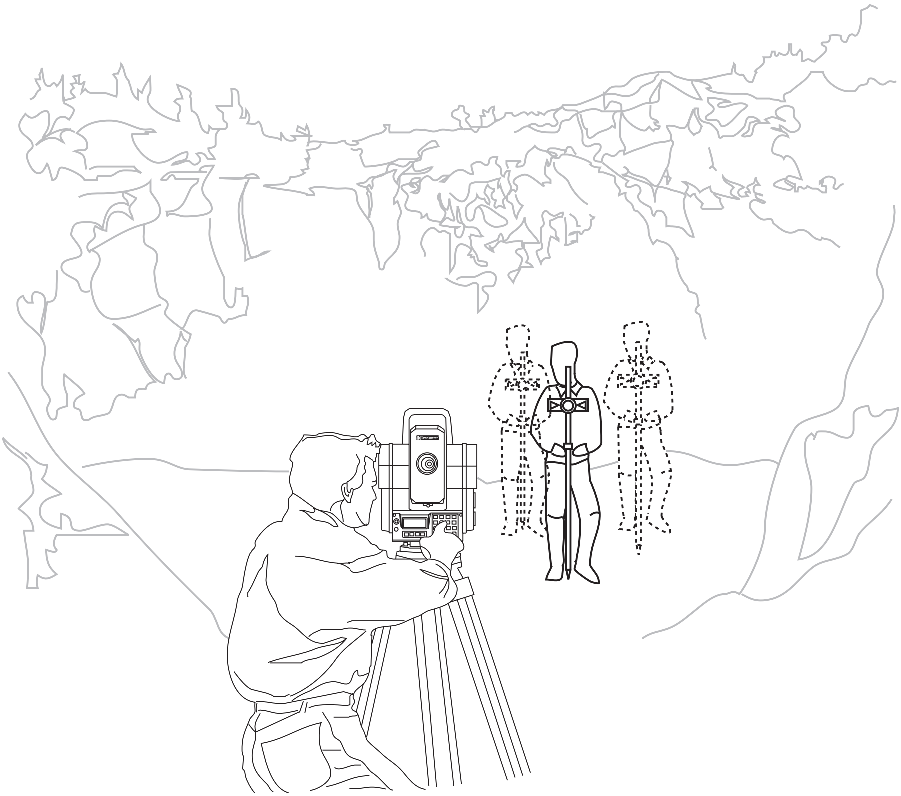
Note !
After the last point your are prompted "Repeat ?" If answering Yes to this question, all points are remeasured.

The following data is stored in the chosen Job file after pressing the REG key.

Job file	
Stn	
IH	If measuring heights
Pno	
Pcode	If Pcode is entered
HA	
VA	
SD	If distance measurement has be done
HAII	0 if no measurement in face 2
VAII	0 if no measurement in face 2
HAI	0 if no measurement in face 2 D- mode
VAI	0 if no measurement in face 2 D- mode
•	
•	

PRG

23



SetOut - In general

PRG

23

In general

SetOut will allow you to set out points in the field much quicker and will also give you access to an automatic point check and storage routine.

SetOut Point Data

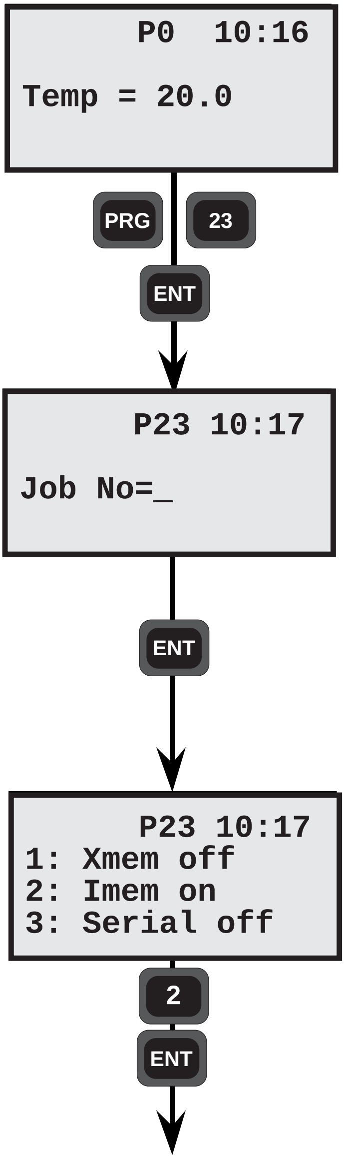
Storage of coordinates and heights of known points is carried out with Program 43 - ENTER COORD. Use of Program 43 means manual keying in of the points. Point storage can be carried out either in Geodat or Internal Memory. During the running of programs 20/23, the stored coordinates are recalled from the specified Geodimeter memory device (GMD) and are used for both orientation of the instrument station and calculation of the bearing and horizontal distance to the set out points.

Automatic Check of Set Out Point´s Position

After having set out the point, you can check its position accuracy relative to the stored point coordinates and height. These deviations are displayed in form of radial and right angle offsets plus height difference. The ± signs of these deviations corresponds to left and right in relation to the point´s correct theoretical position. Once the point has been set out i.e. when the offset values are zero or almost zero, P23 allows the deviations dN, dE and dELE to be stored in Geodat or Internal Memory. As a final check, the point´s present actual coordinates i.e. N, E and ELE can be viewed and compared with the correct theoretical point coordinates and elevation. If you would also like to store these N, E and ELE values, we recommend that you configurate the user defined output table (see page 4.3).

How to use

How to use



The instrument's station has been established. Select program 23 (SetOut).

Key in the number of the Jobfile in which you want to store the set out point data. Then press ENT.

Activate the device you wish for storage of the Job file by choosing the appropriate number 1, 2 or 3.

See next page

PRG

23

How to use

From previous page.

```
     P23 10:17

Stn=1000
```

This was the Station No. you entered in program 20, Station Establishment. Press ENT.
If no station establishment has been made, P23 will automatically propose establishment of a known or free station (P20) when you press ENT. See page 4.3.2

ENT

```
     P23 10:17

Area=_
```

Key in the Area file number in which the set out point coordinates are stored and press ENT.

ENT

```
     P23 10:17
1 Xmem
2 Imem
```

Choose what type of device in which the points are stored. If heights are to be set out, next question would be SH=.

Note! ☛ *Signal height*

2

```
    P23  10:17

Pcode=_
```

If you have entered a Pcode for the set out point you can enter the desired Pcode here. The program will then seek for the point with that Pcode. If you have no Pcode just leave the line blank and press ENT.

ENT

See next page.

PRG

23

How to use

From previous page.

```
    P23  10:17

Pno=1
```

The program suggests the first point in the Areafile. Accept it or key in the point number at which you wish to begin with your setting out task. In this example we key in 206.

206

ENT

Note! ☛

Note!
If you have more than one point in the Areafile to set out the program will automatically suggest the next point.

```
Pno ok?
N=975.000
E=1025
ELE=4.098
```

Check the coordinates and answer YES to accept them or NO.

YES

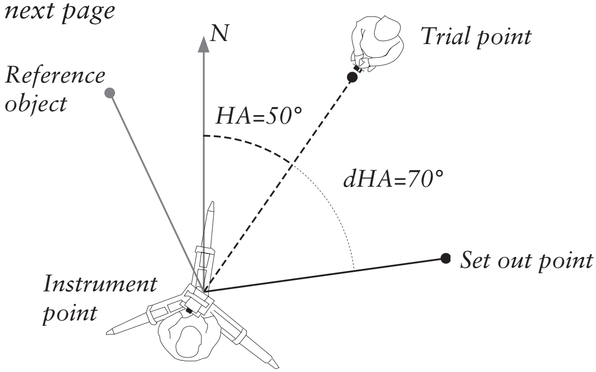
The instrument now automatically switches to the TRK-mode.

```
TRK   P23 10:17
HA:   50.000
dHA:  70.000
```

The instrument should be rotated to the right + 70.000 degrees.
-=Left
+=Right
Here follows the count down to zero angle method. See page 4.3.63 for the radial/right angle method.

Note! ☛ *If you have servo you can rotate the instrument by pressing the key*

See next page



PRG

23

How to use

From previous page.

Countdown to zero method

```
TRK   P23 10:17
HA:120.0000
dHA:0.0000
```

When the instrument displays dHA approx. 0.0000 it is pointing in the direction of the point to set out.
HA is the calculated bearing to the set out point.

```
TRK   P23 10:17
dHA:0.0000
dHD:2.75
dHT:0.155
```

As soon as the prism comes within the measurement beam you will see dHD=remaining. In this case the prism is on line but the distance has to be increased by 2.75m.

Note! ☛ Measure-ment tip

Measurement tip!
It is convenient to decrease the number of decimals in the Label 77=dHA. This can be done via menu 13.

```
TRK   P23 10:17
dHA:0.0000
dHD:0.00
dHT:0.000
```

The point is now set out. Press ENT to check the points coordinates and deviations to the theoretical set out point. Switch to STD or D-bar mode to check the point more accurately.

See next page

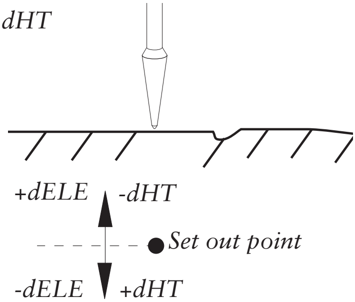
Note - Rotate the instrument with servo!
If you press without measured distance ELE=the height at the theoretical set out point.
If you press with measured distance ELE=the height at the measured set out point.
If you press longer than 1 sec. with measured distance ELE=the height at the theoretical set out point.

PRG

23

How to use

Definition of dELE and dHT



From previous page

```
TRK   P23 10:18
Radofs:0.00
RT.ofs:0.00
dHT:0.000
```

When the radial offset, right angle offset and dHT are 0.00, the correct lateral set out position and height have been set out.

Note! Skip point

Note - skip point !
If you have difficulties to set out the point, the program will give you a opportunity to skip it. Turn the instrument away from the prism when HA and dHA are displayed and press Reg. The question "Skip Point?" will be displayed. Answer YES to this question and the program will continue with the next setting out point.

ENT

```
TRK   P23 10:18
dN:0.00
dE:0.00
dELE:0.000
```

When you press REG, these are the three values which are stored in the memory, i.e. deviations from the correct set out point coordinates. Press REG to record deviations or ENT to see coord. of the set out point. In this example we press ENT.

ENT

```
TRK   P23 10:18
N:975.000
E:1025
ELE:4.098
```

These are the actual coordinates of the set out point´s present position. Press REG to store the deviations.

REG

The program continues with the next set out point. Press the PRG-key and 0 to exit to theodolite mode.

Next set out point

PRG

23

How to use

From page 4.3.60

Radial/Right angle offset method

```
TRK   P23 10:18
HA:   50.000
dHA: 100.000
```

Aim the instrument towards the prism bearer.

```
TRK   P23 10:18
dHA: 100.000
dHD: 2.75
dHT:0.155
```

When the prism comes within the measurement beam you will see dHD=remaining. Press ENT to see the values for radial and right angle offsets.

ENT

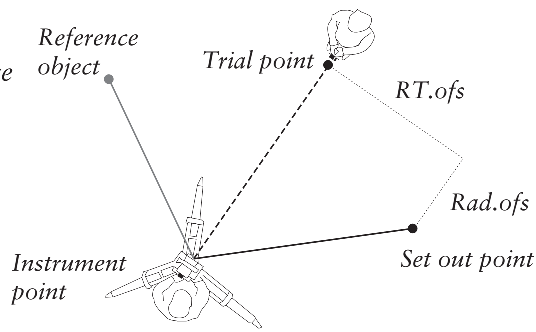
```
TRK   P23 10:18
Radofs: 2.00
RT.ofs: -3.00
dHT: 0.155
```

In this case the prism should be moved 3 meters towards the instrument and 2 meters to the left. The instrument should also be tilted up 0.155 meters.

```
TRK   P23 10:18
Radofs:0.00
RT.ofs:0.00
dHT:0.000
```

When the radial offset, right angle offset and dHT are 0.00, the correct lateral set out position and height have been set out.

See next page



PRG

23

How to use

From previous page

```
TRK   P23 10:18
dN:0.00
dE:0.00
dELE:0.000
```

When you press REG, these are the three values which are stored in the Imem, i.e. deviations from the correct set out point coordinates. Press REG to record deviations or ENT to see coord. of the set out point. In this example we press ENT.

ENT

```
TRK   P23 10:18
N:975.00
E:1025.00
ELE:4.098
```

These are the actual coordinates of the set out point´s present position. Press REG to store the deviations.

The program continues with the next set out point. Press the PRG-key and 0 to exit to theodolite mode.

REG

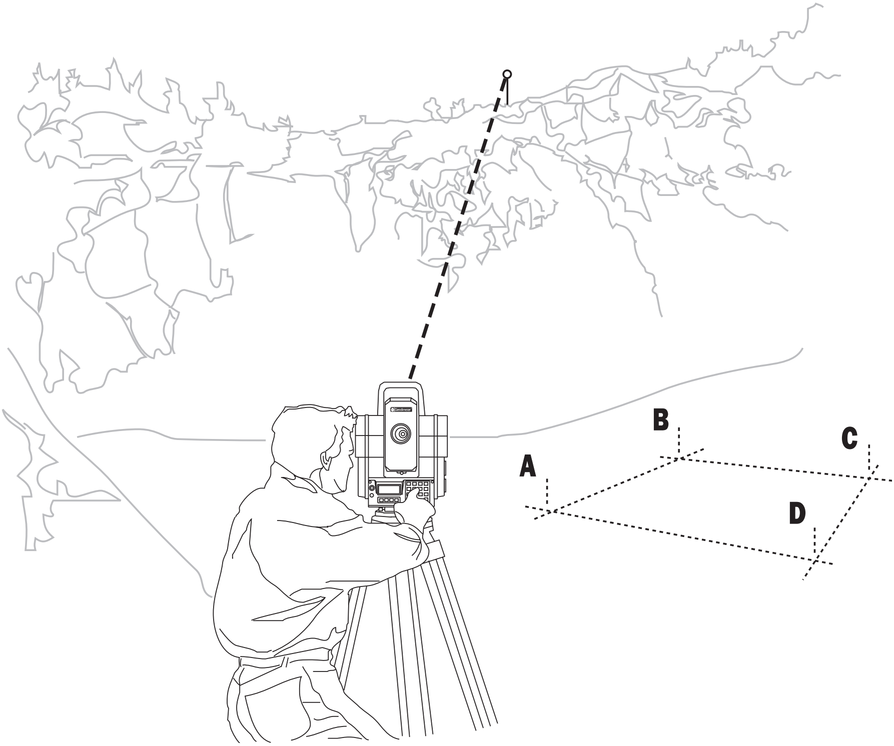
Next set out point

Note! ☛ Skip point

Note - skip point !
If you have difficulties to set out the point, the program will give you a opportunity to skip it. Turn the instrument away from the prism when HA and dHA are displayed and press Reg. The question "Skip Point?" will be displayed. Answer YES to this question and the program will continue with the next setting out point.

PRG

24



In general

PRG

24

In general

RefLine is a program with many applications in the field. The idea is to measure markings along, or parallel to, a predetermined line. If, for example, you have two points whose coordinates are known, you can use this program to place any number of points along the line or, at a specified distance, parallell to it.
It does not matter whether you have visibility between the points or not. Nor does it matter if you go beyond the line's end points. The program will maintain the direction of the line independent of distance. The program can be used for a variety of applications in the field — for example, setting out for pipelines or electric power lines, constructing facade walls on profiles, for drainage ditches, along roadways, etc.
RefLine (P24) also contains P20 (Station Establishment) and P43 (Enter Coordinates).

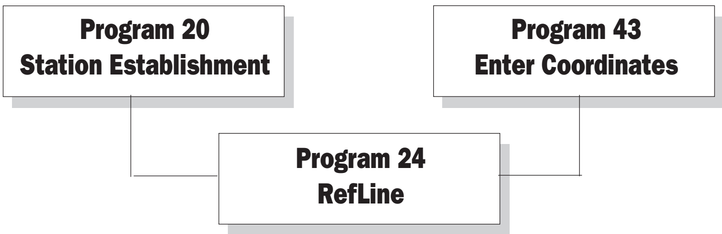


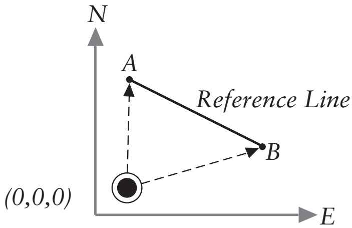
Fig. 1 Programs included in Refline.

The program is divided into two different parts:

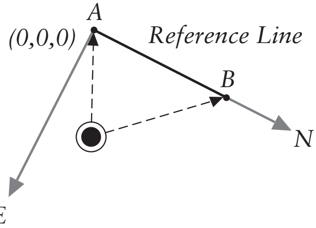
• Known or Unknown line
You can enter the coordinates for the reference line if they are known or construct a reference line by measuring two points. In the first case it is necessary to have established the station before using the program otherwise the program will automatically propose station establishment, P20. In the second case it is not necessary to have established the station since the program will create a new coordinate system with origo in the first point in the reference line.

How to use

How to use

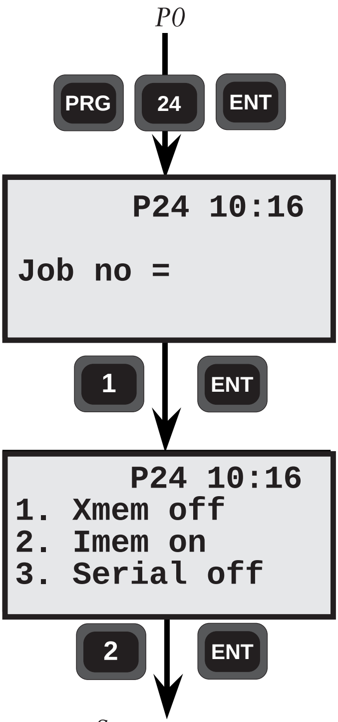


Known Line



Unknown Line

• Measure or SetOut
In the second part you can choose between measure and set out points from the reference line.



Select program 24 (RefLine).

Key in the number or name of the Job file in which you wish to store data about your reference line. A list of data stored in the selected Job file can be seen on page 4.3.83.

Choose in which memory unit you wish to store your Job file. Activate/deactivate a memory unit by pressing its corresponding key number and ENT. In this example we choose 2, Imem.

See next page.

PRG

24

Known line

From previous page

```
      P24 10:16
1 Known Line
2 Unknown Line
```

Choose 1 if you have already stored the coordinates for the points in the reference line or choose 2 to measure them. In this example we choose 1 since we already have stored the points. See page 4.3.69 for instructions of how to measure the reference line.

1

```
      P24 10:16

Stn =1
```

Is "1" your station?
If no station establishment has been made, P24 will automatically propose establishment of a known or free station (that is, P20, StnEst) when you press ENT. In this example, we will continue by accepting the suggested station. Press ENT.

ENT

```
      P24 10:17

Area =
```

Key in the name of the Area file in which we have stored the points whose coordinates are known, which we shall be using to establish our reference line.

ENT

```
Sel device10:17
1 Xmem
2 Imem
```

In which memory unit is the Area file stored? In this example we are using the internal memory (Imem).

2

See next page

PRG

24

Known line

Note! ☛ If ELE is missing you can enter it manually.

From previous page

```
     P24 10:17
Ref.line point
A
Pno =
```

Key in the point number for point A on your reference line. Point A=Pno 100.

If you have chosen to include heights in your station establishment and ELE is missing for the point the following display appears and you must enter the elevation manually:

```
Z not found
ELE=_
```

100 ENT

```
Pno ok ?
N=61825.772
E=21807.023
ELE=20.768
```

Are your coordinates correct? Press ENT to accept them. If they have to be changed, press NO and use Edit or P43 (Enter Coordinates).

We will continue by accepting them.

ENT

Note! ☛ If ELE is missing you can enter it manually.

```
     P24 10:17
Ref.line point
B
Pno =
```

Key in the point number for point B on your reference line. Point B = Pno 101.

101 ENT

```
Pno ok ?
N=61814.748
E=21817.195
ELE=21.890
```

Are your coordinates correct? Press ENT to accept them. If they have to be changed, press NO and use Edit or P43 (Enter Coordinates).

We will continue by accepting them.

ENT

See page 4.3.67

PRG

24

Unknown line

P0 and memory procedure

```
      P24 10:17
1 Known Line
2 Unknown Line
```

In this example we choose 2 since we want to measure two points and use them as reference line.

2

```
      P24 10:17

HT measure ?
```

Are you going to measure heights? If you decide not to measure heights it means that the instrument height (IH) and signal height (SH) will be ignored. In this example we choose to measure heights. Press YES or ENT.

YES

```
STD   P24 10:17

IH=
```

Enter the instrument height and press ENT.

ENT

```
      P24 10:17
Ref.line point A
Pno=
```

Key in the point number for point A on your reference line. Point A=Pno 200.

200 ENT

See next page

PRG

24

Unknown line

From previous page

```
        P24 10:17

SH=
```

Enter the signal height and press ENT.

ENT

```
STD     P24 10:17
HA:       165.2355
VA:       106.5505
```

Aim at the first point, pnt A and press A/M to start measurement.

A/M

```
STD     P24 10:17
HA:       165.2350
VA:       107.0020
SD:         37.225
```

When you are ready press REG to store the point.

REG

```
STD     P24 10:17
Ref.line point B
Pno=
```

Key in the point number for point B on your reference line. Point B=Pno 201.

201 ENT

See next page

PRG

24

Unknown line

From previous page

```
      P24 10:17

SH=
```

Enter the signal height and press ENT.

1 ENT

```
STD   P24 10:17
HA:     200.0056
VA:     102.1095
```

Aim at the second point, pnt B, and press A/M to start measurement.

A/M

```
STD   P24 10:17
HA:     201.0001
VA:     102.1096
SD:      12.0022
```

When you are ready press REG to store the point.

REG

See next page

PRG

24

Measure

```
        P24 10:18
1 Meas
2 Setout
3 Exit
```

Choose whether you wish to measure or set out points relative your reference line. You can also exit from the program with 3. In this case we choose to measure points. Press 1.

See page 4.3.76 for setout instructions.

1

```
        P24 10:18

Slope=-98.90740
```

The program has calculated a slope for the reference line with help of the points A and B. The slope is defined as ‰ (per thousand). Accept it or key in a new slope. The slope of the line is expressed as a negative figure per thousand from point A for a downward slope, and as a positive figure for an upward slope. In the case of a slope, dELE is the deviation from the theoretical elevation of the point.

ENT

```
        P24 10:18

SH=
```

Enter the signal height.

0.7 ENT

```
STD     P24 10:18
HA:       36.5110
VA:      102.8955
```

Aim at the first point and press A/M to start measurement.
Note! You can also change to another measurement mode at this point (TRK or D-bar).

A/M

See next page.

PRG

24

Measure

From previous page

```
STD   P24 10:18
Radofs: 10.010
RT.ofs: 2.010
dELE:0.002
```

REG

See next page

Radofs *is a definition of how far your measured point lies from point A.* ***RT.ofs*** *is defined as the right-angle distance from reference line AB.* ***dELE*** *is the difference in height from point A. If you have defined a slope as a ‰ (per thousand), dELE is calculated as the deviation from the theoretical point.*

See fig. 2 for offset definitions.

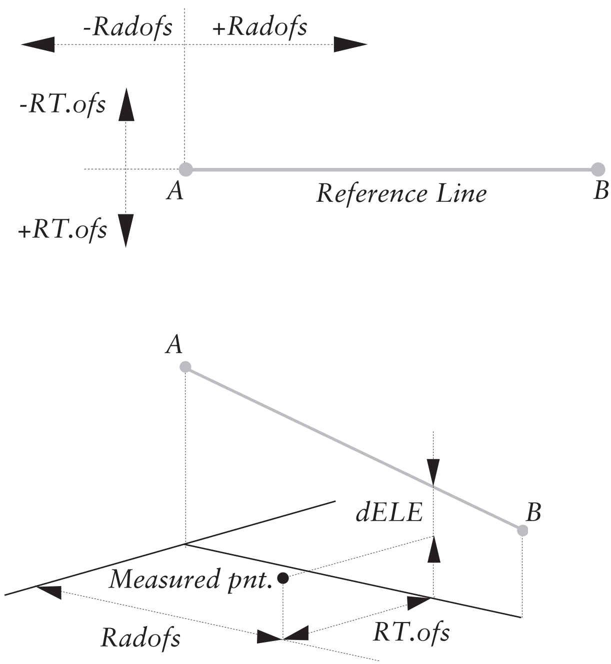


Fig. 2 Offset definitions measuring mode

PRG

24

Measure

From previous page

```
        P24 10:18

Pno=
```

What name/number will you give your new control point? Key in the name and ENT to store Pno, Radofs, RT.ofs, and the coordinates, in the Job file you have chosen in Imem.The program will automatically increment the point number when you continue with the next point. See page 4.3.83 for a list of what is stored in after registration.

ENT

```
        P24 10:18

Pcode=
```

Here you have the opportunity to choose a Pcode for the measured point. The numerical value you enter corresponds to an alpha title which you enter with Program 45, Pcode. If you leave the line blank no Pcode will be stored and the question will not appear for the next point.

ENT

```
        P24 10:18

Continue ?
```

Do you wish to measure more points press YES or ENT, otherwise press NO to step to the mode menu.

YES

```
STD     P24 10:18
HA:       33.0092
VA:      100.0033
```

NO

```
        P24 10:18
1 Measure
2 Setout
3 Exit
```

PRG

24

Setout with Radofs/ RT.ofs

```
        P24 10:18
1 Meas
2 Setout
3 Exit
```

Choose whether you wish to measure or set out points relative your reference line. You can also exit from the program with 3. In this case we choose to setout points. Press 2.

2

```
        P24 10:18
1 Radofs/Rt.ofs
2 Coord
```

This menu will only appear if you have a known reference line. Choose 1 to set out with Radofs and Rt.ofs.

See page 4.3.80 for instructions of how to set out with coordinates.

1

```
        P24 10:18

SH=
```

Enter the signal height.

0.7 ENT

```
        P24 10:18

Pno=
```

Enter a number for the first point you wish to set out. The program will automatically increment the point number when you continue with the next point.

ENT

```
        P24 10:18

Pcode=
```

Here you have the opportunity to choose a Pcode for the measured point. The numerical value you enter corresponds to an alpha title which you enter with Program 45, Pcode. If you leave the line blank no Pcode will be stored and the question will not appear for the next point.

ENT

PRG 24

Setout with Radofs/ RT.ofs

From the previous page

```
     P24 10:18

Radofs=
```

Enter the radial offset to the set out point. See fig. 3.

ENT

```
     P24 10:18

Rt.ofs=
```

Enter the right angle offset to the set out point. See fig. 3.

ENT

```
     P24 10:18

SHT=
```

Enter the height for the set out point.

ENT

```
TRK   P24 10:18
dHA: 0.0000
dHD: 0.00
dHT: 0.000
```

The instrument switches to TRK-mode. When dHA 0.0000 the instrument is pointing in the direction of the set out point. As soon as the prism comes within the measurement beam you will see dHD =remaining. Press ENT to see the values for radial and right angle off-sets or press REG to registrate the point.

See next page

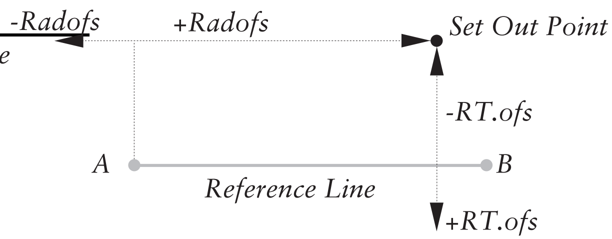


Fig. 3 Offset definitions set out with Radofs/RT.ofs

PRG

24

Set out with Radofs/ RT.ofs

From the previous page

ENT

```
TRK   P24 10:18
Radofs:0.00
RT.ofs:0.00
dHT:0.000
```

When the radial offset, right angle offset and dHT are 0.00, the correct lateral set out point position and height have been set out. See fig. 4 for offset definitions.

ENT

```
TRK   P24 10:18
dN:0.00
dE:0.00
dELE:0.000
```

Press REG to register the set out deviations, see fig. 4, or press ENT to see the coordinates of the set out point.

ENT

See next page

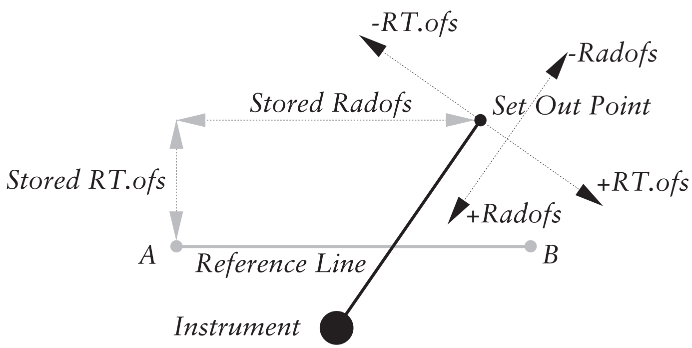


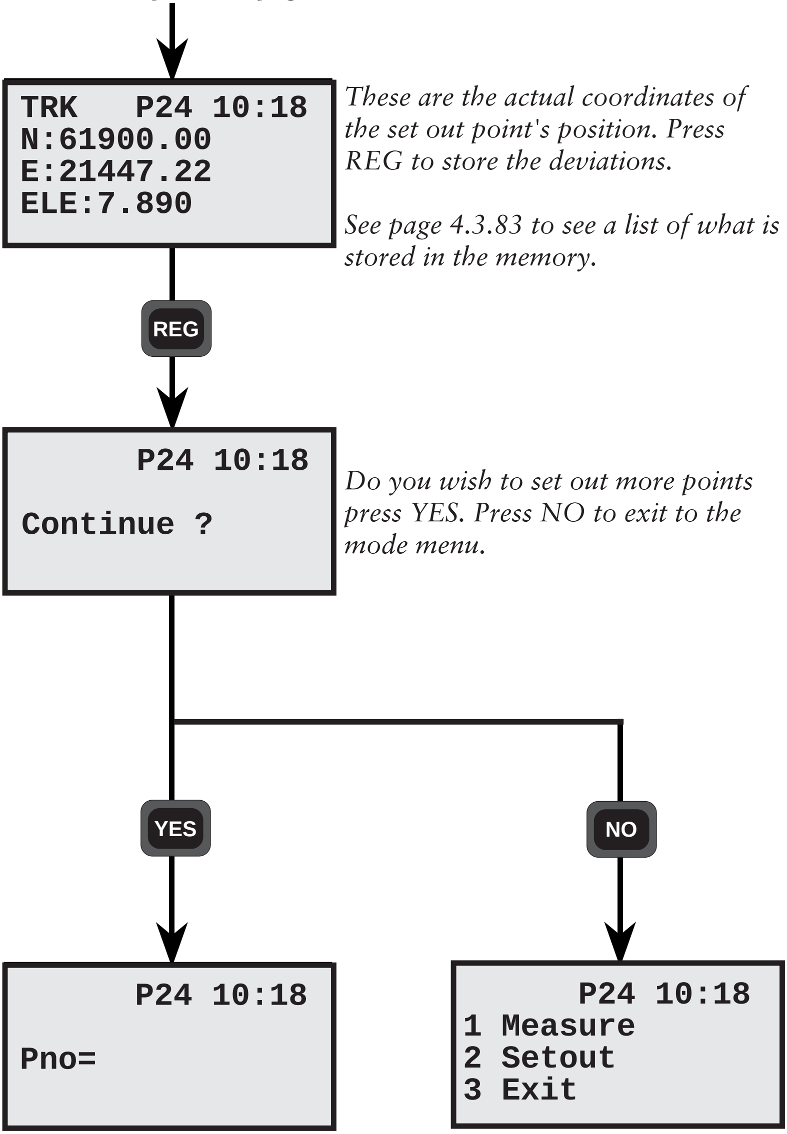
Fig.4 Offset definitions setout mode

PRG

24

Set out with Radofs/ RT.ofs

From the previous page



These are the actual coordinates of the set out point's position. Press REG to store the deviations.

See page 4.3.83 to see a list of what is stored in the memory.

Do you wish to set out more points press YES. Press NO to exit to the mode menu.

PRG

24

Setout with coordinates

```
      P24 10:18
1 Meas
2 Setout
3 Exit
```

In this case we are going to set out point with known coordinates. This is only possible if we have a known reference line.

2

```
      P24 10:18
1 Radofs/Rt.ofs
2 Coord
```

Choose 2 to set out points with known coordinates. This section is similar to Program 23, SetOut. (This option is not available for the unknown line).

2

```
      P24 10:18

SH=
```

Enter the signal height.

0.7 ENT

```
      P24 10:18

Pcode=
```

If you have entered a Pcode for the set out point you can enter the desired Pcode here. The program will then seek for the point with this Pcode. If you don't have any Pcode just leave the line blank and press ENT. If you leave it blank this question will not appear for the next point.

ENT

See next page

PRG

24

Setout with coordinates

From the previous page

```
        P24 10:18

Pno=
```

The program suggests the first point in the Areafile. Accept it or key a new.

ENT

```
Pno ok?
N=61870.890
E=21980.300
ELE=4.098
```

Check the coordinates and answer YES to accept them or NO.

ENT

```
TRK   P24 10:18
dHA:0.0000
dHD:0.00
dHT:0.000
```

When dHA 0.0000 the instrument is pointing in the direction of the set out point.
As soon as the prism comes within the measurement beam you will see dHD=remaining. Press ENT to see the values for radial and right angle offsets or press REG to registrate the point.

ENT

```
TRK   P24 10:18
Radofs:0.00
RT.ofs:0.00
dHT:0.000
```

When the radial offset, right angle offset and dHT are 0.00, the correct lateral set out point position and height have been set out.

See page 4.3.78, fig.4, for the definitions of radial and right angle offsets.

See next page

PRG

24

Set out with coordinates

From the previous page

```
TRK   P24 10:18
dN:0.00
dE:0.00
dELE:0.000
```

When you press the REG key, these are the three values which are stored in the memory, i.e. deviations from the correct set out point coordinates. Press REG to register the deviations or press ENT to see coordinates of the set out point.

ENT

```
TRK   P24 10:18
N:61870.89
E:21980.30
ELE:4.098
```

These are the actual coordinates of the set out point's position. Press REG to store the deviations.

See page 4.3.83 for a list of what is stored in the memory.

REG

```
STD   P24 10:18

Continue ?
```

Do you wish to set out more points press YES. Press NO to exit to the mode menu.

YES

```
STD   P24 10:18

Pno=
```

NO

```
      P24 10:18
1 Measure
2 Setout
3 Exit
```

PRG

24

Registered data

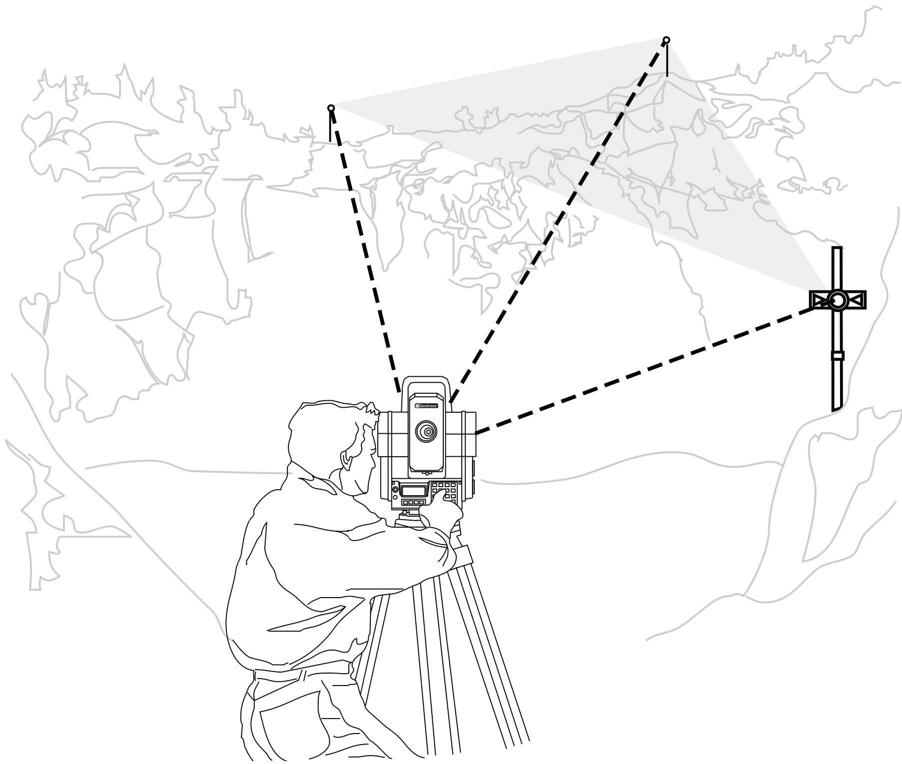
The list below shows which data will be stored after registration.

Job file in Imem	Comments
Stn Coord.	Station establishment
RefObj. Coord.	
HAref	
HD	Distance to ref. obj. (known stn.)
IH	
Pno1 (A). Coord*	Coordinates for the reference line
Pno2 (B). Coord*	
Slope	Stored only in measure mode
Measure mode	
Pno 1.	Measured data, control points
SH	
Coord.	
Radofs¤	
RT.ofs¤	
dELE	
Setout mode with Radofs/RT.ofs	
Pno	Setout data, control points
Radofs¤	
RT.ofs¤	
dELE	
Setout mode with coordinates	
Pno	Setout data, control points
dN	Coordinate deviations
dE	
dELE	

** Stored only if using a known reference line*
¤ Relative the reference line

PRG

25



Area Calculation - In general

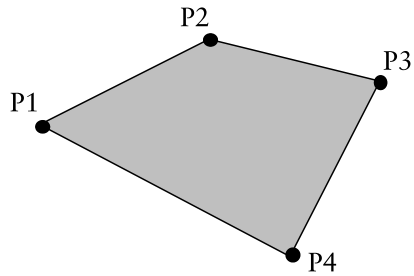
PRG

25

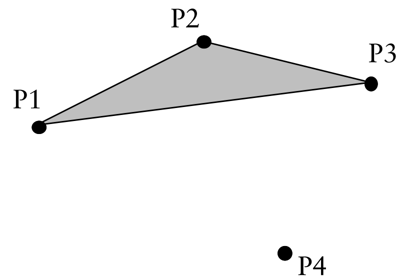
In general

With program 25 you are able to calculate the area and the volume between measured points.
The program contains three main functions:

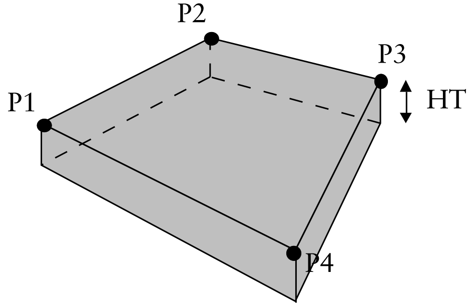
1. Calc
With this function you can calculate the area between measured points in the order they are registered.



2. Arrange list
With this function you can arrange a list of measured points and calculate the area between the points in the order they are arranged in the list.



3. Volume
With this function you can enter a height for the calculated area and calculate the volume.



How to use

PRG

25

How to use - Calc.

```
STD    P0   13:38
HA:  310.8390
VA:   98.1720
```

The Geodimeter is now in program 0 (P0). Choose program 25 - Area Calc.

PRG 25

```
      P25   13:38
1 Calc
2 Arrange list
```

Here can choose if you want to calculate the area in the order the points are measured (1 Calc) or if you want to arrange the points in a different order and calculate that area. Here we choose 1 Calc.

1

```
      P25   13:38

Job no=_
```

Key in the Job file in which the measured points are stored and press ENT.

ENT

```
Sel.device 13:38
1 Xmem
2 Imem
```

In which memory unit is the Job file located. In this example it is in the internal memory. Press 2.

Note ! ☛

Note!

If Info 32 appears it may be that the Job file you have keyed in does not exist in the chosen memory unit or if you are using an external memory that the connections are bad.

If Info 44 appears it may be that the Job file does not contain right point data.

2

See next page

PRG

25

How to use - Calc.

From previous page

```
      P25  13.38

SqrAre=3163.50
```

Here is the calculated area. Press enter to continue.

ENT

```
      P25  13.39

volume?
```

Do you want to calculate a volume. Press YES to accept or NO to cancel. In this case we accept with YES.

YES

```
      P25  13.39

HT=
```

Key in the height of the volume. In this case we key in 10 and press ENT.

ENT

```
      P25  13.39

volume=-218281.5
```

Here is the calculated volume. Press ENT to exit the program.

ENT

PRG

25

How to use - Arrange list

```
STD    P0  13.38
HA: 310.8390
VA:  98.1720
```

The Geodimeter is now in program 0 (P0). Choose program 25 - Area Calc.

PRG 25

```
      P25  13.38
1 Calc
2 Arrange list
```

Here can choose if you want to calculate the area in the order the points are measured (1 Calc) or if you want to arrange the points in a different order and calculate that area. Here we choose 2 Arrange list.

2

```
      P25  13.38

Job no=_
```

Key in the Job file in which the measured points are stored and press ENT.

ENT

```
Sel.device 13.38
1 Xmem
2 Imem
```

In which memory unit is the Job file located. In this example it is in the internal memory. Press 2.

Note ! ☛

Note!
If Info 32 appears it may be that the Job file you have keyed in does not exist in the chosen memory unit or if you are using an external memory that the connections are bad.
If Info 44 appears it may be that the Job file does not contain right point data.

2

See next page

PRG

25

How to use - Arrange list

From previous page

```
        13:38

Pno=1
```

Key in the first point no in the area. The point must exist in your Job file. In this case we key in 1 and press ENT.

1

```
Pno ok?
N=10
E=20
ELE=30
```

Here is the point coordinates displayed. Accept the point with YES or cancel with NO. Here we accept the point.

YES

```
        13.39

Pno=1
```

Key in the second point in the area. In this case we key in point no 4.

4

```
Pno ok?
N=14
E=15
ELE=16
```

Accept the point coordinates with YES or cancel them with no.

YES

See next page

PRG

25

How to use - Arrange list

From previous page

```
          13:39

more?
```

After having keyed in 3 points you have the chance to calculate the area. Press YES to continue key in more points or press NO to calculate the area.

NO

```
          13:39

SqrAre=9.00
```

Here is the calculated area. Press ENT to continue.

ENT

```
          13:39

volume?
```

Do you want to calculate the volume. Press YES to accept or NO to cancel. In this example we press NO.

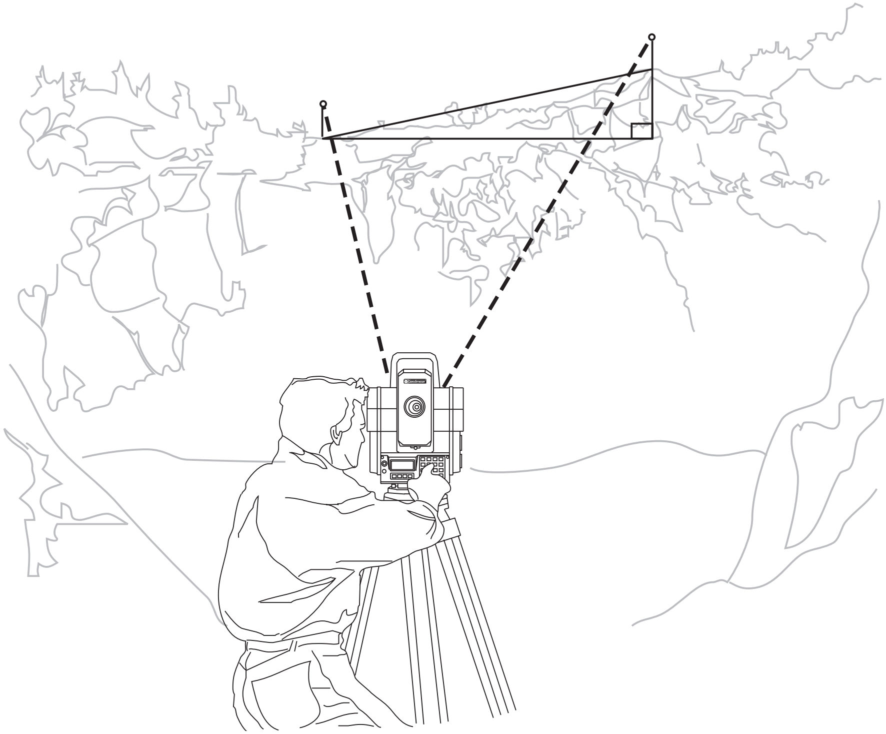
NO

```
STD    P0  13:39
HA:   45.0009
VA:  120.0984
```

You are now returned to program 0.

PRG

26



DistOb - In general

PRG

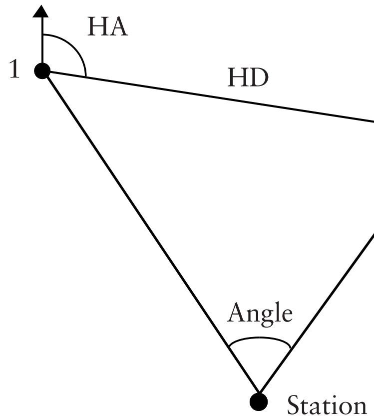
26

In general

DistOb will allow you to calculate distances between objects even if the line of sight is obstructed. The program calculates the horizontal distance and the difference in height between two points. If the instrument is oriented in a coordinate system the true bearing (azimuth) between the two points will be calculated as well.

How do I Work with DistOb

This is done simply by choosing the program No 26. Select a Stn.point where you have a free line of sight to the two points between which you would like to measure the distance.



The result is given in the form of HA=bearing, HD=horizontal distance and DHT=difference in height between these two points.

PRG

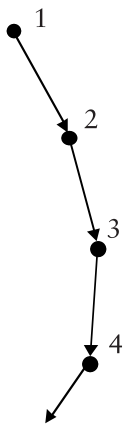
26

The actual measuring can be made using two different combinations:

In general

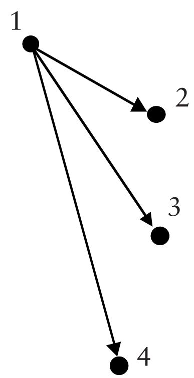
Combination 1

HA, HD and DHT are displayed as the measured and calculated result between point 1 to 2, 2 to 3 and so on.



Combination 2

HA, HD and DHT are displayed as the measured and calculated result between point 1 to 2, 1 to 3 and so on.



How to use

PRG

26

How to use - 2 Meas

Switch on the instrument and go through the Start procedure until the instrument is in theodolite mode.

```
STD   P0  10:16
HA=392.9095
VA=102.8955
```

The instrument's station has been established. Select program 26 (DistOb).

PRG 26

ENT

```
       P26 10:17
1 File
2 Meas
```

If you want to measure the distance between two objects choose 2. Meas. If you want to calculate the distance between two points stored in the memory choose 1. File, see page 4.3.98.

2

```
       P26 10:17

Job No=_
```

Key in the number of the Jobfile in which you want to store your bearing distance and height.

ENT

See next page

PRG

26

How to use - 2 Meas

From previous page.

```
     P26 10:17
1:Xmem off
2:Imem on
3:Serial off
```

You can activate which device you wish for the storage of the Job file by choosing the appropriate number 1, 2 or 3.

2

ENT

```
     P26 10:17
From
Pno=
```

Select the first point you want to measure from. Key in e.g. 1 and press ENT.

Note!

Note!
If you select a point that already has been measured in a previous task, this point will not be remeasured.

1

```
     P26 10:17

SH=
```

Key in the Signal Height and press ENT.

ENT

```
STD  P26 10:17
HA:  36.5110
VA: 102.8955
```

The instrument is in theodolite mode. Aim to the first point and press the A/M key.

A/M

See next page.

PRG

26

How to use - 2 Meas

From previous page.

```
STD   P26 10:17
HA:  36.5110
VA: 102.8955
SD: 247.517
```

The instrument has now measured angle and distance to Pno=1. The values are ready for registration. Press REG.

REG

```
STD   P26 10:17
To
Pno=1_
```

The program remembers the latest measured point. Choose the second point. Key in 2 and press ENT.

2

ENT

```
STD   P26 10:17

SH=
```

Key in the signal height. In this example we key in 1.000 and press ENT.

1.000

ENT

```
STD   P26 10:17
HA:   50.1585
VA:  104.1620
```

The instrument is in theodolite mode. Aim to the second point and press A/M.

A/M

See next page.

PRG

26

How to use - 2 Meas

From previous page.

```
STD   P26   10:18
HA:    50.1585
VA:   104.1620
SD:    98.732
```

The instrument has now measured angle and distance to Pno=2. The values are ready for registration. Press REG.

REG

```
STD   P26   10:18
HA=227.7320
HD=152.443
Press ENT...
```

The result is calculated and shown in form of:
HA=Horizontal angle (Bearing)
HD=Horizontal distance
Press ENT to see more.

ENT

```
Store ?
DHT=4.784
Grade=8.984
```

DHT=Difference in height.
Grade=Slope between the included points in percent (DHT/HD).
Press YES to store the results.

YES

```
more ?
DHT=4.784
Grade=8.984
```

Do you want to continue press YES.
Press NO to exit.

YES

```
      P26   10:18
From
Pno=2
```

You are now able to continue with the next point.

PRG

26

How to use - 1 File

```
      P26 10:17
1 File
2 Meas
```

Choose 1 File

1

```
      P26 10:17

Job no=_
```

Key in the number of the Jobfile in which you want to store your bearing distance and height.

ENT

```
      P26 10:17
1:Xmem off
2:Imem off
3:Serial off
```

In which memory device do you want to store your Jobfile. Press ENT.

2 ENT

```
      P26 10:17

Area=_
```

In which Areafile are your point coordinates stored. Key in the number press ENT.
Note - The points must have an elevation.

9

```
Sel devic 10:17
1 Xmem
2 Imem
```

In which memory device is the Areafile stored.

2

PRG

26

How to use - 1 File

```
      P26 10:17
From
Pno=1_
```

Select the first point in the calculation. Key in e.g. 1 and press ENT.

1

```
      P26 10:17
To
Pno=2_
```

Select the second in the calculation. Key in e.g 2 and press ENT.

2

```
      P26 10:17
HA=200.0000
HD=2.000
Press ENT ...
```

The result is calculated and shown in form of:
HA=Horizontal angle (Bearing)
HD=Horizontal distance
Press ENT to see more.

ENT

```
Store?
DHT=2.000
Grade=100.000
```

DHT=Difference in height.
Grade=Slope between the included points in percent (DHT/HD).
Press YES to store the results.

YES

```
more ?
DHT=2.000
Grade=100.000
```

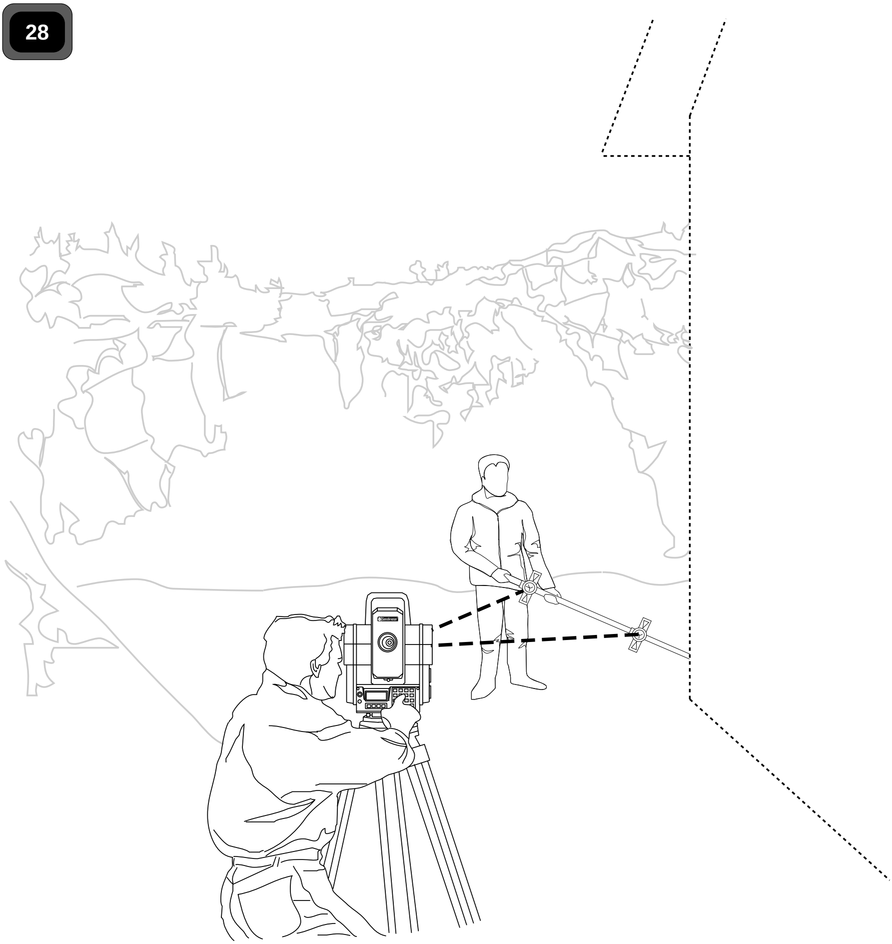
Do you want to continue press YES.
Press NO to exit to P0.

NO

P0

PRG

28



In general

PRG

28

In general

Obstructed Point is a program which will help you to measure towards obstructed points.
The method simplifies the measuring task since the range pole does not have to be held in a levelled position.
Mount two prisms on a range pole. Locate the pole on the difficult point and measure towards each prism. The program will then calculate the position of the difficult point.
To get the best result locate the prism B as close as possible to the obstructed point, C. The highest accuracy of the measurement is also achieved if the distance between prism A and B, dist AB, is as large as possible. See fig 1.

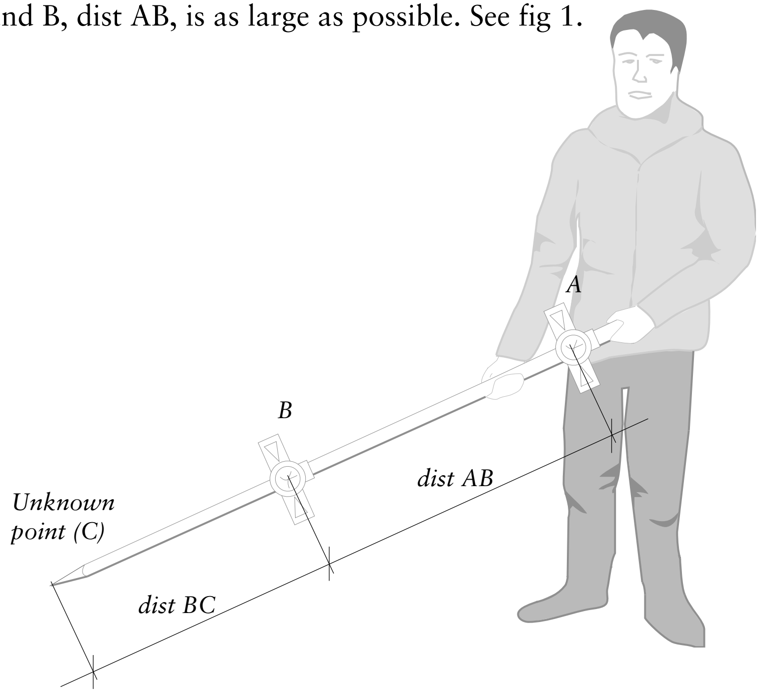


Fig. 1 Distance definitions.

How to use

PRG

28

How to use

Mount two prisms on a range pole and note the distance BC, see fig.1 on page 4.3.101. The distance between the two prisms will be calculated and does not have to be entered.
Locate the pole on the obstructed point (it is not necessary to hold the pole in a levelled position).
Startup the instrument and follow the instructions below.

P0

PRG 28 ENT

Select program 28 (Obstructed Point).

```
      P28 10:16

Job no =

```

Key in the number or name of the Job file in which you wish to store data about your measurements. A list of data stored in the selected Job file can be seen on page 4.3.106.

1 ENT

```
      P28 10:16
1. Xmem off
2. Imem off
3. Serial off
```

Choose in which memory unit you wish to store your Job file. Activate/deactivate a memory unit by pressing its corresponding key number and ENT. In this example we choose 2, Imem.

2 ENT

```
      P28 10:16

Prism=

```

Enter the prism offset and press ENT.

0 ENT

See next page

PRG

28

Obstructed Point

```
        P28 10:16

dist BC=
```

Enter the distance BC, that is the distance between prism B and the obstructed point C. See page 4.3.101 fig. 1.

ENT

```
        P28 10:16

Pno=
```

Enter a point number for the point to be measured and press ENT.

ENT

```
        P28 10:16

Pcode=
```

Here you have an opportunity to enter a Pcode for the point. The program will propose the last Pcode entered. Accept it, key in a new or leave it blank for no Pcode.
If you leave it blank this question will not appear for the next point.

ENT

Note! ☞

```
        P28 10:16

meas A
```

Start with measuring towards the first prism, A, and press ENT.
Note !
If you have a signal from the prism you can start the measurement at this point by pressing A/M.

ENT

```
STD     P28 10:17
HA:      355.8192
VA:       95.2208
```

Aim towards the first prism, A, and press the A/M-key to start measurement.

A/M

PRG

28

Obstructed Point

From previous page

```
STD    P28 10:17
HA:     356.6407
VA:      95.2208
SD:        3.456
```

Press REG to registrate the first measurement.

REG

```
       P28 10:17

meas B
```

Note! ☛

Continue with measuring towards the second prism, B and press ENT.
Note !
If you have a signal from the prism you can start the measurement at this point by pressing A/M.

ENT

```
STD    P28 10:17
HA:     355.8192
VA:      94.1760
```

Aim towards the second prism, B, and press the A/M-key to start measurement.

A/M

```
STD    P28 10:17
HA:     355.8193
VA:      94.1800
SD:        3.586
```

Press REG to registrate the second measurement.

REG

See next page

PRG

28

Obstructed Point

From the previous page

```
STD   P28 10:17
N:     2890.987
E:     1098.879
ELE:    222.098
```

These are the coordinates for the obstructed point. Press ENT to see more data for the point or press REG to store the point and continue with a new measurement.

Note - Skip point

If you press CL the following display appear and you are able to skip the point and continue with a new point:

```
STD   P28   10:17

Skip point?
```

Note! ☞ *Press CL to skip the point*

ENT

```
STD   P28 10:17
HA:    354.1908
HD:     96.0008
```

HA=Horizontal Angle (Bearing)

HD=Horizontal Distance

Press ENT to see more or press REG to store the point and continue with a new measurement.

Note - Skip point

Press CL to skip the point and continue with a new point.

Note! ☞ *Press CL to skip the point*

ENT

```
STD   P28 10:17
DHT=4.784
Grade=8.984
```

DHT=Difference in height between the obstructed point and the instrument.

Grade=Slope between the obstructed point and the instrument in percent.

REG

Press ENT to see the coordinates for the point or press REG to store the point and continue with a new measurement.

Note - Skip point

Press CL to skip the point and continue with a new point.

Note! ☞ *Press CL to skip the point*

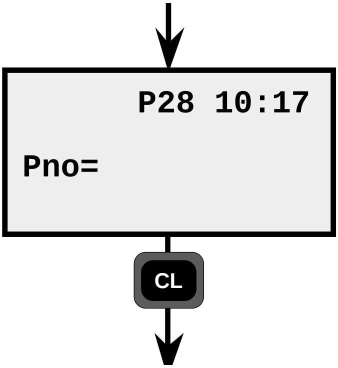
See the next page

PRG

28

Registered data

From the previous page



The program automatically increments the point number. Accept it, enter a new value or press CL to exit to program 0.

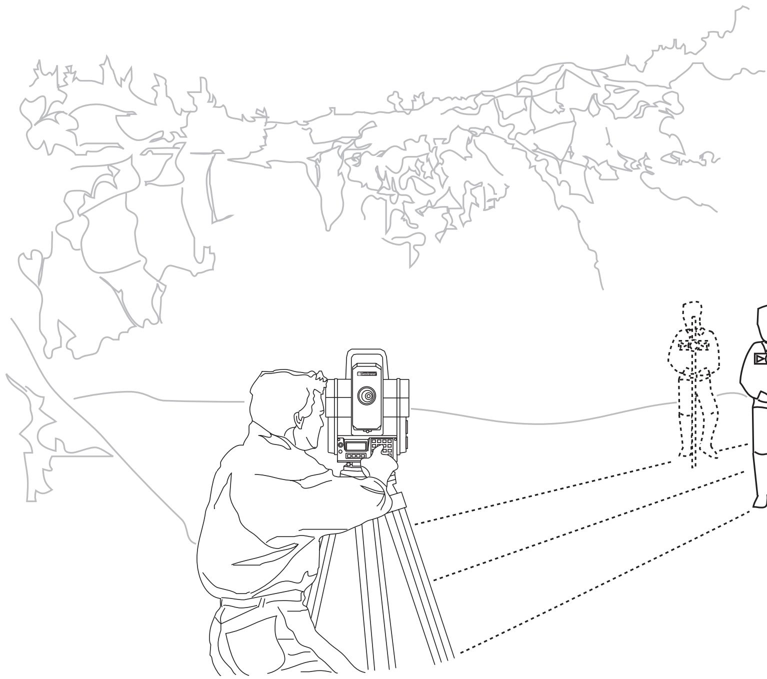
P0

Job file in Imem	Comments
Prism offset	Stored before the first
distance BC	measurement
User defined data, pnt A	
User defined data, pnt B	
Activity code	Calculated data follows
Data for the obstructed point (C)	
Pno	
Pcode	Stored if it has been entered
N	
E	
ELE	
HA	
HD	
DHT	
Grade	

Fig. 2. List of data stored in the selected Jobfile.

PRG

29



RoadLine - In general

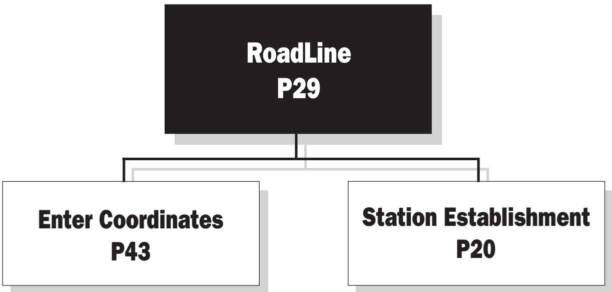
PRG

29

In general

RoadLine is a program for setting out road/rail lines. It is easy to use and contains routines for registering section interval, centre offsets, section (="chainage" in some countries or "station" in USA), coordinates and different types of road/rail elements. The program also contains check/control function which ensures that the stored element parameters are correct. Two methods can be used while setting out; 1. Conventional radial setting out and 2. Orthogonal or rectangular setting out. At key in of section interval (longitudal section) and optional centreline offset (-=Left, +=Right), the program automatically converts the setting out point coordinate values to setting out data i.e. Horizontal distance and Bearing.

The program covers intergrated use of following programs:



PRG

29

In general

Structure

Roadline comprises 4 main functions:

1. Store

For registration of the start and end coordinates of the different elements.

2. Check

For mathematical check of the stored element coordinates and parameters.

3. Set Out

For setting out points along roadline both centreline and offset, plus station establishment (Known or Free Station).

4. Measure

For measuring in existing roadline elements, both centreline and offset, and objects that may lie along the roadline.

Store

With this function in the RoadLine program you store all roadline data, i.e. section interval, centre line offset, section, start and end coordinates of the different roadline elements and type of element. A roadline can contain 3 types of elements:

- ❑ **Straight**
- ❑ **Circular Arc**
- ❑ **Transition**

Roadline data is stored in the form of section, start and end points of the element and the type of element, i.e. straight, arc or transition. This data is then either stored in the internal memory of the instrument or in Geodat.

PRG

29

In general

When storing circular arc and transition elements, radius and A-parameter must also be stored. While storing transition curves instead of keying in the A-parameter, the option to store Radius and length is open ($A= \sqrt{R \times L}$). In this case, at the prompt "Radius", key in the RxL factor, at the prompt "Length" key in -1 or 1 which is the direction of the curve (-=Left, no sign=Right).

When storing roadline data, you must ensure that the following combinations **do not occur** in the data produced by your roaddesign program:

- ❏ **Transition - Transition - Transition**
- ❏ **Straight - Transition - Transition**
- ❏ **Transition - Transition - Straight**
- ❏ **Straight - Transition - Straight**

In order to overcome the problems concerning the mathematical solutions of any of the above combinations, they can be overcome by defining a radius at the different elements´ connecting points, i.e. by defining a straight or arc element and placing it between the elements in question. These "pseudo elements" need only have a longitudal length of a few millimetres, which will not effect the accuracy of the eventual setting out of the points which lie along those elements. In the case of the first combination, store it with this combination instead:

- ❏ **Transition - Straight - Transition - Straight- Transition**

PRG

29

Check
This function mathematically checks the stored coordinates and curve parameters of the different elements after registration of the data in an Area file. All errors in excess of 20mm are displayed and the element in which they are. Errors which occur due to wrongly keyed in In-Data can be easily rectified with the help of Edit (MNU 2).

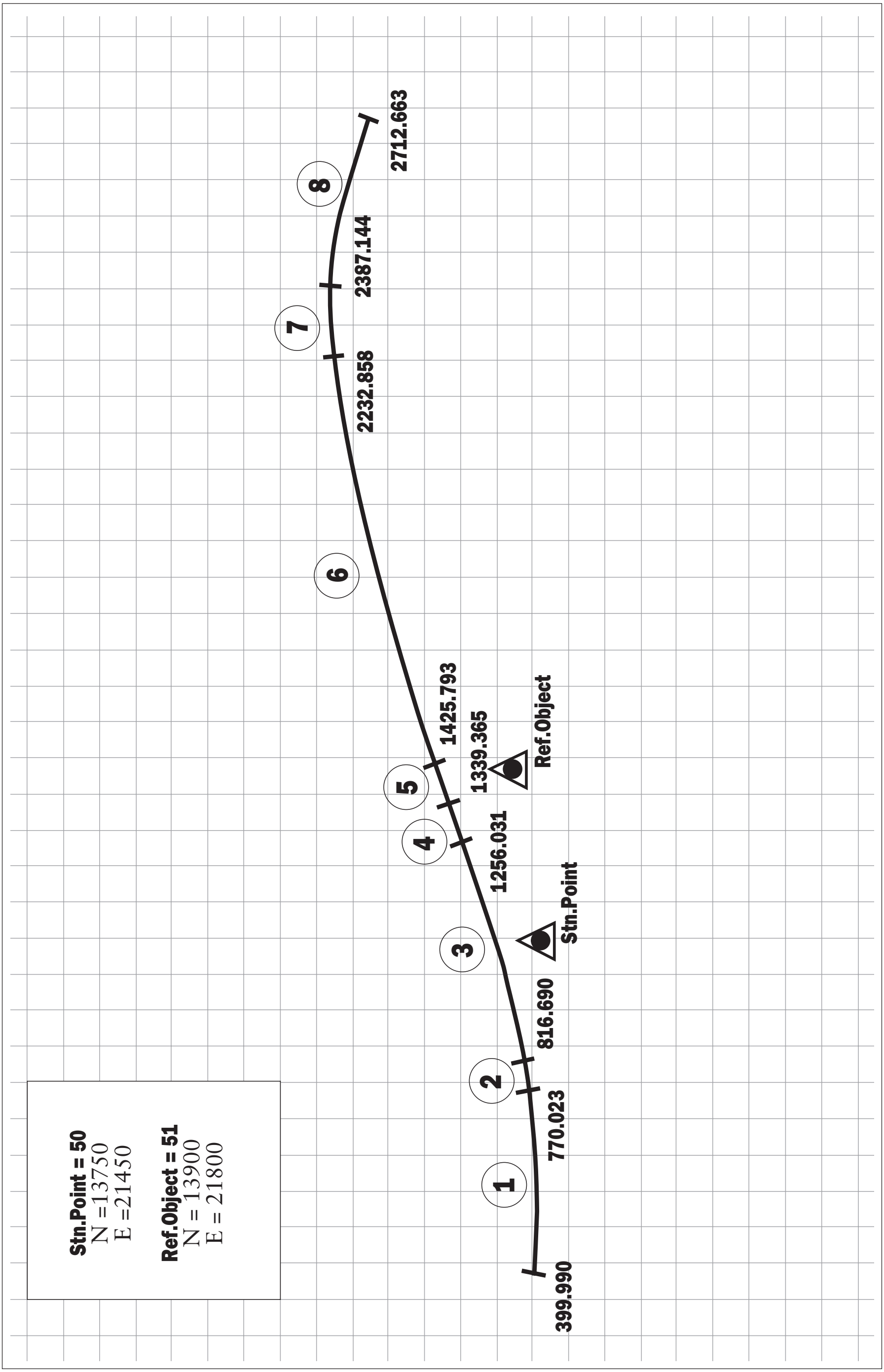
Note ! ☛

Note - error
A detected error can depend on either keyin in errors or incorrect design of the roadline.

Set Out
Before any setting out task can be commenced, it is necessary of course to inform the Geodimeter of the position at which the instrument is set up. Program 29 contains Station establishment.

Setting out task
After establishment and orientation of your survey station, registration of section interval and centre line offset is carried out (if it has not already been done with the STORE, option file). Directly thereafter the setting out data in the form of horizontal bearing and horizontal distance to the setting out point are calculated. If cross section data is available for each or some sections, 3 dimensional setting out of cross sections can be executed. In this case questions regarding (HT_measure?) in the station establishment program must be answered with YES.

Measure
The option Measure enables the operator to localize the section and centre line relative to a stored roadline. You simply measure an arbitrary point and the program calculates the section/centre line offset and coordinates of the point. This part of the program is especially suitable for cross-sectioning or localizing an obstacle when checking a planned section of road.


Stn.Point = 50
N =13750
E =21450
Ref.Object = 51
N = 13900
E = 21800
399.990
770.023
816.690
1256.031
1339.365
1425.793
2232.858
2387.144
2712.663
Stn.Point
Ref.Object
1
2
3
4
5
6
7
8

PRG

29

Roadline example

Roadline example

This table is used in the following examples.

Element no.	Section	Northing	Easting	Type	Radius /A-par.
	399.990	13751,63	20872,790		
1				circle	-1400
	770.023	13766,681	21241,440		
2				clothoid	-350
	816.690	13775,341	21287,294		
3				circle	-3000
	1256.031	13892,688	21710,267		
4				clothoid	-500
	1339.365	13921,506	21788,458		
5				clothoid	+550
	1425.793	13951,437	21869,538		
6				circle	+3500
	2232.858	14135,099	22653,592		
7				clothoid	+400
	2387.144	14145,571	22807,429		
8				circle	+800
	2712.663	14079,093	23123,798		
9				clothoid	+300
	2825.163	14029,418	23224,709		
10				clothoid	-300
	2937.663	13979,743	23325,621		
11				circle	-800
	3175.785	13918,354	23554,785		
12				clothoid	-300
	3288.285	13910,932	23667,015		
13				straight	-
	3297.592	13910,536	23676,313		

How to use

PRG

29

How to use - Store

Before beginning to use RoadLine in the field we recommend that you run through the program in the office.
Switch on the instrument, and disengage the dual-axis compensator with function 22 and step through program 0 by pressing only ENT until you place Geodimeter in the theodolite mode.

P29 - 1. Store

```
STD    P0   10:16
HA=392.9095
VA=102.8955
```

The instrument's station has been established. Select program 29 (RoadLine).

PRG 29

ENT

```
Roadline   10:17
1 Store
2 Check
3 Setout
```

ENT

```
Roadline   10:17
4 Measure
```

Now you can choose between the four main functions. Let us start to store roadline data. Press 1.

1

PRG

29

How to use - Store

From previous page.

```
Store       10:17
1 Roadline
2 Sect/Offset
```

At this stage you are able to select if you want to store the Section incrementation and Offset, but this can also be done in Setout. Let us select Roadline. Press 1.*

Note!

**Note!*
In this case the offset and incrementation values will not be saved when you exit the program.

1

```
Sel.device10:17
1 Xmem
2 Imem
```

This is a display of the memory devices available. Let us select in which device we shall store our roadline data e.g. Imem (Internal Memory). Press 2.

2

```
      P29 10:17

Area=_
```

Key in the name of the Area file in which you wish to store the Section No., Coordinates and type of elements and press ENT.

ENT

```
Clothoid  10:17
1 A-param
2 Radius/Length
```

This is a switch key, you can choose if you want to store A-param or if you want to store Radius and Length. In this case we choose 1.

1

See next page.

PRG

29

How to use - Store

From previous page.

```
      P29 10:17

Sect.=0.000_
```

Key in the first Section No. for the roadline. In this example we key in 399.990 and ENT.

ENT

```
      P29 10:17

Sect.=399.990
N=
```

Key in the Northing value of section No. 399.990. In this example it is 13751.63.

ENT

```
      P29 10:17

Sect.=399.990
E=
```

Key in the Easting value of section No. 399.990. In this example it is 20872.790.

ENT

```
      P29 10:17

Sect.=399.990
Straight?
```

Select type of roadline element, Straight, Arc or Roadline end by pressing NO until the correct element type is displayed. Accept the type by answering YES.
In this example we choose ARC.

YES

See next page.

PRG

29

How to use - Store

From previous page.

```
    P29  10:19

Sect.=399.990
Radius=
```

Key in the radial dimension, in our example -1400. After you have pressed ENT, a beep signal will be heard. The roadline data for section 399.990 are now stored in Area file 100.

ENT

```
    P29  10:19

Sect.=0.000_
```

Key in the next section point and repeat the above instructions. In this example we key in 770.023 and ENT.

ENT

```
    P29  10:19

Sect.=3297.592
Straight?
```

When you are selecting the last road-line element, select Roadline end. Roadline end=YES, means that the last element will be stored as a straight line.

Note!

The last element must be a straight line.

Note! ☛ You must end the roadline with a Straight line.

YES

```
STD  P0   10:19
HA: 266.9930
VA: 110.1425
```

You are now returned to the program P0.

PRG 29

How to use - Check

You have now stored all roadline data in Area file 100, the stored data are; the different types of roadline elements, section no. and coordinates.
Now it´s time to check the keying in and geometrical solutions of the different roadline elements with the help of function CHECK.

P29 - 2. Check

```
STD   P0  10:19
HA=392.9095
VA=102.8955
```

Choose program 29.

PRG 29

ENT

```
Roadline  10:19
1 Store
2 Check
3 Setout
```

Let us select the control function CHECK. Press 2.

2

```
Sel.device10:19
1 Xmem
2 Imem
```

Select in which device roadline data is stored. In this example it is in the internal memory.

2

See next page

PRG

29

How to use - Check

From previous page.

```
    P29 10:19

Area=_
```

Key in the name of the Area file you wish to check.

ENT

```
    P29 10:19

Elem:1
Diff:
```

Note ! ☛

The program check each element stored in Area file.

Note - check routine

A comparison with the total longitudinal centre line measurement of each individual section is carried out. If the final result gives an error message, one or more elements contain errors in which curve length errors are 20mm. Re-check the roadline and define the element with an error. The element can be changed with EDIT (MNU 2).

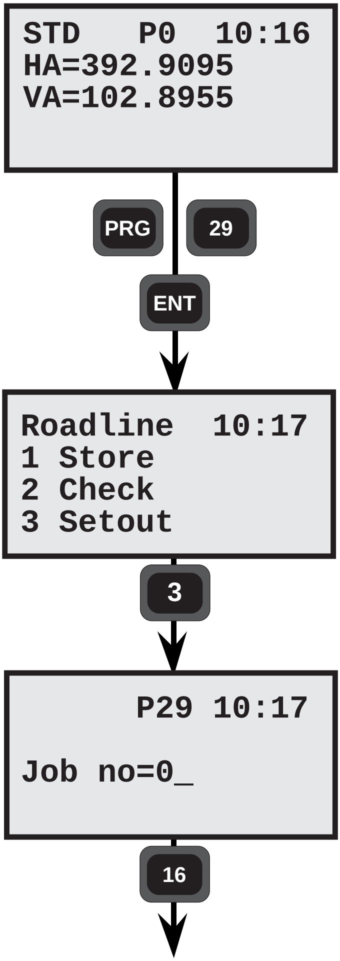
ENT

```
STD   P0  10:19

Temp=20.0
```

After have gone through CHECK the instrument returns to program P0.

How to use - Set Out

P29 - 3. Set Out



Choose program 29.

Let us select start the setting out. Press 3.

Key in the number of the Job file in which you want to store the set out point coordinate deviations.

See next page

Storage of Control Data

The coordinate deviations will represent the differences between stored set out point coordinates and the actual set out point coordinates. This is the basis of the printed out data sheet which will act as proof of having carried out your setting out task to within the contract specified accuracy.

PRG

29

How to use - Set Out

These dN, dE and dELE deviations are also much easier to use than comparing actual set out values with their respective theoretical values. If you don´t want to store any control data, clear the suggested Job no, and press ENT. Control data that will be stored are:

Pno=Section/Offset
dN=
dE=
dELE=

If height measurement is carried out also elevation is stored (staked elevation). If you wish to store other control data you can configurate the user defined output table (see 4.3)

From previous page

```
      P29 10:17
1:Xmem off
2:Imem off
3:RS232 off
```

Here you can activate which device you wish for storage of the Job file by choosing the appropriate number. Here we choose the internal memory. Press 2 and ENT.

2

ENT

```
      P29 10:17

Stn=1
```

Is "1" your station? As station establishment was done prior to P29, this station will be proposed now. If no station establishment has been made, P29 will automatically propose establishment of a known or free station (that is, P20 Station Establishment) when you press ENT. In this example we will continue by accepting the suggested station. Press ENT.

ENT

See next page

PRG

29

How to use - Set Out

From previous page.

```
Sel.device10:17
1 Xmem
2 Imem
```

Choose the type of device in which the roadline data is stored. In this example we have stored the roadline data in Imem Area 100. Press 2.

2

```
          P29 10:17

Area=_
```

Key in the Area file number in which the roadline data is stored and press ENT.

ENT

```
          P29 10:17

SecInc=10.000
```

Here you are able to select which Sec.Inc. you shall have in this roadline example. If you already have stored Sec. Inc. in "STORE", the program selects that value. Let us select Sec.Inc.=10m. Press 10 and ENT.

10 ENT

```
          P29 10:17

cl.ofs=
```

Now you are able to store the centre line offset. "0"=centreline.

0 ENT

See next page.

PRG

29

How to use - Set Out

From previous page.

```
       P29 10:17

more ?
```

Answer YES to this question if you have more values to store, in our example -5m, -10m to the left and 5m, 10m to the right. When all offset values are stored answer NO to the question.

NO

```
       P29 10:17

Roadline check
Wait !
```

The program checks that the element combinations, shown on page 4.3.110 do not occur. Wait !

```
       P29 10:17

Sect.=399.990
```

The program suggests the first section in the Area file, but can easily be changed to any value. In this example we accept the value, press ENT.

ENT

```
       P29 10:17

cl.ofs=0.00
```

The program is presenting the centreline for the first section, if ok press ENT, otherwise you will have the opportunity to select another offset value. Press ENT.

ENT

See next page.

PRG

29

How to use - Set Out

From previous page.

```
      P29 10:17
Sect.:399.990
cl.ofs:0.00
ok?
```

Is the setting out data for the first section ok, press YES. The instrument adopts the TRACKING mode automatically.

YES

Countdown to zero method

```
TRK   P29 10:17
HA:129.8210
dHA:170.3595
```

The instrument should be rotated to the right +170.3595 degrees.
-=Left
+=Right
This is called the count down to zero angle method.
See page 4.3.127 for the radial/right angle method.

```
TRK   P29 10:17
HA:300.2475
dHA:0.0000
```

When the instrument displays approx. 0.0000 opposite dHA, it is pointing in the direction of the first section point.
HA is the calculated bearing to the first section point.

```
TRK   P29 10:17
dHA:0.0000
dHD:2.75
dHT:-0.155
```

As soon as the prism comes within the measurement beam you will see dHD=remaining. In this case the prism is on line but the distance has to be increased by 2.75m.

See next page.

PRG

29

How to use - Set Out

From previous page.

```
TRK   P29 10:18
Radofs:0.00
RT.ofs:0.00
dHT:0.000
```

When the radial offset, right angle offset and dHT are 0.00, the correct lateral set out position and height have been set out.

Measurement tip
When using the count down to zero as your setting out method, it is convenient to decrease the number of decimals in the Label 77=dHA. This can be done via menu 13.

ENT

Note! ☛ Skip point

Note - skip point
If you during the setting out will have difficulties in being able to set out the point, the program will give you a opportunity to skip it. Just press Reg and the question "Skip Point?" will be displayed. Answer YES to this question and the program will continue with the next setting out point.

```
TRK   P29 10:18
dN:0.00
dE:0.00
dELE:0.000
```

When you press REG, these are the three values which are stored in the Imem, i.e. deviations from the correct set out point coordinates.
Press REG to record deviations or ENT to see coord. of the set out point. In this example we press ENT.

ENT

See next page.

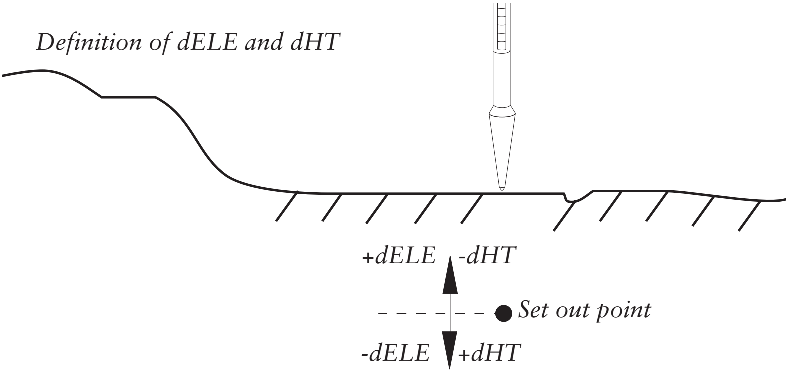
Note - Rotate the instrument with servo!
If you press *without measured distance ELE=the height at the theoretical set out point.*
If you press *with measured distance ELE=the height at the measured set out point.*
If you press *longer than 1 sec. with measured distance ELE=the height at the theoretical set out point.*

PRG

29

How to use - Set Out

Definition of dELE and dHT



From previous page.

```
TRK   P29 10:18
N:13749.99
E:21447.22
ELE:0.313
```

These are the actual coordinates of the set out point´s present position. Press REG to store the deviations seen on the previous page.

REG

```
TRK   P29 10:18

Sect.=409.990
```

The program suggests the next section stored in Area file. Key in the section number and centreline offset you want to work with and repeat the above instructions.

PRG

29

How to use - Set Out

Radial/Right angle offset method

```
TRK   P29 10:18
Radofs:0.00
RT.ofs:0.00
dHT:0.015
```

When you have a radial and right angle offset of 0.00 the correct lateral set out position has been found, i.e. N&E only!

ENT

```
TRK   P29 10:18
dN:0.00
dE:0.00
dELE:0.000
```

When you press REG, these are the three values which are stored in the Imem, i.e. deviations from the correct set out point coordinates.
Press REG to record deviations or ENT to see coord. of the set out point.
In this example we press ENT.

ENT

```
TRK   P29 10:18
N:13749.99
E:21447.22
ELE:0.313
```

These are the actual coordinates of the set out point´s present position. Press REG to store the deviations seen on the previous page.

REG

```
TRK   P29 10:18

Sect.=409.990
```

The program suggests the next section. Key in the section number and centreline offset you want to work with and repeat the above instructions.

PRG

29

How to use - Set Out

How to combine countdown to zero and radial/right angle offset for setting out

In order to benefit most from the inherent intelligence of your Geodimeter, we recommend that you try to combine the two different setting out methods, previously described. Here below is an example of how we combine the count-down to zero method with the radial and right angle offset method.

1. If the setting out data for the first section is ok, press YES and the instrument will automatically adopt the TRACKING mode. The display will show the calculated bearing, Hz, and the dHA.

2. Rotate the instrument until the display shows approx. dHA=0.0000.

3. The instrument is now pointing in the direction of the first setting out point.

4. Guide the prism bearer on line with help of the tracklight.

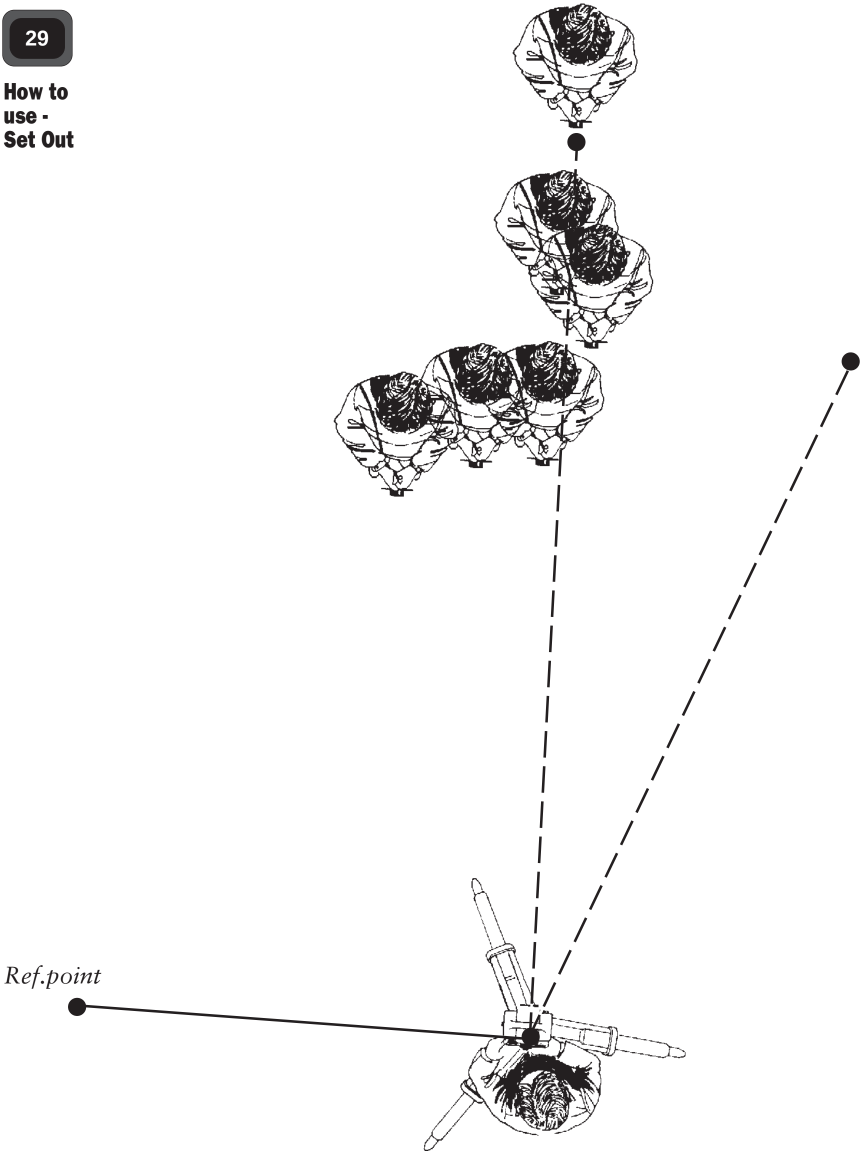
5. As soon as the prism comes within the measurement beam, you will see dHD=remaining distance to your set out point.

6. By pressing ENT at this stage, you are also able to see the radial and right angle offset to the point. When Radofs.= 0.000 and RT.ofs.=0.000, the correct lateral set out position is reached.

PRG

29

How to use - Set Out



PRG

29

How to use - Set Out

Height Setting Out

If cross section data is available for each or some sections, 3 dimensional setting out of cross sections can be executed. The following questions must be answered with YES:

1. It is assumed that elevation exists in your Stn. coordinates.

2. The question height measurement "HT=?" comes up in the program 20 Station Establishment.

3. If YES, "IH=?" (Instrument Height) appears automatically.

4. The question "SH=?" (Signal Height) appears when you enter the setting out part of the program. If you are going to use R.O.E (Remote Object Elevation) we recommend that you key in SH=0.

5. After given section interval and centreline offset the question "SHT" appears. Key in the information given in your cross section.

Measurement tip

If you would like to set out the height e.g. at +1.0m, add 1.0m to your instrument height and use R.O.E. When dHT=0 you are pointing 1.0m above finished construction level.

PRG

29

How to use - Measure

P29 - 4. Measure

```
STD   P0  10:16
HA=392.9095
VA=102.8955
```

Choose program 29.

PRG 29 ENT

```
Roadline  10:17
1 Store
2 Check
3 Setout
```

Let us select start the measuring. Press 4.

4

```
      P29 10:17

Job no=_
```

Key in the number of the Job file in which you want to store the measured point coordinate deviations.

ENT

```
      P29 10:17
1:Xmem off
2:Imem off
3:Serial off
```

In which memory device to you want to store the Job file. In this case we choose 2. The internal memory and press ENT.

2 ENT

See next page

PRG

29

How to use - Measure

From previous page

```
      P29 10:17

Stn=1_
```

Is "1" your station ? As station establishment was done prior to P29, this station will be proposed now. If no station establishment has been made, P29 will automatically propose establishment when you press ENT.

ENT

```
Sel device10:17
1 Xmem
2 Imem
```

Choose in what type of device in the roadline data is stored. In this example we have stored the roadline data in Imem.

2

```
      P29 10:17

Area=
```

In which area file are the roadline data stored?

ENT

```
STD   P29 10:17
HA:76.5600
VA:86.5555
```

The instrument is now in theodolite mode. Aim at the first point and press A/M to start measurement.

A/M

```
STD   P29 10:17
HA: 391.2341
HD:   4.641
VD:   0.226
```

Press the REG key to check the points location according to the roadline.

PRG

29

How to use - Measure

From previous page

REG

```
STD   P29 10:17

Wait
```

The program checks if the point lays close to any of the roadline sections. If no section is found INFO 32 will appear. The maximum distance between the point to measure and the nearest roadline section is 1.000m.

```
STD   P29 10:17
Sect.: 804.318
CL.ofs: -16.891
OK ?
```

The point lays 16.891 meters from roadline section 804.318. If this is ok press YES. If you answer NO the program will check if the point lays close to any other section.

YES

```
STD   P29 10:17

Pcode=HOUSE
```

Here you have the opportunity to choose a Pcode for the measured point. If you leave the line blank no Pcode will be stored and the question will not appear for the next point.

ENT

```
STD   P29 10:17
HA:  39.897
VA: 120.899
```

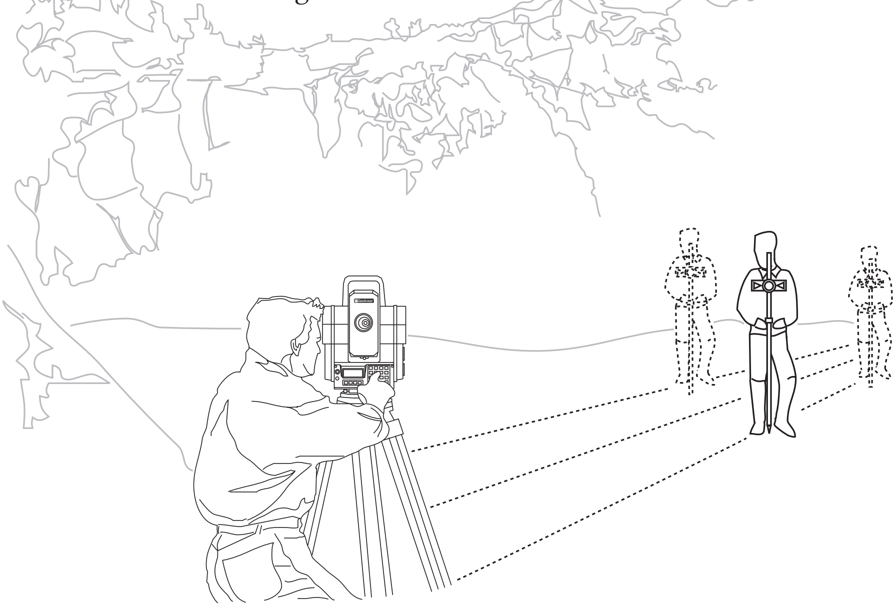
The program is now in theodolite mode. If you want to exit the program to program 0 press the program key and then 0.

PRG 0

PRG

39

Program 39 - RoadLine 3D



In general

PRG

39

In general

With program 39, RoadLine 3D, you can measure and setout roadlines in three dimensions.
The program contains routines for storing, checking, setting out, measuring, slope staking and reference point. Two different methods can be used while setting out, 1 conventional radial setting out and 2 orthogonal or rectangular setting out.

Structure

1. Store

This function is divided in 5 subsections:

1.1 Roadline- to store the horizontal spread of the roadline.

1.2 Vertical alignment - to store the vertical spread of the roadline.

1.3 Cross sections definition - to store the different cross sections for the roadline.

1.4 Cross section - to describe how the different cross sections changes along the road.

1.5 Camber (Super elevation) - to define how much the road slopes.

1.6 Layer - to store road layer data.

1.7 Length - to store length table data (for Swedish railways).

2. Check

For mathematical check that the data in the areafiles is correct.

3. Set Out

For setting out points along or parallel to the centre of the road.

4. Measure

For measuring in existing elements and objects that may lie along the roadline.

5. Slope staking

Function to find out where the ground level intersects with the finished road and to set out embankment sides.

6. Reference point

Function to set out a point on an optional distance from e.g. a road edge or for measuring in a point and get data for a ref. pnt. It is also possible to define a boning (guide stake) height.

Store

PRG

39

Store

With this function you store all roadline data, i.e. section interval, centre line offset, section, start- and endpoints of every element and the type of element.
In order to survey or set out a road in P39 at all, a description of the plane, i.e. the horizontal curve, is required.
In order to make a complete description of the vertical spread, a height curve, two cross sections (left and right road halves) and two descriptions of the road camber (super elevation) are required. All these tables are described using a number of elements, where the position of these elements is determined by the section (station), one section value that denotes where the element begins and another that denotes where it ends.
The section describes ones whereabouts on the road.
The section always describes ones whereabouts on the road in the horizontal plane, even for the vertical descriptions.
The elements in the various descriptions are not coupled together and will be dealt with separately in the calculations.

All roadline data will be stored in separate areafiles sorted after type of data according to the following:

Extension	Description
nn	Section interval and layer
nn#1	Horizontal alignment (roadline)
nn#2	Vertical alignment (height profile)
nn#3	Cross sections definition (road profile)
nn#4	Cross sections for right road half
nn#5	Cross sections for left road half
nn#6	Camber* information for right road half
nn#7	Camber* information for left road half
nn#8	Length table, for defining kilometre sections that aren't a kilometre (mainly for use on Swedish railways)

*Camber = Super elevation

PRG
39
Store

Requirements

- To work with Program 39 the areafile nn#1 must be stored.

- If you wish to include heights relative to the centre of the road, the areafile nn#2 must be stored.

- If you have defined a cross section and wish to refer the heights to this, the areafiles nn#3, nn#4 and nn#5 must also be stored.

- If you wish to use the camber (super elevation) function, also the area files nn#6 and nn#7 must be stored.

- If you want to use Length tables (mainly for Swedish railways) the area file nn#8 must be stored.

- If you wish to use the layer function, the areafile nn must be stored.

- It is not necessary to define a point code in all files, but it is of great help.

PRG

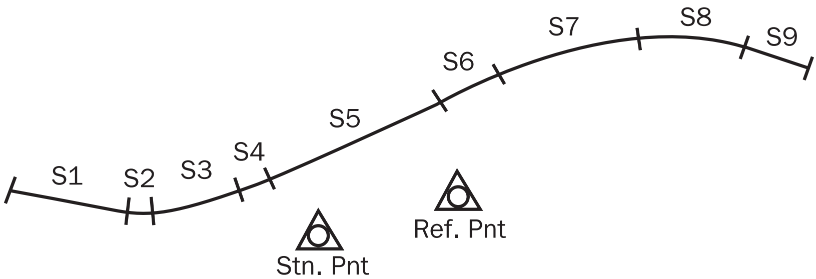
39

General - Horizontal alignment

Horizontal alignment

In order to work with P39 at all, you must have keyed in data for the horizontal alignment of the roadline.
This will be stored as section (station), the starting point coordinates for the element and possibly a radius or a parameter for an arc and clothoid.
When you store clothoids (spirals) you can choose between keying in A-parameter or to key in radius and length.
The roadline must begin and end with a straight element.

The elements on the opposite of a clothoid (spiral) must denote the radius in the conjunction. If this is infinite, the element should be a straight line, otherwise an arc.



The following apply to the figure above:
S1: X-coordinate, Y-coordinate
S2: X-coordinate, Y-coordinate, Radius
S3: X-coordinate, Y-coordinate, A-parameter
S4: X-coordinate, Y-coordinate, Radius
S5: X-coordinate, Y-coordinate
S6: X-coordinate, Y-coordinate, Radius
S7: X-coordinate, Y-coordinate, A-parameter
S8: X-coordinate, Y-coordinate, Radius
S9: X-coordinate, Y-coordinate

PRG

39

General - Horizontal alignment

The following data is required to describe the different types of elements for the horizontal alignment of the roadline:

Typ	Label	Description
Straight	80	Section (Station)
	37	X-coordinate
	38	Y-coordinate
Arc	80	Section (Station)
	37	X-coordinate
	38	Y-coordinate
	64	Radius, Left=-, Right=+
Clothoid (Spiral)	80	Section (Station)
	37	X-coordinate
	38	Y-coordinate
	81	A-parameter*

* You can choose between keying in the A-parameter or radius and length.

Example of an areafile with a horizontal alignment:

```
80=0.000
37=37305.028
38=73505.770
80=68.480
37=37350.638
38=73556.850
64=750.000
80=919.863
37=37480.143
38=74352.784
64=3200.000
80=1803.633
37=37023.901
38=75106.401
80=1803.634
37=37023.900
38=75106.400
```

PRG
39

Store horizontal alignment

Store horizontal alignment

PRG 3 9 ENT

Select program 39 and press ENT.

```
Roadl.3D  10:17
1 Store
2 Check
3 Setout
```

Select 1 Store.

1

```
Store   P39  10:17
1 Roadline
2 Vertical alig.
3 Cross sect.def
```

Since it's the horizontal alignment you will store, Select 1 Roadline.

1

```
Sel.dev.    10:17
1 Xmem
2 Imem
```

Select in which memory unit you wish to store the horizontal alignment. In this case we choose 2 Imem.

2

```
        P39 10:17

Area=
```

Key in the name of the Areafile in which you wish to store the roadline and press ENT.
The areafile will automatically get the extension, #1.

ENT

See next page

PRG

39

Store horizontal alignment

Note. A-param

From previous page

```
Clothoid  10:17
1 A-param
2 Radius/Length
```

Here you can choose how the clothoid (spiral) will be described, stored and calculated; either with an A-parameter or with radius and length. In this case we choose 1 A-param.

1

```
      P39 10:17

Sect.=_
```

Key in the first section (station) number for the roadline and press ENT.

ENT

```
      P39 10:17

Sect.=XXX.XXX
N=
```

Key in the Northing value of the chosen and press ENT.

ENT

```
      P39 10:17

Sect.=XXX.XXX
E=
```

Key in the Easting value of the chosen and press ENT.

ENT

See next page

PRG

39

Store horizontal alignment

From previous page

```
      P39 10:17

Sect.=XXX.XXX
Straight?
```

Select type of roadline element by pressing NO until the correct element type is displayed. In this example we choose Straight and press ENT.

ENT

```
      P39 10:17

Sect.=
```

Key in the next section (station) point and repeat the above instructions.

ENT

```
      P39 10:17

Sect.=
Roadline end?
```

When you are selecting the last roadline element, select Roadline end. This means that the last element will be stored as a straight line.

ENT

PRG

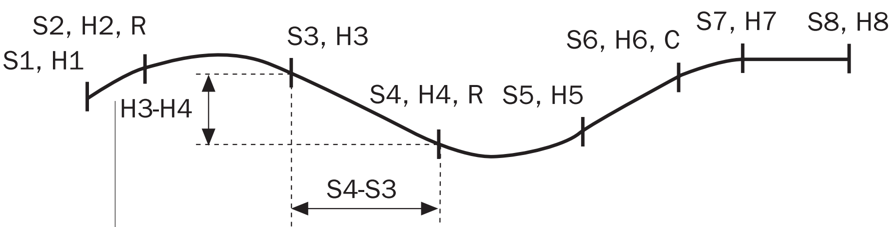
39

General - Vertical alignment

Vertical alignment

If you have chosen to include heights in the calculations for the roadline, there must be a description of the vertical alignment.
The height for the roadline gives a description of the middle line in the vertical plane.
A height profile is described by defining height elements with consecutive section values. The end section (station) of an element is identical to the start section (station) of the next element.
The elements can be of the type straight, arc or parabola.

To define a straight element only the height and the section (station) at the start- and end points is required.
A circular or a parabel element also require a start slope. This means that you need to enter a start slope if the previous element type is not a straight line. If a start direction is stated, this should be used.
If the coefficient for a parabola is entered as zero, the coefficient will be calculated by the program when it is to be used. This requires that a slope exists both before and after this parabolic element.



The following apply to the figure above:
S=Section (Station)
H=Height
R=Radius of circle arc
C=Coefficient for a parabola, in the form $Y=C*X^2$.

PRG

39

General - Vertical alignment

The following data is required to describe the different element types for the vertical alignment:

Type	Label	Description
Straight	80	Section (Station)
	39	ELE, Height
Arc	80	Section (Station)
	39	ELE, Height
	44*	Start slope, Up=+, Down=-
	64	Radius, Up=+, Down=-
Parabola	80	Section (Station)
	39	ELE, Height
	44*	Start slope, Up=+, Down=-
	84	Coefficient
End	80	Section (Station)
	39	ELE, Height

* Not mandatory if the previous element type is a straight line.

Example on a areafile with a height profile:

80=60
39=16.004
80=80
39=15.657
80=450.568
39=11.581
64=8000
80=746.568
39=13.801
80=1233.983
39=26.474
64=-16000
.
.

PRG

39

Store vertical alignment

Store vertical alignment

PRG 3 9 ENT

Select program 39 and press ENT.

```
Roadl. 3D 10:17
1 Store
2 Check
3 Setout
```

Select 1 Store.

1

```
Store  P39 10:17
1 Roadline
2 Vertical alig.
3 Cross sect.def
```

Since it is the vertical alignment you will store, select 2 Vertical alig.

2

```
      P39 10:17
Area=
```

Key in the name of the areafile in which you wish to store the vertical alignment and press ENT.
The area file will automatically get the extension, #2.

ENT

```
Sel. dev. 10:17
1 Xmem
2 Imem
```

Select in which memory unit you wish to store the vertical alignment. In this case we choose, 2 Imem.

2

See next page

PRG

39

Store vertical alignment

Note Straight

From previous page

```
Store    10:17
1 Straight
2 Arc
3 Parabola
```

Select element type, 1 Straight, 2 Arc, 3 Parabola or 4 Roadline end. In this case we choose 1 Straight.

1

```
     P39 10:17
Sect.=_
```

Key in the first section (station) number for the roadline and press ENT.

ENT

```
     P39 10:17
Sect.=XXX.XXX
ELE=
```

Key in the height value for the chosen section (station) and press ENT.

ENT

Note Arc

```
Store  P39 10:17
1 Straight
2 Arc
3 Parabola
```

Select type of element, 1 Straight, 2 Arc, 3 Parabola or 4 Roadline end. In this case we choose 2 Arc.

2

See next page

PRG

39

Store vertical alignment

From previous page

```
      P39 10:17
Sect.=
```

Key in the second section (station) number for the roadline and press ENT.

ENT

```
      P39 10:17
Sect.=XXX.XXX
ELE=
```

Key in height value for the chosen section (station) and press ENT.

ENT

Note Radius: Up=+ Down=-

```
      P39 10:17
Sect.=XXX.XXX
ELE=
Radius=
```

Key in the radius of the arc and press ENT. A radius that turns upwards is keyed in with a positive figure and a radius turning downwards with a negative figure.

ENT

```
      P39 10:17
Sect.=XXX.XXX
Slope=
Radius=
```

Key in a start direction for the arc and press ENT. Upwards is entered with at positive figure and downwards with a negative. This display will not be shown if this data is not required, i.e. if the first element is straight.

ENT

See next page

PRG

39

Store vertical alignment

From previous page

```
Store  P39 10:17
1 Straight
2 Arc
3 Parabola
```

Note Parabola

Select type of element, 1 Straight, 2 Arc, 3 Parabola or 4 Roadline end. In this case we choose 3 Parabola.

3

```
      P39 10:17
1 Radius
2 Coefficient
```

Note Coeff.

Select 1 if you wish to key in a radius for the parabola or 2 if you wish to key in a coefficient. In this case we select 2 coefficient.

2

```
      P39 10:17
Sect.=
```

Key in the third section number for the roadline and press ENT.

ENT

```
      P39 10:17
Sect.=XXX.XXX
ELE=
```

Key in the height value for the chosen section (station) and press ENT.

ENT

See next page

PRG

39

Store vertical alignment

From previous page

```
      P39 10:17
Sect.=XXX.XXX
Slope=
```

Key in a start direction for the parabola and press ENT. Upwards is entered with at positive figure and downwards with a negative. This display will not be shown if this data is not required, i.e. if the previous element is straight.

ENT

```
      P39 10:17
Sect.=XXX.XXX
Slope=
Coeff.=
```

Key in coefficient for the parabola and press ENT. If you key in 0.000 the parabola will be calculated by the program provided that the intersection of both lines lies half-way between the two points that are about to be connected.

ENT

Note Roadline end

```
Store P39 10:17
1 Straight
2 Arc
3 Parabola
```

Continue to key in the different elements for the vertical alignment. Select 4 Roadline when you are finished.

4

```
      P39 10:17
Sect.=
```

Key in fourth and last section (station) number for the roadline and press ENT. Key in the end section (station) or leave the line blank if you already have defined the end of the height curve. In this case we leave it blank.

ENT

PRG

39

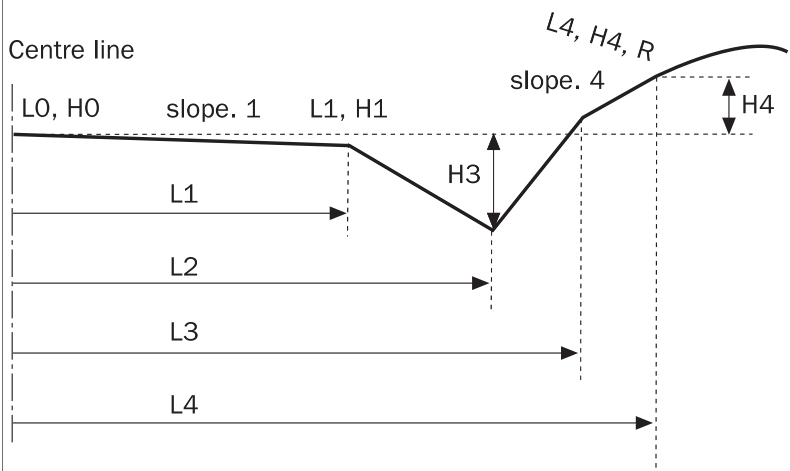
General - Cross section

Cross section

The cross section is divided in 3 different areafiles; #3, which contains all cross section definitions which will be used along the road, #4 which describes how the right half of the road changes along the road and #5 which describes the same thing for the left half of the road.

Cross section definitions (road profiles)

The cross section is defined by a number of breakpoints as Horizontal and Vertical offsets (difference in height from the Centre line) and possibly a radius.
If a point has a radius and there is another point further on, these two points are joined together with an arc irrespective of the direction of the tangent. The tangent direction for the radius in the starting point is defined by the direction for the previous line. If no start direction exists, the arc will get the start direction 0, i.e. horizontal direction.
A radius turning upwards shall be given a positive sign and a radius turning downwards a negative sign.



An example of the road profile is shown in the figure above:
L=Distance from the centre line
H=Height difference from the Centre line
R=Radius of circle arc

PRG

39

General - Cross section

The number of break points that can be used to describe the cross section is limited to 12 per road half. If the first Centre line offset is not equal to zero, it is assumed that the first point lies at a height of zero on the centre line.

It is not necessary to describe point codes for all points, but the point code is of great help if you wish to search for a specific point by name.
Separate tables are used to describe which cross sections are to be used along a certain part of road. These cross section descriptions will only describe one road half only and can then be used to describe both the left and right road halves.
The points are described below:

Type	Label	Description
Cross section	88	Cross section number
Straight	4	Point code
	83	Centre line offset. Distance from Centre line to the point at which the slope or bend shall be defined.
	85	Elevation. Difference in height from the Centre line.
Arc	4	Point code
	83	Centre line offset. Distance from Centre line to the point at which the slope or bend shall be defined.
	85	Elevation. Difference in height from the Centre line.
	64	Radius of road profile. Requires a tangent direction at the starting point of the arc if there is no new point to follow. Up=+, Down=-

PRG

39

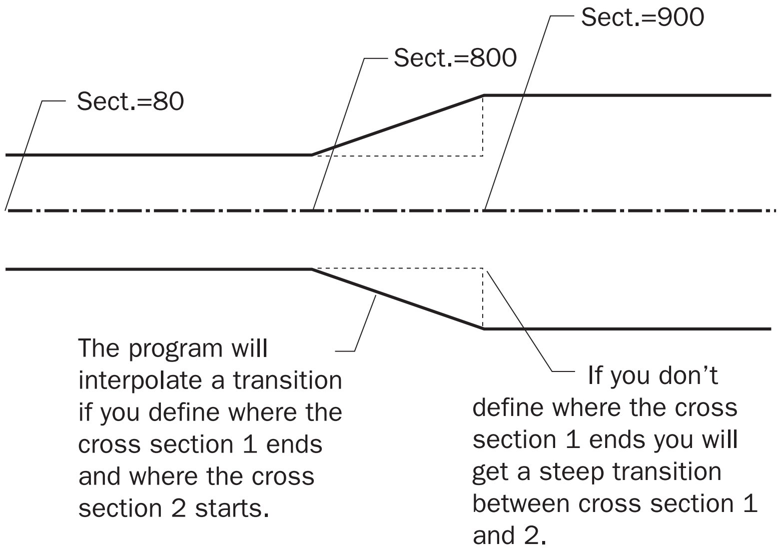
General - Cross section

Example of an areafile with cross sections:

```
88=1
4=1
83=0
85=0
4=2
83=6
85=-0.2
4=3
83=7
85=-1.0
.
.
```

Cross section definitions for left and right road half (profile curve)

Changes in the cross section along the road are stored in two separate area files, one for the right and one for the left side of the road. Reference is made to the predefined profiles in areafile #3.
The extension for the right half is #4 and for the left #5.



PRG

39

General - Cross sections

If the beginning or end of the road is undefined, i.e. if the start section (station) for the first cross section is a distance along the roadline or if the end section (station) is defined before the end of the road, the height at the middle of the road will be valid for the whole of the cross section. If there is no cross section defined, the latest profile is valid for the remainder of the road.

The cross section definitions are stored as described below:

Type	Label	Description
Straight	80	Section (Station)
	88	Cross section number
	80	
	88	
	.	
	.	
Profile transition	80	Section (Station)
	88	Cross section number
	80	End of 1:st cross section
	80	Start of 2:nd cross section
	88	Cross section number

Example of an areafile with cross section definitions:

80=80
88=1
80=800
80=900
88=2
80=1800

PRG

39

Store cross section data with distance and height

Store cross section data - with length and height difference

PRG 3 9

ENT

Select program 39 and press ENT.

```
Roadl. 3D 10:17
1 Store
2 Check
3 Setout
```

Select 1 Store.

1

```
Store  P39 10:17
1 Roadline
2 Vertical alig.
3 Cross sect.def
```

Since it is a cross section you will store, select 3 Cross sect.def.

3

```
       P39 10:17

Area=
```

Key in the name of the areafile in which you wish to store the cross section and press ENT.
The areafile will automatically get the extension, #3.

ENT

```
Sel. dev. 10:17
1 Xmem
2 Imem
```

Select in which memory unit you wish to store the profile. In this case we select 2 Imem.

2

See next page

PRG

39

Store cross section data with distance and height

From previous page

```
     P39 10:17

Profil=
```

Key in the number for the profile you wish to define and press ENT.

ENT

```
Enter P39 10:17
1 HT
2 Slope
```

Select 1 HT, if you wish to enter the profile with distance and difference in height, or 2 Slope, if you wish to enter the profile with a slope and a distance. In this case we select 1 HT.
Note !
If you choose alt. 2 you can not enter the radius but you store data as a slope and the program will calculate this into a height.

1

Note Straight

```
     P39 10:17
1 Straight
2 Arc
3 Ready
```

Select type of element, 1 Straight or 2 Arc. 3 Ready you choose if you are ready with storing cross sections. In this case we select 1 Straight.

1

```
     P39 10:17

Pcode=_
```

Here you can key in a code for the point. This can then be useful if you wish to search for the point by its code.

ENT

See next page

PRG

39

Store cross section data with distance and height

From previous page

```
      P39 10:17
Cl.ofs=
```

Key in the the Centre line offset and press ENT.

ENT

```
      P39 10:17
Cl.ofs=
Pht=
```

Key in the difference in height between the middle of the road and the chosen profile and press ENT.

ENT

Note Arc

```
Store P39 10:17
1 Straight
2 Arc
3 Ready
```

Select type of element, 1 Straight or 2 Arc. 3 Ready you choose if you are ready with storing cross sections. In this case we select 2 Arc.

2

```
      P39 10:17

Pcode=_
```

Here you can key in a code for the point. This can then be useful if you wish to search for the point by its code.

ENT

See next page

PRG

39

Store cross section data with distance and height

From previous page

```
    P39 10:17
Cl.ofs=
```

Key in the the Centre line offset and press ENT.

ENT

```
    P39 10:17
Cl.ofs
Pht=
```

Key in the difference in height between the middle of the road and the chosen profile and press ENT.

ENT

Note Radius: Up=+ Down=-

```
    P39 10:17
Cl.ofs=
Pht=
Radius=
```

Key in the radius of the arc and press ENT. A radius that turns upwards is keyed in with a positive figure and a radius turning downwards with a negative figure.

When you have keyed in all parts of the road profile you select 3 Ready.

ENT

PRG

39

Store cross section definitions with slope

Store cross section definitions - with slope

PRG 3 9

ENT

Select program 39 and press ENT.

```
Roadl. 3D 10:17
1 Store
2 Check
3 Setout
```

Select 1 Store.

1

```
Store P39 10:17
1 Roadline
2 Vertical alig.
3 Cross sect.def
```

Since it is a road profile you will store, select 3 Road profile.

3

```
      P39 10:17

Area=
```

Key in the name of the areafile in which you wish to store the profile and press ENT.
The areafile will automatically get the extension, #3.

ENT

```
Sel. dev. 10:17
1 Xmem
2 Imem
```

Select in which memory unit you wish to store the profile. In this case we select 2 Imem.

2

See next page

PRG

39

Store cross section definitions with slope

From previous page

```
      P39 10:17

Profil=
```

Key in the number for the profile you wish to define and press ENT.

ENT

```
Enter P39 10:17
1 HT
2 Slope
```

Select 1 HT, if you wish to enter the profile with distance and difference in height, or 2 Slope, if you wish to enter the profile with a slope. In this case we select 2 Slope.
Note !
If you choose alt. 2 you can not enter the radius but you store data as difference in height and the program will calculate this into a slope.

2

Note Straight

```
      P39 10:17
1 Straight
2 Ready
```

Proceed with 1 Straight or quit storing road profiles with 2 Ready. In this case we select 1 Straight.

1

```
      P39 10:17

Pcode=
```

Here you can key in a code for the point. This can then be useful if you wish to search for the point by its code.

ENT

PRG

39

Store cross section definitions with slope

Note Slope: Up=+ Down=-

From previous page

```
     P39 10:17
Slope=_
```

Key in the slope from the middle of the road in percent and press ENT. In this case we key in 0.02 which is the same as a slope of 2%.

ENT

```
     P39 10:17
Slope=
Cl.Ofs=_
```

Key in the Centre line offset and press ENT.

ENT

When you have keyed in all parts of the profile, select 2 Ready.

PRG

39

Store cross section

Store cross section

PRG 3 9

ENT

Select program 39 and press ENT.

```
Roadl. 3D 10:17
1 Store
2 Check
3 Setout
```

Select 1 Store and press ENT.

1

```
Store P39 10:17
4 Cross section
5 Camber
6 Layer
```

Since it is a cross section you are about to store, select 4 Cross section.

4

```
      P39 10:17

Area=
```

Key in the name of the areafile in which you wish to store the cross section and press ENT.

ENT

```
Sel. dev. 10:17
1 Xmem
2 Imem
```

Select in which memory device you wish to store the cross section. In this case we select 2 Imem.

2

See next page

PRG

39

Store cross section

From previous page

```
      P39 10:17

Right ?
```

Here you can select which road half you shall define, right or left. Press ENT to accept or NO to select left. Note -Pressing NO when the left alternative displayed means that the program jumps to the previous menu.) The areafile will automatically get the extension, #4 if you select right or #5 if you select left.

ENT

```
      P39 10:17
Sect.=_
```

Key in the section (station) number for the first cross section and press ENT.

ENT

```
      P39 10:17
Sect.=
Profil=
```

Key in the profile that should be valid for the chosen section and press ENT.

ENT

```
      P39 10:17
1 more
2 Ready
```

Press 1 more if you wish to continue defining more profiles for the right road half or 2 Ready if you are finished with this half of the road.

2

PRG

39

Store cross section

From previous page

```
      P39 10:17
Sect.=
```

Key in an end section (station) for the right half of the road. This can however be blank; that means that the latest profile is valid for the remainder of the road.

ENT

```
      P39 10:17

Left ?
```

Press ENT to define the left road half or NO to exit.

YES

Continue describing the cross sections for the left half of the road in the same way as for the right road half.

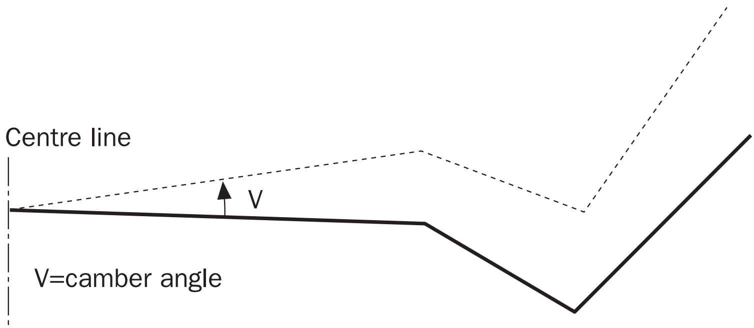
PRG

39

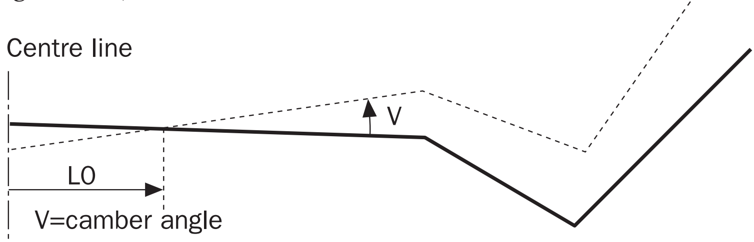
General - Camber

Camber (Super elevation)

The camber (super elevation) defines the slope of the road. The left and right halves of the road are defined separately. When describing how one half of the road changes along the road, a section (station) and the slope in that section are defined. If the slope between two sections (stations) is changing, the slope will gradually change and the correct slope will be obtained in the next section (station).
The slope is stated as a decimal (tangent of the slope angle) and is positive upwards and negative downwards based on the Centre line.



Alternatively, an offset from the Centre line can be entered and the camber (super elevation) defined from this point (see fig. below).



PRG

39

General - Camber

The start section (station) of the next element is the end section (station) of the previous element. The change of the slope within the element will be linear so that it corresponds to the slope of the next element at its start point. If there is no new element, the slope of the last element will be applicable for the remainder of the roadline.

Data for the camber (super elevation) of the road are stored as follows:

Type	Label	Description
Camber about	80	Section (Station)
Centre line	44	Slope, Up=+, Down=-
Camber with	80	Section (Station)
an offset	83	Centre line offset. Distance from the Centre line to where the road profile should slope.
	44	Slope, Up=+, Down=-

Example of an areafile with camber (super elevation) data:

80=80.000
44=0.01
80=180
83=1.5
44=0.03
80=1250
44=0.01
80=1800
.
.

PRG
39
Store camber data

Store Camber (Super elevation) data

PRG 3 9
ENT

Select program 39 and press ENT.

```
Roadl. 3D 10:17
1 Store
2 Check
3 Setout
```

Select 1 Store and press ENT.

1 ENT

```
Store P39 10:17
4 Cross section
5 Camber
6 Layer
```

Since it is camber data you will store, select 5 Camber (Super elevation).

5

```
      P39 10:17

Area=
```

Key in the name of the areafil in which you wish to store camber (super elevation) data and press ENT.

ENT

```
Sel. dev. 10:17
1 Xmem
2 Imem
```

Select in which memory unit you wish to store camber (super elevation) data. In this case we select 2 Imem.

2

See next page

PRG

39

Store camber data

From previous page

```
      P39 10:17

Right ?
```

Here you can select which road half you shall define, right or left. Press ENT to accept or NO to select left. Note -Pressing NO when the left alternative displayed means that the program jumps to the previous menu.) The areafile will automatically get the extension, #6 if you select right or #7 if you select left.

ENT

```
      P39 10:17
Sect.=_
```

Key in the first section (station) number for the camber (super elevation) and press ENT.

ENT

```
      P39 10:17
Sect.=
Cl.Ofs=
```

Key in a Centre line offset around which the road half should slope and press ENT. Key in zero if the slope should be around the Centre line.

ENT

```
      P39 10:17
Sect.=
Cl.Ofs=
Slope=
```

Key in the slope from the start section (station) in percent and press ENT. E.g. 2% should be key in as 0.02.

Note Slope: Up=+ Down=-

ENT

PRG

39

Store camber data

From previous page

```
      P39 10:17
1 more
2 Ready
```

Press 1 more if you wish to continue storing camber (super elevation) data for the right road half or 2 Ready if you are finished with this road half.

2

```
      P39 10:17

Sect.=
```

Key in a end section (station) for the right half of the road. This can however be blank; that means that the latest profile is valid for the remainder of the road.

ENT

```
      P39 10:17

Left ?
```

Press ENT to define the left road half or NO to exit.

YES

Continue storing the camber data for the left half of the road in the same way as for the right road half.

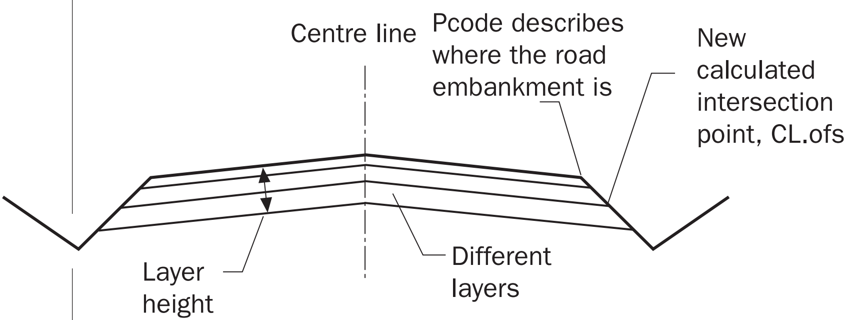
PRG

39

General - layers

Layers

The road consists of different layers. At startup you can key in the layer you wish to work with and what point code the road embankment should have (this to identify the roadway). These layers must be prestored in an areafile.
This areafile also contains the layer height. New cross sections will then be calculated continuously. The changes lies in where the roadway intersects with the road embankment. If the roadway has a slope, the height difference from the original cross section will be larger than the layer heights, since the layer runs with the slope of the roadway.
If no layers are defined, the unmodified cross section will be used.
A single roadway gives only one point of intersection. The roadway in this example has a slope of the angle v.



If the cross section have two embankments, two points of intersection will be calculated.

PRG

39

General - layers

The point code denotes where the road embankment is, i.e. which element that is the road embankment. The program will search after a point with a given point code and will then lower the element that ends with the road embankment code. If there are more points with the exact code the last point will be used (highways can have two road embankments). The program will then calculate new cross section points for the road embankments. If there are no point code entered or if the entered point code does not exist, it is assumed that the roadway begins at the middle of the road.

The different layers for the road are described as follows:

Type	Label	Description
First layer	80	Start section (station)
	4	Point code for road embankment
	86	Layer ident., name or no.
	0	Layer description, e.g. type of material
	87	Difference in height from the road profile
Next layer	86	Layer ident., name or no.
	0	Layer description, e.g. type of material
	87	Difference in height from the road profile

Example of an areafile with layer data:

```
4=2
86=1
0=LAYER1
87=0.2
86=2
0=LAYER2
87=0.5
86=3
0=LAYER3
87=0.8
```

PRG

39

Store layer data

Store Layer data

PRG 3 9 ENT

Select program 39 and press ENT.

```
Roadl. 3D 10:17
1 Store
2 Check
3 Setout
```

Select 1 Store and press ENT.

1 ENT

```
Store P39 10:17
4 Cross section
5 Camber
6 Layer
```

Since it is layer data you are about to store, select 6 Layer.

6

```
      P39 10:17

Area=
```

Key in the name of the area file in which you wish to store layer data and press ENT.

ENT

```
Sel. dev. 10:17
1 Xmem
2 Imem
```

Select in which memory unit you wish to store layer data. In this case we select 2 Imem.

2

See next page

PRG

39

Store layer data

From previous page

```
      P39 10:17
Sect.=
```

Key in the first section number and press ENT.

ENT

```
      P39 10:17
Sect.=
Pcode=_
```

Key in a point code for the road embankment and press ENT.

ENT

```
      P39 10:17
Layer=
```

Key in a identification for the chosen layer, brief name or number and press ENT.

ENT

```
      P39 10:17
Layer=
Info=
```

Key in a description of the layer and press ENT.

ENT

See next page

PRG

39

Store layer data

From previous page

```
      P39 10:17
Layer=
Info=
LayerH=
```

Key in the difference in height to the cross section and press ENT.

ENT

```
      P39 10:17

more ?
```

Do you wish to continue defining more layers for the current section you press ENT, otherwise press NO. In this case we press NO.

NO

```
      P39 10:17
1 more
2 Ready
```

Press 1 more if you wish to continue defining layers for other sections or 2 Ready if you are finished.

2

```
      P39 10:17
Sect.=
```

Key in a end section (station) for the keyed in layer data and press ENT. This can however be blank; that means that the latest layer definition is valid for the remainder of the road.

ENT

PRG

39

General - Length table

Length table - in general

Swedish railways use a special section definition. Each section is described as an even kilometre figure. If a railway track is modified, e.g shortened, the kilometre figures does no longer correspond with the actual track length. This is where the length table comes in use. Here label 80, which in all other RoadLine applications stores section (Sect.) data, is now used for storing the kilometre figure of the length table. RoadLine section is now stored in label 35 instead.

The length table must always be stored with the file extention #8.are. This will be done automatically when keying in length data from a Geodimeter control unit. All kilometre data about the length table is stored in label 80. All other Roadline section data (S) now uses label 35 if Length table is used.

When storing a Lenght table from the Geodimeter control unit you choose alternative 7 Lenghts from the Store menu. The keying in of length data can be done in two different ways:

35=3+955.364 or
35=3 955.364

meaning kilometre no. 3 has a length of 955.364 metres. The difference between the two examples is that you can use either a + sign or a space between the kilometre number and the length. If you are loading the length table data from a computer it is best to use the + sign.

Note! ☛ **Note! If you are going to key in a length table from a Geodimeter control unit it is important that you key in this table (#8.are -file) before any other Roadline data. Otherwise wrong labels will be used for the rest of the Roadline calculations.**
If you transfer length table data from a computer it doesn't matter when you do this – the right labels are used automatically.

PRG

39

General - Length table

Example of an areafile with length table data:

80=1	for kilomtre no. 1
89=1002.892	length of kilometre no. 1
80=2	for kilometre no. 2
89=976.475	length of kilometre no. 2
80=3	for kilometre no. 3
89=955.364	length of kilomtre no. 3
.	
.	

PRG
39
Store Length data

Store Length data (mainly used for Swedish railways)

PRG 3 9
ENT

Select program 39 and press ENT.

```
Roadl. 3D 10:17
1 Store
2 Check
3 Setout
```

Select 1 Store and press ENT twice.

1 ENT ENT

```
Store P39 10:17
7 Length
8 Exit
```

Since it is length data you are about to store, select 7 Length.

7

```
      P39 10:17

Area=
```

Key in the name of the area file in which you wish to store length data and press ENT.

ENT

```
Sel. dev. 10:17
1 Imem
2 Xmem
```

Select in which memory unit you wish to store layer data. In this case we select 1 Imem.

1

See next page

PRG

39

Store Length data

From previous page

```
      P39 10:17
Sect.=
```

Key in the first section number and press ENT.

ENT

```
      P39 10:17
Sect.=1
Length=_
```

Key in actual length for the first kilometre and press ENT.

ENT

```
      P39 10:17
more?
```

Do you want to enter more lengths? Press ENT to add more lengths or NO to exit Length. In this example we will enter one more length.

ENT

```
      P39 10:17
Sect.=
```

Key in the second section number and press ENT.

ENT

See next page

PRG

39

Store Length data

From previous page

```
      P39 10:17
Sect.=2
Length=_
```

Key in actual length for the second kilometre and press ENT.

ENT

```
      P39 10:17
more?
```

Do you want to enter more lengths? Press ENT to add more lengths or NO to exit Length. In this example we are satisfied with 2 lengths and answer NO.

NO

```
Store P39 10:17
1 Roadline
2 Vertical alig.
3 Cross sect.def
```

You are taken back to the Store menu and can now continue with Program 39.

PRG

39

Store Length data

The length table must always be stored with the file extention #8.are. This will be done automatically when keying in length data from a Geodimeter Control Unit. All kilometre data about length tables is stored in label 80. All other Roadline section data (S) now uses label 35 if Length table is used.

Example of an areafile with length table data:

80=1	for kilomtre no. 1
89=1002.892	length of kilometre no. 1
80=2	for kilometre no. 2
89=976.475	length of kilometre no. 2
80=3	for kilometre no. 3
89=955.364	length of kilomtre no. 3
.	
.	

Check

PRG

39

Check

This function mathematically checks that the data in the areafiles is correct.
All errors in excess of ≥ 20mm horizontally and ≥10mm vertically will be displayed and the element in which they occur. The control function will also notify slope deviations larger than 0.01, i.e. 1%. Errors which occur due to wrongly keyed in data can be easily rectified with the help of Edit.

Note - Error
A detected error can depend on either keyed in errors or incorrect design of the roadline.

PRG 3 9

ENT

Select program 39 and press ENT.

```
Roadl. 3D 10:17
1 Store
2 Check
3 Setout
```

Select 2 Check and press ENT.

2

```
Check P39 10:17
1 Roadline
2 Vertical alig.
3 Cross section
```

Select which type of object you wish to check. In this case we select 1 Roadline. The other options are:
2 Vertical alig.
3 Cross sect. def.
4 Camber (Super elevation)
5 Layer
6 Length
7 All files
8 Exit

1

See next page

PRG

39

Check

From previous page

```
Sel. dev.   10:17
1 Xmem
2 Imem
```

Select in which device roadline data is stored. In this case we select 2 Imem.

2

```
      P39 10:17

Area=
```

Key in the name of the area file you wish to check and press ENT.

ENT

```
      P39 10:17

Elem:1
Diff:
```

The program check each element stored.

Note !

A comparison with the total longitudinal centre line measurement of each individual section (station) is carried out. If the final result gives an error message, one or more elements contain errors in which curve length errors are ≥20mm. Re-check the roadline and define the element with an error. The element can be changed with Edit.

ENT

Setout

PRG
39
Setout

Before any setting out task can be commenced you will have to do a free or known station establishment. This is done with Program 20, Stn Est.
After having stored the roadline and thereafter checked that it is OK you can start with setting out.
After keying in section (station) and Centre line offset values the program will calculate bearing and distance to these roadline points. Three-dimensional setting out of cross sections can be performed if heights have been included in the station establishment.

Storage of control data
The coordinate deviations will represent the differences between the stored set out point coordinates and the actual set out point coordinates.
This is the basis of the printed out data sheet which will act as proof of having carried out your setting out task to within the contract specified accuracy.
These deviations (dN, dE, dELE) are much easier to use than comparing coordinates.
If you don't want to store any control data, clear the suggested Job file, and press ENT.
Control data that will be stored are:

Label	Description
80 (or 35)	Section (Station)
83	Centre line offset
39	ELE
86	Layer
87	Layer height
36	Ht.Ofs
40	dN
41	dE
42	dELE

If height measurement is carried out elevations are also stored (staked elevation). If you wish to store other control data you can configurate the user defined output table (see page 4.3).

PRG

39

Setout

How to combine countdown to zero and radial/right angle offset for setting out

In order to benefit most from the inherent intelligence of your instrument, we recommend that you try to combine the above mentioned setting out methods. Here below is an example:

1. If the setting out data for the first section (station) is OK, press ENT and the instrument will automatically adopt TRK mode. The display will show the calculated bearing and the dHA.

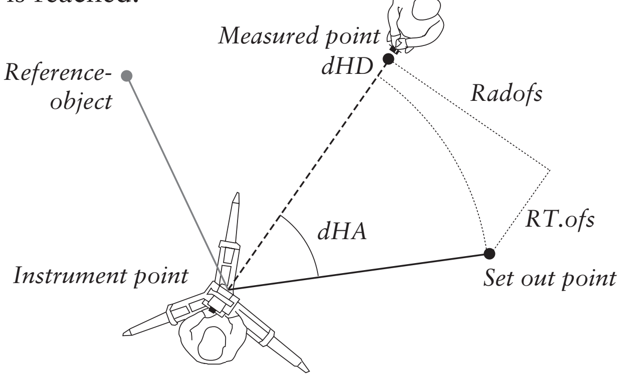
2. Rotate the instrument until the display shows ≈0.0000 opposite dHA. With a servo instrument, press .

3. The instrument is now pointing in the direction of the point.

4. Guide the prism bearer on line with help of the Tracklight.

5. As soon as the prism comes within the measurement beam, you will see dHD=remaining distance to your set out point.

6. If you are in robotic mode, you can easily translate the dHA and dHD values into Radofs. and RT.ofs to the point. When both these values are 0, the correct lateral set out position is reached.



PRG

39

Setout

Setout

PRG 3 9

ENT

Select program 39 and press ENT.

```
Roadl. 3D 10:17
1 Store
2 Check
3 Setout
```

Select 3 Setout and press ENT.

3

```
      P39 10:17

Job no=_
```

Key in the job file in which you wish to store the set out point coordinate deviations.

ENT

```
      P39 10:17
1 Xmem OFF
2 Imem OFF
3 Serial OFF
```

Select in which memory unit you wish to store the data and press ENT. In this case we select 2 Imem.

2 ENT

```
STD   P39 10:17

Stn=1
```

Is this the station you chose when you ran program 20, prior to P39? If no station establishment has been made, P39 will automatically start P20.
It is impossible to start with setting out before you have established your instrument. In this example we accept the station and press ENT.

ENT

See next page

PRG

39

Setout

From previous page

```
      P39 10:17

Area=_
```

Key in the name of the area file in which the roadline data is stored and press ENT.

ENT

```
Sel. dev.  10:17
1 Xmem
2 Imem
```

Select in what type of device in which the roadline data is stored. In this case we choose 2 Imem.

2

```
      P39 10:17

HT Measure?
```

Do you wish to set out heights? Press ENT to accept. If you select not to set out heights the answer will be NO which means that the instrument height and the signal height will not be prompted. In this case we choose to accept with ENT.

ENT

```
      P39 10:17

SH=
```

Enter the signal height and press ENT. This question only appears if you have chosen to include heights in the previous display.

ENT

See next page

PRG

39

Setout

From previous page

```
P39 10:17

Ht.Ofs=_
```

Key in a boning (guide stake) height if you wish to move up the set out point on the rod and press ENT.

ENT

```
P39 10:17

Roadline check
Wait !
```

The program checks the element combinations. Wait !

```
P39 10:17

Pcode=
```

If you have chosen to include point codes you can key in a code here. The program will choose points with this code. If you have chosen not to include point codes, leave this line blank and press ENT.

ENT

```
P39 10:17

Layer=
```

Key in the layer on which you wish to set out the point and press ENT or leave the line blank if you don't want to work with layers.

ENT

See next page

PRG

39

Setout

From previous page

```
      P39 10:17
Layer:1
Descr:LAYER1
OK?
```

Is this the correct layer? If not press NO. In this case we accept with ENT.

ENT

```
      P39 10:17

New Cl.ofs ?
```

Do you want the program to calculate a new centre line offset, see fig. on page 169, for the road embankment press ENT, otherwise press NO and you will work at the same centre line offset. This display will not be shown if you have not defined a layer.

ENT

```
      P39 10:17

SecInc=
```

Select which section interval you shall have in this roadline and press ENT. If you choose this interval when you stored the roadline, the program selects that value.

ENT

```
      P39 10:17

Sect.=
```

The program suggests the last used section (station) in the area file, but this can easily be changed into any value. In this case we accept the section (station) with ENT.

ENT

See next page

PRG

39

Setout-with countdown to zero

Setout with countdown to zero

```
Layerinfo 10:17
Layer:1
Descr:LAYER1
LayerH:0.200
```

Here the layer information is displayed for the chosen section. Press ENT to proceed.

ENT

```
      P39 10:17

Cl.ofs=
```

Now you can select the offset value you wish to set out. In this case we select 0 and press ENT. Is there a cross section stored will the offset values be taken from this, or by the point code.

ENT

```
Ok?   P39 10:17
Sect.:400.000
Cl.ofs:0.00
Pcode:
```

Is the setting out data OK?
If so, press ENT. The instrument automatically adopts the TRK-mode.

ENT

```
TRK   P39 10:17
HA:   129.8210
dHA:  170.3595
```

The instrument should be rotated to the right 170.3595 degrees.
-=Left
+=Right
This method is called the count down to zero angle method. See page 4.3.192 for the radial/right angle method.

See next page

PRG

39

Setout-with countdown to zero

From previous page

```
TRK    P39 10:17
HA:    300.1805
dHA:     0.0000
```

When the instrument displays ≈0.0000 opposite dHA it is pointing in the direction of the point. HA is the calculated bearing to the point.
Measurement tip - for mechanical
When using the count down to zero as your setting out method, it is convenient to decrease the number of decimals in the Label 77=dHA. This can be done via menu 13.

```
TRK    P39 10:17
dHA:     0.0000
dHD:     2.75
dHT:    -0.155
```

As soon as the prism comes within the measurement beam you will see dHD,i.e. how much you must change the horizontal distance from the instrument.
+=increase
-=decrease
In this case the prism is on line but the distance has to be increased by 2.75m.

ENT

When you are finished, i.e. dHD=0.000 you can press REG for the next point or ENT to see Radofs and RT.ofs. In this case we press ENT.

```
TRK    P39 10:17
Radofs: 0.00
RT.ofs: 0.00
dHT:     0.000
```

When the Radofs and RT.ofs are 0.000 you have found the correct lateral set out position.

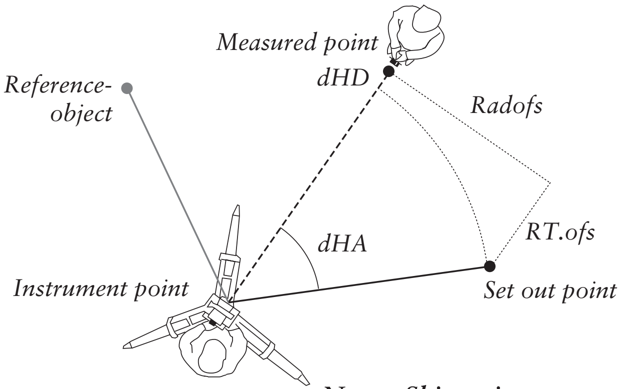
ENT

See next page

PRG

39

Setout- with countdown to zero



Note - Skip point
If during the setting out you have difficulties in being able to set out the point, you have a opportunity to skip it. Just turn the instrument until HD disappears (30cm) and press REG and the question "Skip Point?" will be displayed. Answer ENT to this question and the program will continue with the next setting out point.

From previous page

```
TRK    P39 10:17
dN:      0.00
dE:      0.00
dELE:    0.000
```

When you press REG, these are the values which are stored in the Job file, i.e. deviations from the correct set out point coordinates. Press ENT to see the coordinates for the point.

ENT

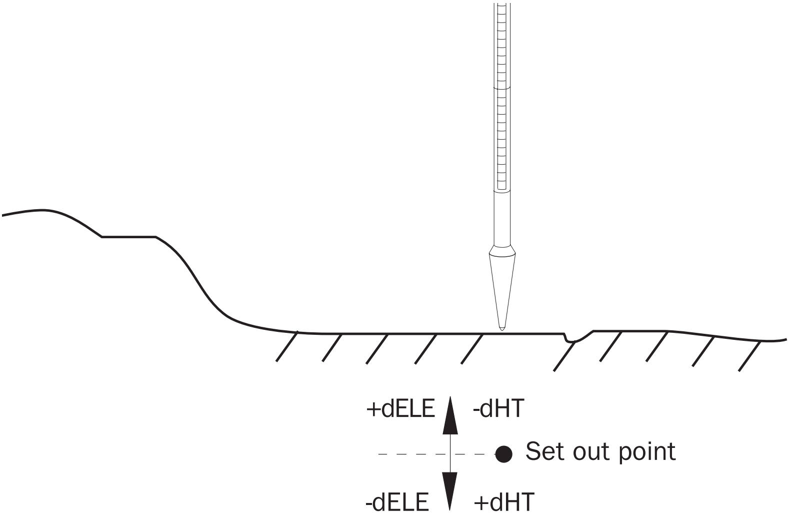
See next page

Rotate the instrument with servo
If you press this key without measured distance ELE=the height at the theoretical set out point.
If you press this key with measured distance ELE=the height at the measured set out point.
If you press this key longer than 1 sec. with measured distance ELE=the height at the theoretical set out point.

PRG

39

Setout-with countdown to zero



From previous page

```
TRK    P39 10:17
X:  13479.99
Y:  21447.22
Z:  0.313
```

These are the actual coordinates of the set out point's present position. Press REG to store the deviations seen on the previous page.

REG

```
       P39 10:17

more ?
```

Do you wish to continue setting out more points, press ENT. Otherwise press NO and you will return to the main menu. In this case we continue with ENT.

ENT

See next page

PRG

39

Setout-with radial/ right angle offset

Setout with radial/right angle offset

```
      P39 10:17

Sect.=420.000
```

The program suggests the next section (station). Key in the section (station) and the Centre line offset you wish to set out…

ENT

```
Ok?   P39 10:17
Sect.: 420.000
Cl.ofs:0.00
Pcode:
```

Is the setting out data OK? If so, press ENT. The instrument automatically adopts the TRK-mode. When the prism is found, press ENT to see Radofs and RT.ofs.

ENT

```
TRK   P39 10:17
Radofs:  0.00
RT.ofs:  0.00
dHT:     0.000
```

When Radofs and RT.ofs are 0.00 the correct lateral set out position has been found. Press REG directly if you do not wish to see the other display pages. In this case we press ENT to see the coordinates and deviations.

ENT

```
TRK   P39 10:17
dN:     0.00
dE:     0.00
dELE:   0.000
```

When you press REG, these are the values which are stored in the Job file, i.e. deviations from the correct set out point coordinates. Press ENT to see the coordinates for the point.

ENT

See next page

PRG

39

Setout-with radial/ right angle offset

From previous page

```
TRK   P39 10:17
N:  13479.99
E:  21447.22
ELE:    0.313
```

These are the actual coordinates of the set out point's present position. Press REG to store the deviations seen on the previous page.

REG

```
TRK   P39 10:17

Sect.=440.000
```

The program suggests the next section (station). Key in the section (station) and the Centre line offset you wish to set out...

ENT

Measure

PRG

39

Measure

This option enables the operator to localize the section (station), Centre line and the difference in height relative to a stored roadline.
You simply measure an arbitrary point and the program calculates the section (station)/Centre line offset and coordinates of the point. This part of the program is especially suitable for cross sectioning or localizing an obstacle when checking a planned section of road.

PRG

39

Measure

Measure

PRG 3 9

ENT

Select program 39 and press ENT until this display appears.

```
Roadl. 3D 10:17
4 Measure
5 Slopestake
6 Ref.Point
```

Select 4 Measure and press ENT.

4 ENT

```
      P39 10:17

Job no=_
```

Key in the Job file in which you wish to store the measured point coordinate deviations.

ENT

```
      P39 10:17
1 Xmem OFF
2 Imem OFF
3 Serial OFF
```

Select in which memory unit you wish to store the Job file and press ENT. In this case we select 2 Imem.

2 ENT

```
      P39 10:17

Stn=1
```

Is this the station you chose when you ran program 20, prior to P39? If no station establishment has been made, P39 will automatically start P20.
It is impossible to start with setting out before you have established your instrument. In this example we accept the station and press ENT.

ENT

See next page

PRG

39

Measure

From previous page

```
         P39 10:17

Area=_
```

Key in the name of the area file in which the roadline data is stored and press ENT.

ENT

```
Sel. dev. 10:17
1 Xmem
2 Imem
```

Select in what type of device in which the roadline data is stored. In this case we choose 2 Imem.

2

```
         P39 10:17

HT measure ?
```

Do you wish to set out heights? Press ENT to accept. If you select not to set out heights the answer will be NO which means that the instrument height and the signal height will not be prompted. In this case we choose to accept with ENT.

ENT

```
         P39 10:17

SH=
```

Enter the signal height and press ENT. This question only appears if you have chosen to include heights in the previous display.

ENT

See next page

PRG

39

Measure

From previous page

```
      P39 10:17

Roadline check
Wait !
```

The program checks the stored data. Wait !

```
      P39 10:17

Layer=
```

Key in the layer on which you wish to measure the point and press ENT or leave the line blank if you don't want to work with layers.

ENT

```
      P39 10:17
Layer:1
Descr:LAYER1
OK?
```

Is this the correct layer? If not press NO. In this case we accept with ENT.

ENT

```
STD   P39 10:17
HA:  76.5600
VA:  86.5555
```

The instrument is now in theodolite mode. Aim at the first point and press A/M to start measurement.

A/M

See next page

PRG
39
Measure

From previous page

```
STD   P39 10:17
HA:   76.5600
VA:   86.5555
SD:   32.685
```

Press REG to check the points location according to the roadline.

REG

```
STD   P39 10:17

Wait
```

The program checks if the point lays close to any of the roadline sections (stations). If no section (station) is found INFO 32 will be displayed.

```
Layerinfo 10:17
Layer:1
Descr:LAYER1
LayerH:0.200
```

Here the layer information is displayed for the chosen section. Press ENT to proceed.

ENT

```
Ok?    P39 10:17
Sect.:   804.318
Cl.ofs:-16.891
dELE:     0.052
```

The point lays 16.891m to the left of the roadline section (station) 804.318. If this is OK, press YES. If you answer NO, the program will check if the point lays close to any other section (station).

ENT

See next page

PRG

39

Measure

From previous page

```
STD   P39 10:17

Pcode=DITCH
```

Here you have the opportunity to choose a point code for the measured point.

ENT

```
      P39 10:17

more ?
```

Do you wish to continue measuring more points, press ENT. Otherwise press NO and you will return to the main menu. In this case we exit with NO.

NO

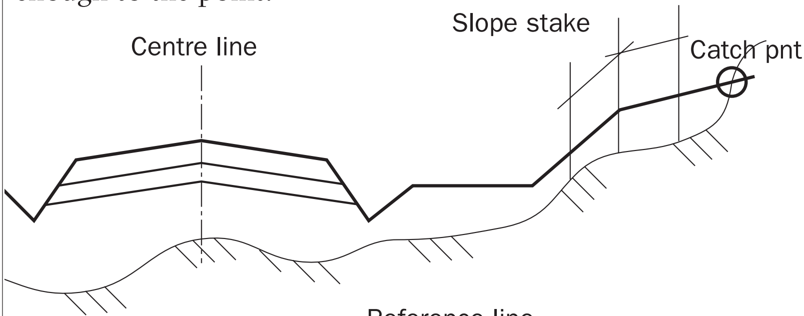
Slope staking

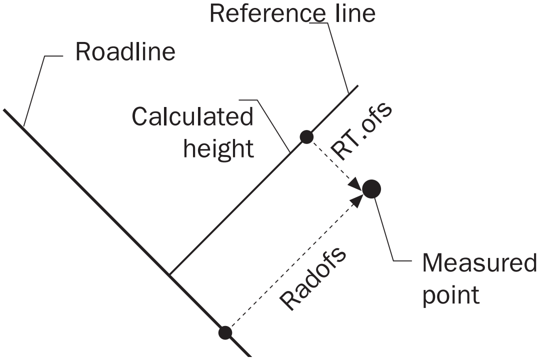
PRG

39

Slope stake

This option is used to find out where the ground level intersects with the finished road and to set out embankment sides. The heights cannot be deselected, which means that the height curve for the centre line of the road must exist to be able to run this option, (area files nn#1, nn#2, #3, #4, #5 are required).
First you have to select the section (station) to work at. The program will calculate N, E, ELE using Cl.Offset=0, and the last point in the cross section. This results in that a reference line will be drawn between these two points in the horizontal plane.
During the survey you will get continuous information about Radofs (Cl.Offset), RT.ofs (Deviation from section (station)) and dELE (Deviation from stored cross section).
When dELE is zero the Catch point is found.
The surveyor can press REG when he thinks he is close enough to the point.





PRG

39

Slope stake

Slope stake

PRG 3 9

ENT

Select program 39 and press ENT until this display appears.

```
Roadl. 3D 10:17
4 Measure
5 Slope stake
6 Ref.Point
```

Select 5 Slope stake and press ENT.

5 ENT

```
      P39 10:17

Job no=_
```

Key in the Job file in which you wish to store the measured points data and press ENT.

ENT

```
      P39 10:17
1 Xmem OFF
2 Imem OFF
3 Serial OFF
```

Select in which memory unit you wish to store the Job file and press ENT. In this case we select 2 Imem.

2 ENT

```
      P39 10:17

Stn=_
```

Is this the station you chose when you ran program 20, prior to P39? If no station establishment has been made, P39 will automatically start P20.
It is impossible to start with setting out before you have established your instrument. In this example we accept the station and press ENT.

ENT

See next page

PRG

39

Slope stake

From previous page

```
      P39 10:17

Area=_
```

Key in the name of the area file in which the roadline data is stored and press ENT.

ENT

```
Sel. dev. 10:17
1 Xmem
2 Imem
```

Select in what type of device the roadline data is stored. In this case we choose 2 Imem.

2

```
      P39 10:17

SH=_
```

Enter the signal height and press ENT.

ENT

```
      P39 10:17

Ht.Ofs=_
```

Key in a boning (guide stake) height if you wish to move up the measured point on the rod and press ENT.

ENT

See next page

PRG

39

Slope stake

From previous page

```
      P39 10:17

Roadline check
Please wait
```

The program checks your chosen roadline. Please wait.

```
      P39 10:17

SecInc=
```

Select which section interval you shall have in this roadline and press ENT. If you choose this interval when you stored the roadline, the program selects that value.

ENT

```
      P39 10:17

Sect.=
```

Do you know which section (station) is closest to the point you are looking for you can key in this and press ENT. Otherwise you leave the line blank and press ENT and let the program calculate in the closest section (station) to your present position.

ENT

```
TRK   P39 10:17
HA:     39.8975
VA:    120.8995
```

You are now in theodolite mode and can start measuring. Aim at the prism to start the measurement.

See next page

PRG

39

Slope stake

From previous page

```
TRK    P39 10:17
HA:     39.8975
VA:    120.8995
SD:       9.00
```

When the distance has been measured, press REG to check the point you stand at.

REG

```
       P39 10:17

Sect:
OK ?
```

The program suggests a section (station) on the roadline. Accept this section with ENT or press NO to look for another section.

ENT

```
       P39 10:17

Sect.=
```

Select an even section (station) or accept the suggested section (station). In this case we accept the suggested section with ENT.

ENT

```
TRK    P39 10:17
HA:
VA:
```

Aim at the prism to see how you lie relative to the current cross section.

See next page

PRG

39

Slope stake

From previous page

```
TRK   P39 10:17
Radofs:
RT.ofs:
dELE:
```

Here you can see how you lie relative to the cross section. When both RT.ofs and dELE are zero you have found the cross section and can mark your Catch pnt. Press ENT to see the coordinates for the point or REG to continue with the next point.

ENT

```
TRK   P39 10:17
N:
E:
ELE:
```

Press REG to store the point.

REG

```
      P39 10:17

Pcode=
```

Here you have an opportunity to store a point code for the measured point.

ENT

```
      P39 10:17

more ?
```

Do you wish to continue looking for new points press ENT and you can key in the section (station). In this case we choose to exit with NO.

NO

Reference Point

PRG

39

Ref. pnt.

The program can be used to mark out the road design with bonings (guide stakes), i.e. rods with height marks for the road embankments.

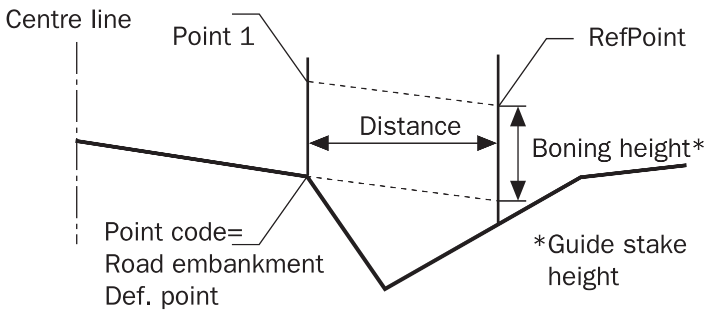
This is practical in those cases you have to dig the cut slope or place material to create the fill, when the bonings (guide stakes) have to be located outside the road embankment.

The program can both be used for setting out and surveying reference points along the roadline.

Setout

When setting out the operator enters the point code for the road embankment or the section (station) and centre line offset for the reference point, i.e. first the road embankment and then a distance to where the reference point should be located. See fig. below. The program uses the direction of the line sloping from the previous break point in the cross section.

Note! dELE runs with the slope of the roadway.



For highways the distance can have to be entered with a negative sign for the road embankment closest the centre line if this lies in the middle of the two roadhalves.

This reference point must be located a bit inside the roadway if you wish to have a correct height, depending on that the program otherwise will use the embankment slope.

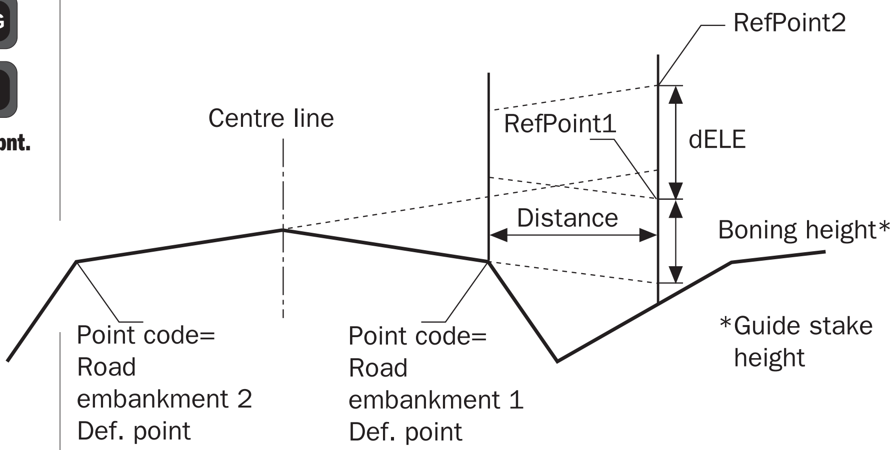
Setting out two reference heights on the same rod.

The program also gives you the opportunity of setting out two reference points on the same rod. Default is that reference point 1 indicates one road embankment and that reference point 2 indicates the other. See fig. on next side.

PRG

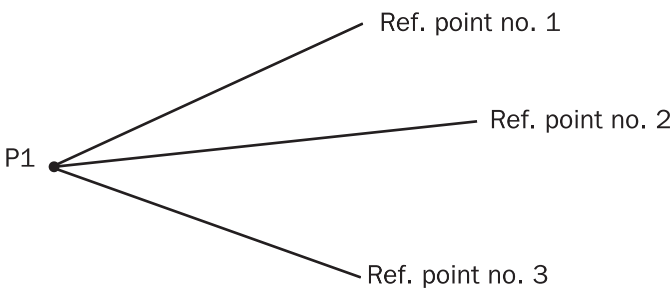
39

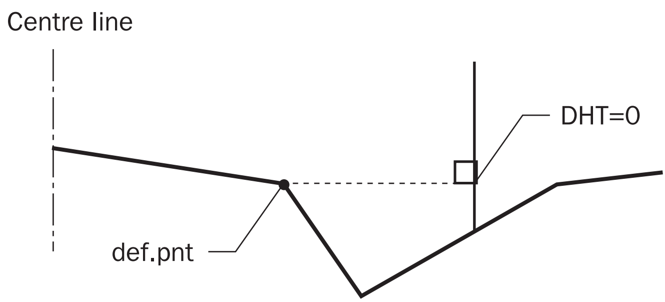
Ref. pnt.



Measuring

When measuring the operator enters the section (station) and centre line offset for the def. point. Then you measure a optional number of reference points, see fig. below.





PRG

39

Ref. pnt. Setout

Reference Point - Setout

PRG 3 9

ENT

Select program 39 and press ENT until this display appears.

```
Roadl. 3D 10:17
4 Measure
5 Slope stake
6 Ref.Point
```

Select 6 Ref.Point and press ENT.

6 ENT

```
      P39 10:17

Job no=_
```

Key in the Job file in which you wish to store data for the reference points and press ENT.

ENT

```
      P39 10:17
1 Xmem OFF
2 Imem OFF
3 Serial OFF
```

Select in which memory unit you wish to store data and press ENT. In this case we select 2 Imem.

2 ENT

```
      P39 10:17

Stn=_
```

Is this the station you chose when you ran program 20, prior to P39? If no station establishment has been made, P39 will automatically start P20.
It is impossible to start with setting out before you have established your instrument. In this example we accept the station and press ENT.

ENT

See next page

PRG

39

Ref. pnt. Setout

From previous page

```
      P39 10:17

Area=_
```

Key in the name of the area file in which the roadline data is stored and press ENT.

ENT

```
Sel. dev.  10:17
1 Xmem
2 Imem
```

Select in what type of device the roadline data is stored. In this case we choose 2 Imem.

2

```
      P39 10:17

SH=_
```

Enter the signal height and press ENT.

ENT

```
      P39 10:17

Pcode=
```

Key in the point code for the definition point that has the correct centre line offset and press ENT, or leave the line blank to enter the Centre line offset manually.

ENT

See next page

PRG

39

Ref. pnt. Setout

From previous page

```
      P39 10:17

Roadline check
Please wait
```

The program checks your chosen roadline. Please wait.

```
      P39 10:17

SecInc=
```

ENT

Select which section interval you shall have in this roadline and press ENT. If you chose this interval when you stored the roadline, the program selects that value.

Note Setout

```
      P39 10:17
1 Setout
2 Measure
3 Exit
```

1

Select 1 to set out reference points, 2 to measure reference points or 3 to end program. In this case we select 1 Setout.

```
      P39 10:17

HT.Ofs=
```

ENT

Key in a boning (guide stake) height if you wish to move up the setout point on the rod and press ENT.

See next page

PRG

39

Ref. pnt. Setout

From previous page

```
      P39 10:17

 Dual elevations?
```

Press ENT if you wish to set out two elevations on the same rod. In this case we press NO to set out only one point.

NO

```
      P39 10:17

Sect.=_
```

Do you know which section (station) is closest to the point you are about to set out you can key in this and press ENT. Otherwise you leave the line blank and press ENT and let the program calculate the closest section (station) to your position.

ENT

```
STD   P39 10:17
HA:
VA:
```

Aim at the prism and press the A/M-key to start the measurement.

A/M

```
STD   P39 10:17
HA:
VA:
SD:
```

Press REG to store the measurement.

REG

See next page

PRG

39

Ref. pnt. Setout

From previous page

```
STD   P39 10:17

Sect.=
OK?
```

The program suggests a section (station) on the roadline. Accept this section (station) with ENT or press NO to look for another section (station).

ENT

```
      P39 10:17

Sect.=
```

Select an even section (station) or accept the suggested section (station). In this case we accept the suggested section (station) with ENT.

ENT

```
      P39 10:17

Cl.Ofs=
```

If you have keyed in the point code for the definition point the program suggests a centre line offset. Otherwise you will have to key in the correct centre line offset. Press ENT or key in a new value.

ENT

```
Ok?   P39 10:17
Sect.=
Cl.ofs=
Pcode=
```

Is the definition point data OK? If so, press ENT, otherwise press NO. In this case we press ENT.

ENT

See next page

PRG

39

Ref. pnt. Setout

From previous page

```
        P39 10:17

 Pno=
```

Key in a number for the reference point you are going to set out.

ENT

```
        P39 10:17

Dist.=
```

Key in the distance that is valid between the definition point and the point you are going to set out and press ENT.

ENT

```
TRK   P39 10:17
HA:
dHA:
```

The program automatically adopts TRK-mode. Aim to the prism to start the measurement.

```
TRK   P39 10:17
dHA:
dHD:
dHT:
```

As soon as the prism comes within the measurement beam you will see dHD,i.e. how much you must change the horizontal distance from the instrument.
+=increase
-=decrease
When you think that you are close enough to zero, press REG to register the point or press ENT if you wish to set out with the radial/ right angle offset method.

REG

See next page

PRG

39

Ref. pnt. Setout of 2 pnt.

From previous page

```
      P39 10:17

more?
```

Do you wish to set out more reference points for this section press ENT and you are able to key in a new point number and a new distance. In this case we press NO.

NO

```
      P39 10:17

New def.pnt?
```

Do you wish to set out new reference points for another section press ENT. That means that you are able to key in a new section (station) number. In this case we choose to exit with NO, in order to set out two reference points.

NO

```
      P39 10:17
1 Setout
2 Measure
3 Exit
```

Select 1 to set out reference points,2 to measure reference points or 3 to end program. In this case we select 1 Setout.

1

```
      P39 10:17

Ht.Ofs=
```

Key in a boning (guide stake) height if you wish to move up the setout point on the rod and press ENT.

ENT

See next page

PRG

39

Ref. pnt. Setout of 2 pnt.

From previous page

```
      P39 10:17

Dual elevations?
```

Press ENT if you wish to set out two elevations on the same rod. In this case we press ENT.

ENT

```
      P39 10:17

Sect.=
```

Do you know which section (station) is closest to the point you are about to set out you can key in this and press ENT. Otherwise you leave the line blank and press ENT and let the program calculate the closest section (station) to your position.

ENT

```
STD   P39 10:17
HA:
VA:
```

Aim at the prism and press the A/M-key to start the measurement.

ENT

```
STD   P39 10:17
HA:
VA:
SD:
```

Press REG to store the measurement.

ENT

See next page

PRG

39

Ref. pnt. Setout of 2 pnt.

From previous page

```
      P39 10:17

Sect.=
OK?
```

The program suggests the section (station) that lies closest to the measured point. Accept this section (station) with ENT or press NO to key in a new section (station).

ENT

```
      P39 10:17

Sect.=
```

Select an even section (station) or accept the suggested section (station). In this case we accept the suggested section (station) with ENT.

ENT

```
      P39 10:17

Cl.ofs=
```

If you have keyed in the point code for the definition point the program suggests a centre line offset. Otherwise you will have to key in the correct centre line offset. Press ENT or key in a new value.

ENT

```
Ok?   P39 10:17
Sect.=
Cl.ofs=
Pcode=
```

Is the definition point data OK? If so, press ENT, otherwise press NO. In this case we press ENT.

ENT

See next page

PRG

39

Ref. pnt. Setout of 2 pnt.

From previous page

```
        P39 10:17

 Pno=
```

ENT

Key in a number for the reference point you are going to set out.

```
      P39 10:17

Dist.=
```

ENT

Key in the distance that is valid between the definition point and the point you are going to set out and press ENT.

```
TRK   P39 10:17
HA:
dHA:
```

The program automatically adopts TRK-mode. Aim to the prism to start the measurement.

See next page

PRG

39

Ref. pnt. Setout of 2 pnt.

From previous page

```
TRK    P39 10:17
dHA:
dHD:
dHT:
```

As soon as the prism comes within the measurement beam you will see dHD,i.e. how much you must change the horizontal distance from the instrument.
+=increase
-=decrease
When you think that you are close enough to zero, press REG to register the point or press ENT if you wish to set out with the radial/ right angle offset method.

REG

```
       P39 10:17

Cl.ofs=-X.XX
```

The program suggests the centre line offset for the other road half which is valid for the second definition point. Press ENT.

ENT

```
Ok?    P39 10:17
Sect.=
Cl.ofs=
Pcode=
```

Is the definition point data OK? If so, press ENT, otherwise press NO. In this case we press ENT.

ENT

```
       P39 10:17

dELE=
```

Here is the difference in height between the first and the second reference point. Press ENT.

ENT

See next page

PRG

39

Ref. pnt. Setout of 2 pnt.

From previous page

```
        P39 10:17

New def.pnt?
```

Do you wish to set out more reference points for another section (station) press ENT and you are able to key in a new section (station) number. In this case we press NO.

NO

```
        P39 10:17
1 Setout
2 Measure
3 Exit
```

Select 1 to set out reference points, 2 to measure reference points or 3 to end program. In this case we select 3 Exit.

3

PRG

39

Ref. pnt. Measure

Reference Point - Measure

PRG 3 9

ENT

Select program 39 and press ENT until this display appears.

```
Roadl. 3D 10:17
4 Measure
5 Slope stake
6 Ref.Point
```

Select 6 Ref.Point and press ENT.

6 ENT

```
      P39 10:17

Job no=_
```

Key in the Job file in which you wish to store data for the reference points and press ENT.

ENT

```
      P39 10:17
1 Xmem OFF
2 Imem OFF
3 Serial OFF
```

Select in which memory unit you wish to store data and press ENT. In this case we select 2 Imem.

2 ENT

```
      P39 10:17

Stn=1
```

Is this the station you chose when you ran program 20, prior to P39? If no station establishment has been made, P39 will automatically start P20.
It is impossible to start with setting out before you have established your instrument. In this example we accept the station and press ENT.

ENT

See next page

PRG

39

Ref. pnt. Measure

From previous page

```
      P39 10:17

Area=_
```

Key in the name of the area file in which the roadline data is stored and press ENT.

ENT

```
Sel. dev. 10:17
1 Xmem
2 Imem
```

Select in what type of device the roadline data is stored. In this case we choose 2 Imem.

2

```
      P39 10:17

SH=_
```

Enter the signal height and press ENT.

ENT

```
      P39 10:17

Pcode=
```

Key in the point code for the def. point that has the correct centre line offset and press ENT, or leave the line blank to enter the Centre line offset manually.

ENT

See next page

PRG

39

Ref. pnt. Measure

From previous page

```
        P39 10:17

 Roadline check
 Please wait
```

The program checks your chosen roadline. Please wait.

ENT

```
        P39 10:17

Sec.Inc=
```

Select which section interval you shall have in this roadline and press ENT. If you choose this interval when you stored the roadline, the program selects that value.

ENT

Note Measure

```
        P39 10:17
1 Setout
2 Measure
3 Exit
```

Select 1 to set out reference points, 2 to measure reference points or 3 to end program. In this case we select 2 Measure.

2

```
        P39 10:17

Sect.=
```

Do you know which section (station) is closest to the point you are looking for you can key in this and press ENT. Otherwise you leave the line blank and press ENT and let the program calculate the section (station) closes to your position.

ENT

See next page

PRG

39

Ref. pnt. Measure

From previous page

```
STD   P39 10:17
HA:
VA:
```

Aim to the prism and press A/M to start the measurement.

A/M

```
STD   P39 10:17
HA:
VA:
SD:
```

When the distance has been measured, press REG to check the point you stand at.

REG

```
      P39 10:17

Sect.=
OK?
```

The program suggests a section (station) on the roadline. Accept this section (station) with ENT or press NO to look for another section (station).

ENT

```
      P39 10:17

Sect.=
```

Select an even section (station) or accept the suggested section (station). In this case we accept the suggested section (station) with ENT.

ENT

See next page

PRG

39

Ref. pnt. Measure

From previous page

```
      P39 10:17

Cl.ofs=
```

If you have keyed in the point code for the definition point the program suggests a centre line offset. Otherwise you will have to key in the correct centre line offset. Press ENT or key in a new value.

ENT

```
Ok?   P39 10:17
Sect.=
Cl.ofs=
Pcode=
```

Is the definition point data OK? If so, press ENT, otherwise press NO. In this case we press ENT.

ENT

```
      P39 10:17

Pno=
```

Key in a number for the reference point.

ENT

See next page

PRG

39

Ref. pnt. Measure

From previous page

```
STD   P39 10:17
HA:
VA:
```

Aim at the prism and press A/M to start the measurement.

A/M

```
STD   P39 10:17
HA:
VA:
SD:
```

When the prism has been found, press REG to register the measurement.

REG

```
Ok?   P39 10:17
HA:
HD:
dELE:
```

Here you can see the correct bearing for the measured point, the distance and the difference in height from the reference point. Press ENT to accept this or NO to ignore.

ENT

```
      P39 10:17

more?
```

Do you wish to measure more reference points for the current section press ENT and you are able to key in a new point number.
In this case we press NO.

NO

PRG

39

Ref. pnt. Measure

From previous page

```
      P39 10:17

New def.pnt?
```

Do you wish to measure reference points for another section press ENT. That means that you are able to key in a new section number. In this case we choose to exit with NO.

NO

```
      P39 10:17
1 Setout
2 Measure
3 Exit
```

Select 1 to set out reference points, 2 to measure reference points or 3 to end program. In this case we select 3 Exit.

3

PRG

39

Registered data

The list below shows which data will be stored after registration. See the configuration part if you wish to store other data.

Job file	Label
3 Setout	
Section	80
Centre line offs.	83
ELE	39
Layer	86
Layerheight	87
Ht.Ofs.	36
dN	40
dE	41
dELE	42
4 Measure	
Section	80
Centre line offs.	83
dELE	42
Pcode	4
Layer	86
Layerheight	87
N	37
E	38
ELE	39
5 Slopestake	
Section	80
Pcode	4
Ht.Ofs	36
Radofs	72
RT.ofs	73
dELE	42
N	37
E	38
ELE	39

Job file	Label
6 Reference pnt	
1 Setout, one ref. point	
Section	80
Centre line offs.	83
Pno	5
Ht.Ofs	36
Distance	89
dN	40
dE	41
dELE	42
1 Setout, two ref. points	
Same data as for one ref. point	
+	
Centre line offs.	83
dELE	42
2 Measure	
Section	80
Centre line offs.	83
E	39
Pno	5
HA	7
HD	11
dELE	42

PRG

27

Program 27 - Moving Coordinates Forward

Moving Coordinates Forward is a program for moving coordinates forward from a known station.

Please note that no calculations will be performed, but the program will store everything in the memory for later PC processing.

PRG

27

How to use

Program 27 - Moving Coordinates Forward

PRG 27 ENT

```
   P27 10:16

Job no =
```

Here you key in the number or name of the Job file in which you wish to store your traverse data. A list of data stored in the selected Job file can be seen on page 4.3.240. Select, for example, Job no = 2.

2 ENT

```
   P27 10:17
1. Xmem off
2. Imem off
3. Serial off
```

Where will you store your Job file? Choose a suitable memory unit by indicating 1, 2 or 3 for activation/ deactivation. Then press ENT. Here we have chosen to work with the internal memory.

2 ENT

```
   P27 10:17

Stn=
```

Key in your station number.

1101 ENT

```
   P27 10:17

Pcode =
```

Here you have the opportunity to choose a Pcode for the station point. If you don't wish to have any Pcode leave the line blank and press ENT.

ENT

```
   P27 10:17
1 Known station
2 Known station+
```

Here you select if you want to use "known station" with one reference object or "known station+" with more reference objects. In this example we'll chose "1 Known station". Press 1.

Note ! ☛ Known Station+ is described on page 4.3.12

1

PRG

27

How to use - Known stn

From previous page

```
   P27 10:17

Area =
```

Key in the name of the Area file in which you have stored your station point and your reference object.
If you leave the line blank you are able to enter the coordinates manually.

2 ENT

```
Sel device10:17
1 Xmem
2 Imem
```

In which memory unit is your Area file stored? In our example, we are using the internal memory (Imem).

2

If you left "Area=" blank you're taken here

Enter the coordinates manually

Note ! ☛ Enter the coordinates manually

```
Coord     10:17
N=xxxx
E=xxxx
ELE=xx
```

Enter your station coordinates. Leave the ELE blank for no height establishment.

ENT

```
Stn ok ?
N=xxxx
E=xxxx
ELE=xx
```

Are your coordinates correct? Press Yes (ENT) to accept them. If you press No you will return to the question about Stn= and Area=. If the coordinates have to be changed, use Edit or P43 (Enter Coordinates). In this example we will continue by accepting them.

See next page.

PRG

27

How to use

Note ! ☛ Only shown if your coordinates includes ELE.

From previous page.

ENT

HT measure ?

Are you going to measure heights? Accept this question by pressing ENT (Yes). If you decide not to measure heights (press No) it means that the instrument height (IH) and signal height (SH) will be ignored.
In this example, we will be measuring heights. Press ENT.

ENT

10:18
IH =

Enter your instrument height (IH). For example, 1.75.

Note ! ☛ Only shown if your coordinates includes ELE.

1.75 ENT

RefObj=

Key in the Pno of your reference object. For example, 1102.

1102 ENT

Area =

Key in the name of the Area file in which you have stored your reference object. If you leave the line blank you will have the opportunity to enter the coordinates manually in the same way as for the station coordinates.

ENT

Ref ok ?
N=xxxx
E=xxxx
ELE =xx

Are your coordinates correct? Press ENT to accept them. If you press No you return to the question Ref.Obj=. If they have to be changed, use Edit or P43 (Enter Coordinates). We will continue by accepting them.

See next page

PRG

27

How to use

From previous page

ENT

```
Aim at refobj
Press A/M
```

Aim at your reference object. Then press the A/M key.

A/M

```
STD   P27 10:18
HAref:xx.xxxx
HA:   xx.xxxx
REG=Exit
```

HAref is the calculated bearing between the station point and the reference object.
If you wish to check the distance to the reference object, press ENT. Otherwise press REG to store the station establishment and exit.

ENT

```
STD   P27 10:18
SHD: xxx.xxx
HD :
REG=Exit
```

If the reference object is marked with a reflector, you can also check the horizontal distance by pressing the A/M key. Otherwise press REG to store the station establishment and exit.

A/M

```
STD   P27 10:19
SHD: xxx.xxx
HD : xxx.xxx
REG=Exit
```

Here you can compare the calculated distance with the actual measured distance. Press REG to store station establishment in the Job file you have chosen (see page 4.3.229).
Note ! The REG key must always be used if you want to store the station establishment. Press REG to continue with Program 27.

Note ! ☛ *Press REG*

REG

PRG

27

Foresight measure-ment

Foresight measurement

From previous page

```
   P27 10:19
1 Foresight
2 Refobj.
3 Other
```

Choose 1 Foresight.
See page 4.3.235 for Other. Choose option 2 Refobj. if you wish to measure more angles. (Not first shot!)

1

```
   P27 10:19

Pno=
```

Key in the foresight point number.

2 ENT

```
   P27 10:19

Pcode=
```

Here you have the opportunity to choose a Pcode for the foresight point. If you don't wish to have any Pcode leave the line blank and press ENT.

ENT

```
   P27 10:19

SH=
```

Enter the signal height.

ENT

See next page.

PRG

27

Foresight measurement

From previous page.

```
STD       10:21
HA:xxx.xxx
VA:xxx.xxx
```

The instrument is now in theodolite position and is ready to measure. Aim at the chosen target. Press the A/M key to measure the distance.

Note !
It is possible to measure in all modes (STD, FSTD, TRK, D-bar) and in both faces.

A/M

```
STD       10:21
HA:xxx.xxx
VA:xxx.xxx
SD:xxx.xx
```

The instrument displays HA, VA and SD for your first point. Your measurement can now be registered. Press the REG key.

See page 4.3.241 for a list of what is stored in the memory.

REG

```
  P27 10:21

more ?
```

Do you wish to measure more points press YES. Press NO to exit the program. Answer NO to the question "End" if you're not finished.

NO

```
  P27 10:21

End ?
```

See page 4.3.238

YES

```
  P27 10:21
1 Foresight
2 Refobj.
3 Other
```

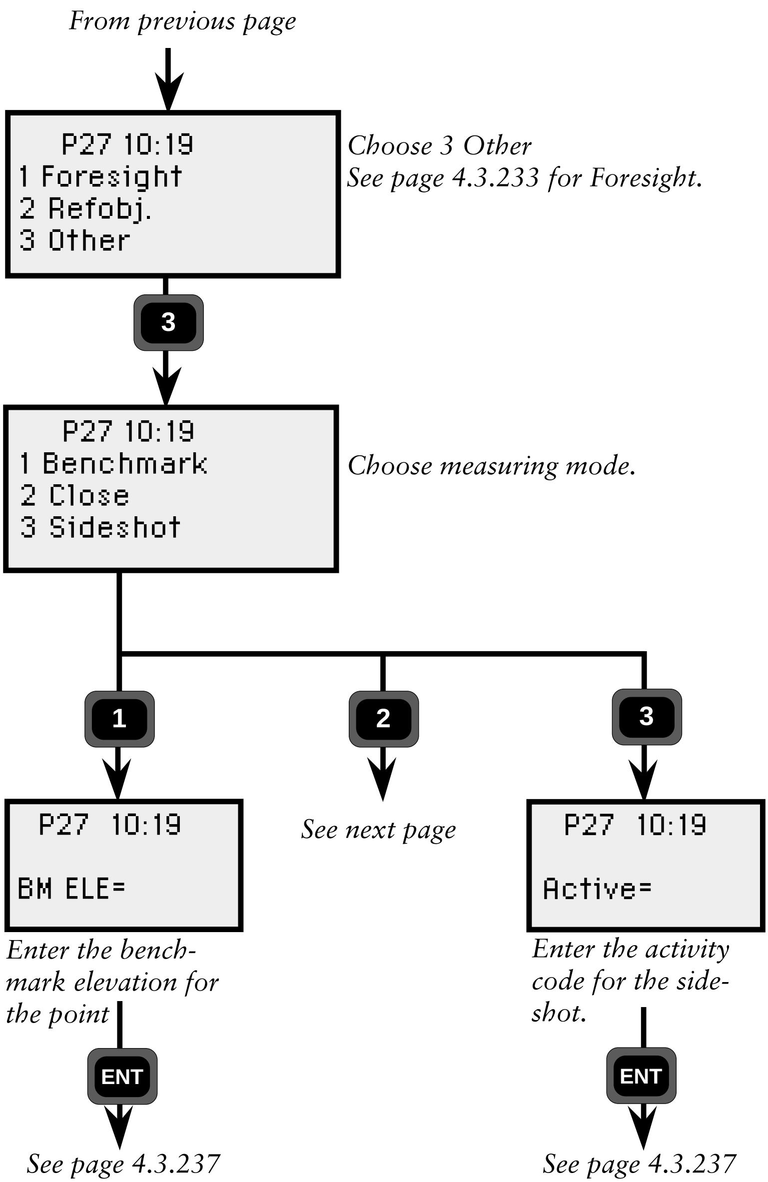
See next page

PRG

27

Other measure-ment

Other measurement

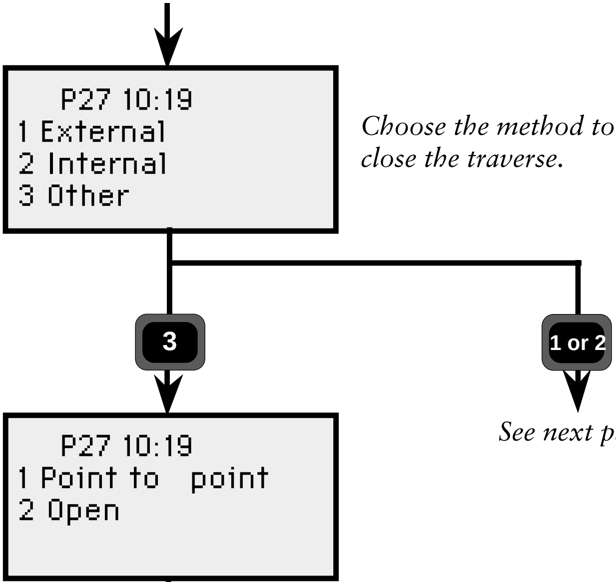


Note ! ☛ The available menu choices below does not perform any calculations, but will only store information in memory for later computer processing.

PRG

27

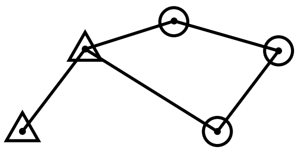
From previous page



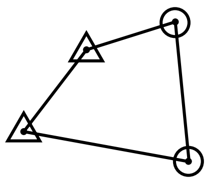
Choose the method to close the traverse.

See next page

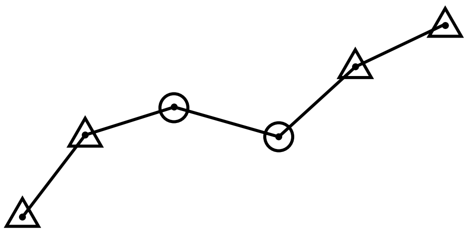
See next page



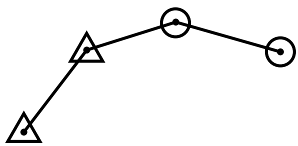
Close External (CE)



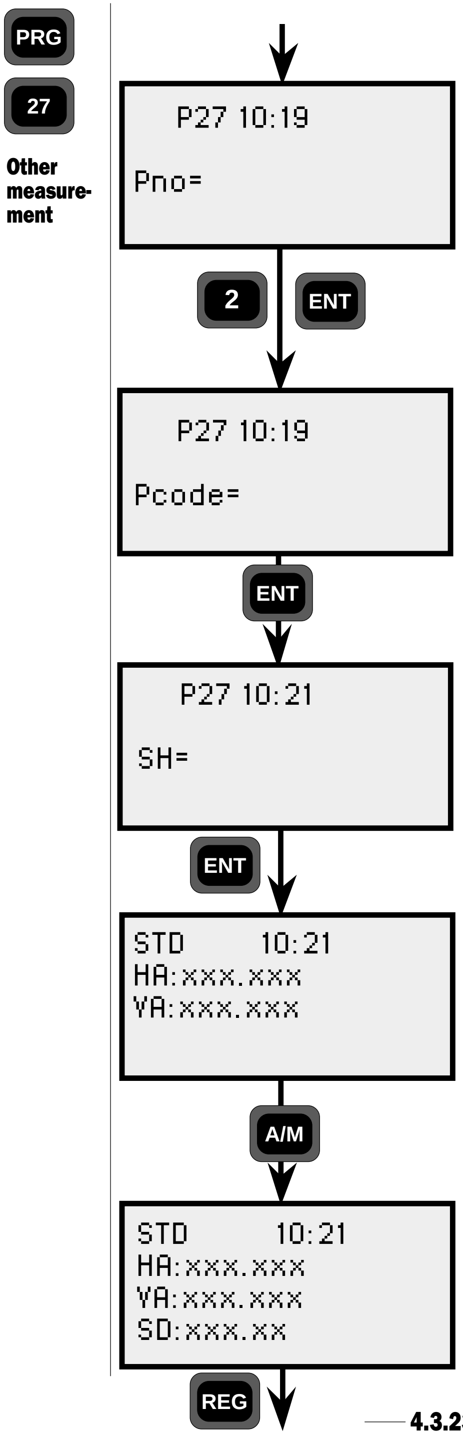
Close Internal (CI)



Point to point (P)



Open (O)



Enter the point number.

Here you have the opportunity to choose a Pcode for the point. If you don't wish to have any Pcode leave the line blank and press ENT.

Enter the signal height.

The instrument is now in theodolite position and is ready to measure. Aim at the chosen target. Press the A/M key to measure the distance.
Note !
It is possible to measure in all modes (STD, FSTD, TRK, D-bar) and in both faces.

The instrument displays HA, VA and SD for your first point. Your measurement can now be registered. Press the REG key.
See page 4.3.242 for a list of what is stored in the memory

PRG

27

Other measurement

```
P27 10:21

more ?
```

Do you wish to measure more points press YES. Press NO to exit the program. Answer NO to the question "End" if you're not finished.

NO

YES

```
P27 10:21

End ?
```

Note ! This question will not appear if you have chosen to close.

```
P27 10:21
1 Foresight
2 Refobj.
3 Other
```

If you wish to re-measure a foresight point press 1. You will then get an info message "Info 55" and a question "New foresight". Press 3 to measure other points.

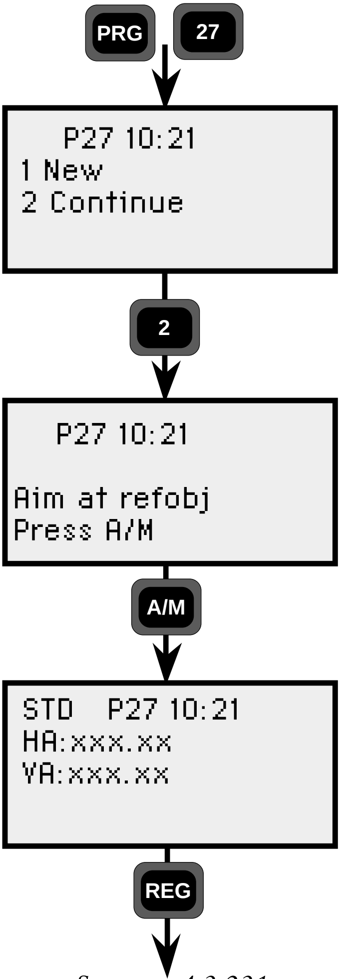
NO

```
P0  10:21

Temp=20.0_
```

The instrument returns to program 0. See next page for instructions of how to start the program on the next station.

See next page

Next station



Start program 27

Choose 1 if you wish to start a new or choose 2 if you wish to continue with the old.

Aim at your reference object and press A/M.

Press A/M and REG if distance is to be measured, otherwise press only REG.

See page 4.3.231

PRG

27

Registered data

Job file		Comments
First Station using one reference object		
Text	**Label**	**Description**
Activity OS	61	Station data
Pno (STN)	5	
Pcode	4	Stored if entered
IH	3	Stored if heights are included
Coordinates	37,38,39	39 if heights are included
Activity RO	61	Reference object data
Pno (Ref.Obj)	5	
Coordinates	37,38,39	39 if heights are included
HA_ref	21	(Set HA)
Raw data	7,8,(9)	Stored if distance is measured
First Station using more than one reference object		
Text	**Label**	**Description**
Stn	2	Point number for station
Coordinates	37,38,39	39 if heights are included
Pno (STN)	5	First point
SH	(6)	
Coordinates	37,38,39	39 if heights are included
Raw data	7,8,(9)	Polar data
Pno		Like first point
.		
Info, Weighting	0	
Info, Diff HA	0	
Info, Point list	0	
Pno	5	First point
(dHD)	(76)	Deviation from true HD
dHA	45	
Pno		Like first point
.		
Activity OS	61	Occupied Station
Pno (STN)	5	
Pcode	4	
IH	3	
Coordinates	37,38,39	
Activity RO	61	Reference Object
Pno Blank	5	no number
Coordinates, 0.000	37,38,(39)	Values = 0.000
HA_ref	21	Instrument direction when exiting Station Establishment
Raw data	7,8,(9)	

PRG

27

Registered data

Job file		Comments
Next Station		
Text	**Label**	**Description**
Activity OS	61	Station data
Pno (STN)	5	
Pcode	4	Stored if entered
IH	3	Stored if heights are included
N (STN)	37	
E (STN)	38	
ELE (STN)	39	Stored if heights are included
Activity RO	61	Reference object data
Pno (Ref.Obj)	5	
Pcode	4	Stored if entered
SH	6	Stored if heights are included
N (RO)	37	
E (RO)	38	
ELE (RO)	39	Stored if heights are included
HA_ref	21	Stored if distance is not measured
HA	7	
VA	8	
SD	9	Stored if distance is measured
HAII	17	Stored if measured in two faces (STD, D-bar)
VAII	18	Stored if measured in two faces (D-bar)
HAI	24	-"-
VAI	25	
Foresight		
Text	**Label**	**Description**
Activity FS	61	Foresight data
Pno	5	
Pcode	4	Stored if entered
SH	6	Stored if heights are measured
N	37	
E	38	
ELE	39	Stored if heights are measured
HA	7	
VA	8	
SD	9	
HAII	17	Stored if measured in two faces (STD, D-bar)
VAII	18	Stored if measured in two faces (D-bar)
HAI	24	-"-
VAI	25	

PRG

27

Registered data

Job file		Comments
Benchmark, Sideshot, Close		
Text	**Label**	**Description**
Activity *	61	
Pno	5	
Pcode	4	Stored if entered
SH	6	Stored if heights are measured
BM ELE	31	Store if BM ELE has been chosen
N	37	
E	38	
ELE	39	Stored if heights are measured
HA	7	
VA	8	
SD	9	
HAII	17	Stored if measured in two faces (STD, D-bar)
VAII	18	Stored if measured in two faces (D-bar)
HAI	24	-"-
VAI	25	* Activity codes: Sideshot = optional Benchmark = BM Close: External = CE Internal = CI Point to point = P Open = O
Refobj.		
Text	**Label**	**Description**
Activity RO	61	Reference object data
Pno	5	
Pcode	4	Stored if entered
SH	6	Stored if heights are measured
N	37	
E	38	
ELE	39	Stored if heights are measured
HA	7	
VA	8	
SD	9	Stored if distance is measured
HAII	17	Stored if measured in two faces (STD, D-bar)
VAII	18	
HAI	24	Stored if measured in two faces (D-bar)
VAI	25	-"-

PRG

61

Program 61 - COGO

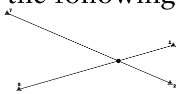
In general

PRG

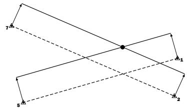
61

In general

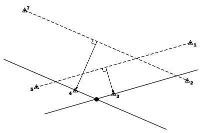
Program 61, COGO, is calculation program for solving coordinate calculations in field or in the office. It is divided into three main sections, Line intersections, Curve intersections and Miscellaneous. These sections then include a number of subsections depending on the current condition and the type of base information you have. The program also includes a general Configuration part which configures the program behaviour. **Please go through this part before you start**.
When you have calculated a point you can also set it out without leaving the program.To help you understand the different calculation programs, we have choosen to illustrate these by the following figures:



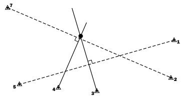
1.1 - Intersection between lines



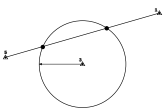
1.2 Offset intersection



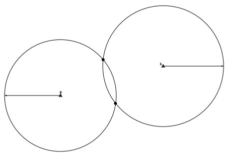
1.3 Offset through points



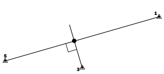
1.4 Right angle intersect.



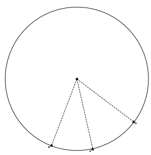
2.1 Points on a curve



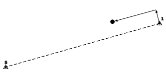
2.2 Curve intersection



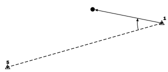
3.1 Perpendicular offset



3.2 Centre of a circle



3.3 Station and offset



3.4 Angle and distance

PRG

61

In general

Coordinate list

In the following examples we have chosen to use an example from real life. Here below you can find a list of the point coordinates:

Pno	N	E
1	88345.862	99136.879
2	88343.971	99153.527
3	88313.151	99157.173
4	88296.446	99155.277
5	88279.753	99153.375
6	88273.289	99145.428
7	88276.149	99120.184

Fetching point data from an Area file

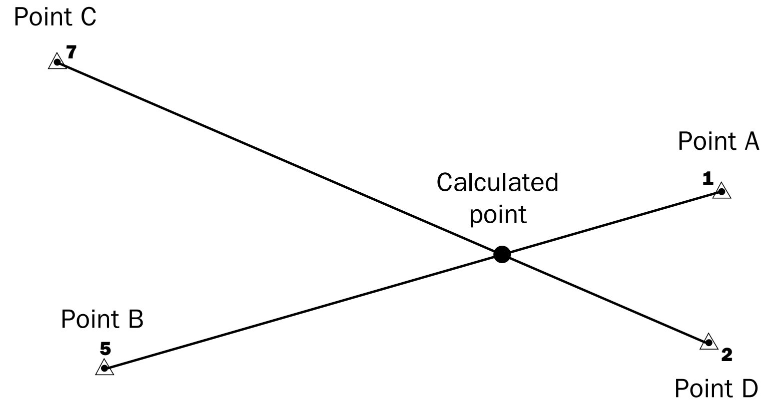
In the following examples you can use pre-stored point data. You will then be prompted to enter in which Area file these points are stored and in which memory device, Imem, Cardmem or Xmem. To speed up this process you can configure the program to use the first entered Area and memory for the following points.

To simplify the manual and also to use less paper, we have chosen not to show every display that concerns the Area and memory. Instead of these displays we will show the following text block. This means that you are able to key in the Area file you wish to fetch point coordinates from and also to enter in which memory device this file is stored:

```
Enter Area &
Select device
```

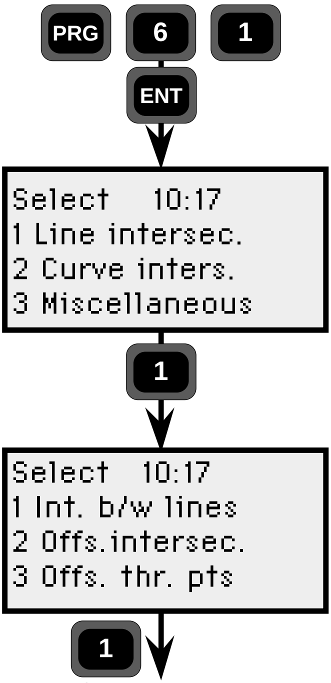
Line intersections

Line inter-sections



1.1 - Intersection between lines

This program calculates the intersection between the lines A-B and C-D.



Select program 61 and press ENT.

Select 1 (Line intersec.).

Select 1 (Int. b/w lines)

See next page

PRG

61

1.1-Intersection between lines

From previous page

```
 P61   10:17
Point A
Pno=_
```

Key in the point number for point A and press ENT.

1 ENT

```
 P61   10:17

Area=_
```

Key in the name of the Area file in which the points are stored and press ENT. If you wish to key in the coordinates manually, leave the line blank and press ENT.
In this case we have stored the points in Area no 1.

1 ENT

```
Sel.dev. 10:17
1 Imem
2 Xmem
```

Select in which memory unit you have stored the Area file and press ENT.

2 ENT

```
 P61    10:17
Ok?
N=88345.862
E=99136.879
```

Press ENT the accept the chosen point or NO to choose another point.

ENT

See next page

PRG

61

1.1-Intersection between lines

From previous page

```
 P61   10:17
Point B
Pno=_
```

Key in the point number for point B and press ENT.

5 ENT

```
Enter Area &
Select device
```

```
 P61   10:17
Ok?
N=88279.753
E=99153.375
```

Press ENT the accept the chosen point or NO to choose another point.

ENT

```
 P61   10:17
Point C
Pno=_
```

Key in the point number for point C and press ENT.

7 ENT

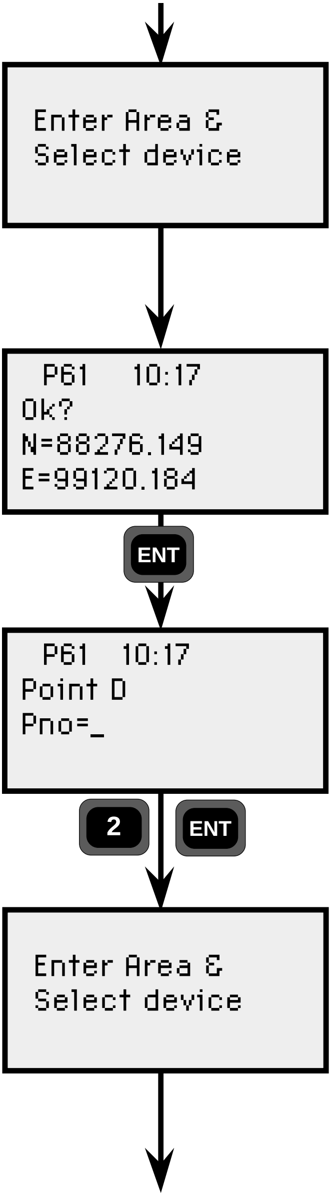
See next page

PRG

61

1.1-Intersection between lines

From previous page



Press ENT the accept the chosen point or NO to choose another point.

Key in the point number for point D and press ENT.

See next page

PRG

61

1.1-Inter-section between lines

From previous page

```
 P61   10:17
Ok?
N=88343.971
E=99153.527
```

Press ENT the accept the chosen point or NO to choose another point.

```
 P61   10:17
N=88322.145
E=99142.797
Store?
```

This is the calculated point coordinates. Press ENT to store the point or NO to cancel.

ENT

```
 P61   10:17

Pno=_
```

Key in a number for the calculated point and press ENT.

ENT

```
 P61   10:17

Area=_
```

Key in the name of the Areafile in which you wish to store the calculated point and press ENT.

ENT

See next page

PRG

61

1.1-Intersection between lines

From previous page

```
 P61   10:17
Pcode=
```

Here you have the opportunity to choose a Pcode for the calculated point. In this case we choose the call the point "TP".

ENT

```
 P61   10:17
Pcode=TP
ELE=?
```

Do you wish to add an elevation to the point before you store it? If so, press ENT, otherwise press NO.

ENT

```
 P61   10:17
Pcode=TP
ELE=12.125
```

Accept the keyed in elevation with ENT or press NO to reenter it.

ENT

```
 P61   10:17

Point stored
```

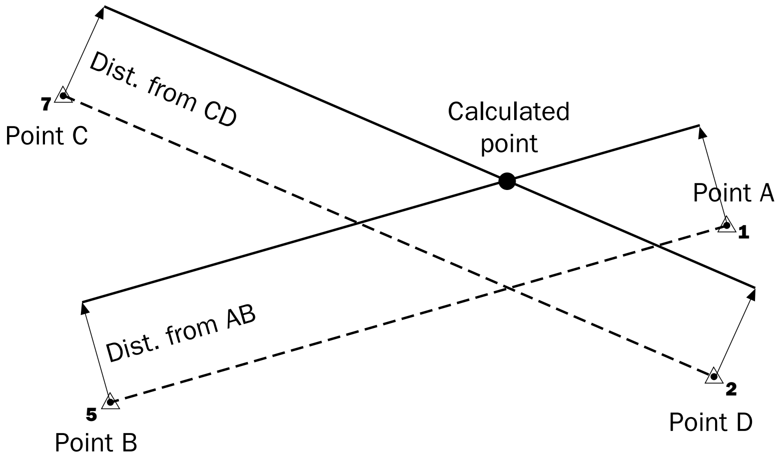
```
Select    10:17
1 Int. b/w lines
2 Offs.intersec.
3 Offs. thr. pts
```

Now you return to the Line intersection menu. If you wish to step to the main menu, press 6.

PRG

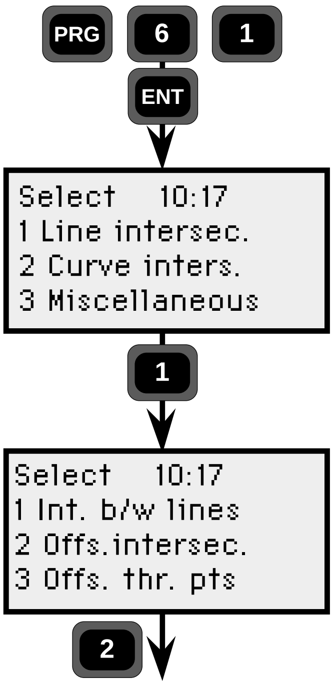
61

1.2-Offset inter- section



1.2 - Offset intersection

This program calculates the intersection between the lines A-B and C-D if they are dislocated with two offsets, Dist. from AB and Dist. from CD.



Select program 61 and press ENT.

Select 1 (Line intersec.).

Select 2 (Offs. intersec.)

See next page

PRG

61

1.2-Offset inter-section

From previous page

```
 P61   10:17
Point A
Pno=_
```

Key in the point number for point A and press ENT.

1 ENT

```
Enter Area &
Select device
```

```
 P61   10:17
Ok?
N=88345.862
E=99136.879
```

Press ENT the accept the chosen point or NO to choose another point.

ENT

```
 P61   10:17
Point B
Pno=_
```

Key in the point number for point B and press ENT.

5 ENT

See next page

PRG

61

1.2-Offset inter-section

From previous page

```
Enter Area &
Select device
```

```
 P61   10:17
Ok?
N=88279.753
E=99153.375
```

Press ENT the accept the chosen point or NO to choose another point.

ENT

```
 P61  10:17
Offs. intersec.
Dist. from AB
Dist.=
```

Key in the offset, Dist. from AB and press ENT. A positive value means that you are dislocating the line at the right from point A. In this example we have chosen the offset +1m.

1 ENT

```
 P61  10:17
Point C
Pno=_
```

Key in the point number for point C and press ENT.

7 ENT

See next page

PRG

61

1.2-Offset inter-section

From previous page

```
Enter Area &
Select device
```

```
 P61   10:17
Ok?
N=88276.149
E=99120.184
```

Press ENT to accept the chosen point or NO to choose another point.

ENT

```
 P61   10:17
Point D
Pno=_
```

Key in the point number for point D and press ENT.

2 ENT

```
Enter Area &
Select device
```

See next page

PRG

61

1.2-Offset inter-section

From previous page

```
 P61  10:17
Ok?
N=88343.971
E=99153.527
```

Press ENT to accept the chosen point or NO to choose another point.

ENT

```
 P61  10:17
Offs. intersec.
Dist. from CD
Dist.=
```

Key in the offset, Dist. from CD and press ENT. A positive value means that you are dislocating the line at the right from point C. In this example we have chosen the offset -1m.

- 1 ENT

```
 P61  10:17
N=88322.258
E=99141.738
Store?
```

This is the calculated point coordinates. Press ENT to store the point or NO to cancel.

ENT

```
 P61  10:17

Pno=_
```

Key in a number for the calculated point and press ENT.

ENT

See next page

PRG

61

1.2-Offset inter-section

From previous page

```
 P61  10:17

Area=_
```

Key in the name of the Areafile in which you wish to store the calculated point and press ENT.

ENT

```
 P61  10:17
Pcode=
```

Here you have the opportunity to choose a Pcode for the calculated point. In this case we choose the call the point "TP".

ENT

```
 P61  10:17
Pcode=TP
ELE=?
```

Do you wish to add an elevation to the point before you store it? If so, press ENT, otherwise press NO.

ENT

```
 P61  10:17
Pcode=TP
ELE=12.125
```

Accept the keyed in elevation with ENT or press NO to reenter it.

ENT

See next page

PRG

61

1.2-Offset inter-section

From previous page

```
  P61   10:17

Point stored
```

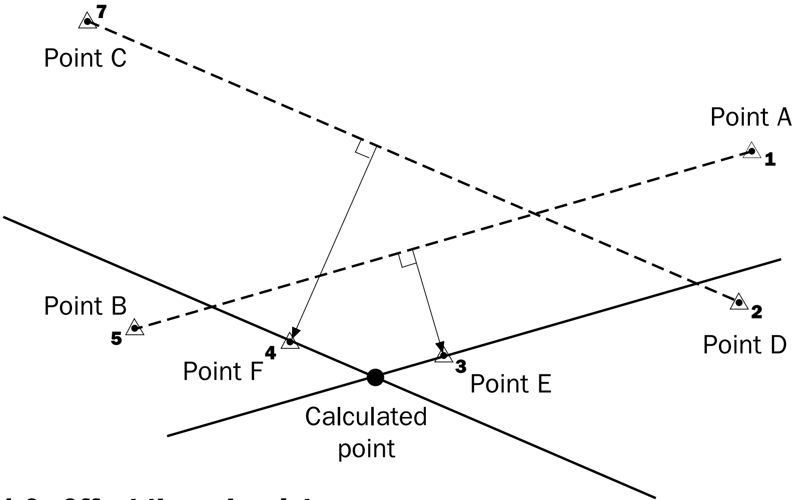
```
Select    10:17
1 Int. b/w lines
2 Offs.intersec.
3 Offs. thr. pts
```

Now you return to the Line intersection menu. If you wish to step to the main menu, press 6.

PRG

61

1.3-Offset through points



1.3 - Offset through points

This program calculates the intersection between the lines A-B and C-D if they are dislocated to the points E resp. F.

PRG 6 1 ENT

Select program 61 and press ENT.

```
Select  10:17
1 Line intersec.
2 Curve inters.
3 Miscellaneous
```

Select 1 (Line intersec.).

1

```
Select   10:17
1 Int. b/w lines
2 Offs.intersec.
3 Offs. thr. pts
```

Select 3 (Offs. thr. pts)

3

See next page

PRG

61

1.3-Offset through points

From previous page

```
 P61   10:17
Point A
Pno=_
```

Key in the point number for point A and press ENT.

1 ENT

```
Enter Area &
Select device
```

```
 P61   10:17
Ok?
N=88345.862
E=99136.879
```

Press ENT the accept the chosen point or NO to choose another point.

```
 P61   10:17
Point B
Pno=_
```

Key in the point number for point B and press ENT.

5 ENT

See next page

PRG

61

1.3-Offset through points

From previous page

Enter Area &
Select device

P61 10:17
Ok?
N=88279.753
E=99153.375

Press ENT the accept the chosen point or NO to choose another point.

ENT

P61 10:17
Point E
Pno=_

Key in the point number for point E and press ENT.

3 ENT

Enter Area &
Select device

See next page

PRG

61

1.3-Offset through points

From previous page

```
 P61  10:17
Ok?
N=88313.151
E=99157.173
```

Press ENT the accept the chosen point or NO to choose another point.

ENT

```
 P61  10:17
Point C
Pno=_
```

Key in the point number for point C and press ENT.

7 ENT

```
Enter Area &
Select device
```

```
 P61  10:17
Ok?
N=88276.149
E=99120.184
```

Press ENT the accept the chosen point or NO to choose another point.

ENT

See next page

PRG

61

1.3-Offset through points

From previous page

```
 P61   10:17
Point D
Pno=_
```

Key in the point number for point D and press ENT.

2 ENT

```
Enter Area &
Select device
```

```
 P61   10:17
Ok?
N=88343.971
E=99153.527
```

Press ENT the accept the chosen point or NO to choose another point.

ENT

```
 P61   10:17
Point F
Pno=_
```

Key in the point number for point F and press ENT.

4 ENT

See next page

PRG

61

1.3-Offset through points

From previous page

```
Enter Area &
Select device
```

```
 P61   10:17
Ok?
N=88296.446
E=99155.277
```

Press ENT the accept the chosen point or NO to choose another point.

ENT

```
 P61   10:17
N=88304.628
E=99159.299
Store?
```

This is the calculated point coordinates. Press ENT to store the point or NO to cancel.

ENT

```
 P61   10:17

Pno=_

```

Key in a number for the calculated point and press ENT.

ENT

See next page

PRG

61

1.3-Offset through points

From previous page

```
 P61  10:17

Area=_
```

Key in the name of the Areafile in which you wish to store the calculated point and press ENT.

ENT

```
 P61  10:17
Pcode=
```

Here you have the opportunity to choose a Pcode for the calculated point. In this case we choose the call the point "TP".

ENT

```
 P61  10:17
Pcode=TP
ELE=?
```

Do you wish to add an elevation to the point before you store it? If so, press ENT, otherwise press NO.

ENT

```
 P61  10:17
Pcode=TP
ELE=12.125
```

Accept the keyed in elevation with ENT or press NO to reenter it.

ENT

See next page

PRG

61

1.3-Offset through points

From previous page

```
  P61   10:17

Point stored
```

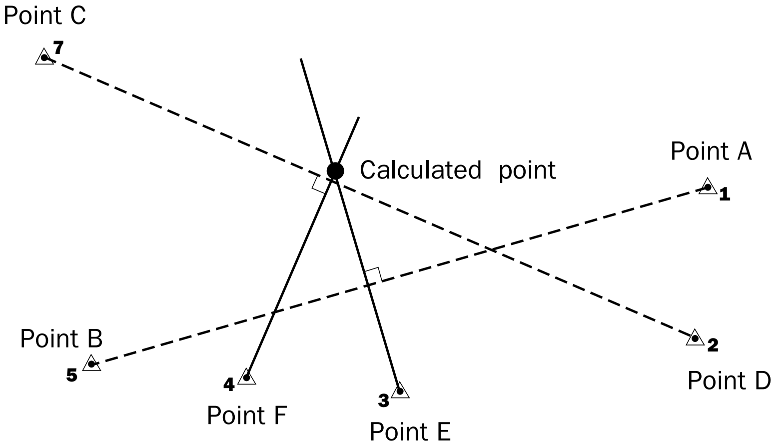
```
Select   10:17
1 Int. b/w lines
2 Offs.intersec.
3 Offs. thr. pts
```

Now you return to the Line intersection menu. If you wish to step to the main menu, press 6.

PRG

61

1.4-Right angle inter-section



1.4 - Right angle intersection

This program calculates the intersection between the line going through point E, perpendicular to the line A-B, and the line going through point F, perpendicular to the line C-D.

PRG 6 1 ENT

Select program 61 and press ENT.

```
Select  10:17
1 Line intersec.
2 Curve inters.
3 Miscellaneous
```

*Select 1 (Line intersec.) and press ENT.**

1 ENT

```
Select  10:17
4 Rt ang. int.
5 Config.
6 Main menu
```

*Select 4 (Rt ang. int.)**

4

** You can also press 1 and 4 directly.*

See next page

PRG

61

1.4-Right angle inter-section

From previous page

```
 P61   10:17
Point A
Pno=_
```

Key in the point number for point A and press ENT.

1 ENT

```
Enter Area &
Select device
```

```
 P61   10:17
Ok?
N=88345.862
E=99136.879
```

Press ENT the accept the chosen point or NO to choose another point.

ENT

```
 P61   10:17
Point B
Pno=_
```

Key in the point number for point B and press ENT.

5 ENT

See next page

PRG

61

1.4-Right angle inter-section

From previous page

```
Enter Area &
Select device
```

```
 P61   10:17
Ok?
N=88279.753
E=99153.375
```

Press ENT the accept the chosen point or NO to choose another point.

ENT

```
 P61   10:17
Point E
Pno=_
```

Key in the point number for point E and press ENT.

3 ENT

```
Enter Area &
Select device
```

See next page

PRG

61

1.4-Right angle inter-section

From previous page

```
 P61   10:17
Ok?
N=88313.151
E=99157.173
```

Press ENT the accept the chosen point or NO to choose another point.

ENT

```
 P61   10:17
Point C
Pno=_
```

Key in the point number for point C and press ENT.

7 ENT

```
 Enter Area &
 Select device
```

```
 P61   10:17
Ok?
N=88276.149
E=99120.184
```

Press ENT the accept the chosen point or NO to choose another point.

ENT

See next page

PRG

61

1.4-Right angle inter-section

From previous page

```
 P61   10:17
Point D
Pno=_
```

Key in the point number for point D and press ENT.

2 ENT

```
Enter Area &
Select device
```

```
 P61   10:17
Ok?
N=88343.971
E=99153.527
```

Press ENT the accept the chosen point or NO to choose another point.

ENT

```
 P61   10:17
Point F
Pno=_
```

Key in the point number for point F and press ENT.

4 ENT

See next page

PRG

61

1.4-Right angle inter-section

From previous page

```
Enter Area &
Select device
```

```
 P61   10:17
Ok?
N=88296.446
E=99155.277
```

Press ENT the accept the chosen point or NO to choose another point.

ENT

```
 P61   10:17
N=88307.213
E=99133.376
Store?
```

This is the calculated point coordinates. Press ENT to store the point or NO to cancel.

ENT

```
 P61   10:17

Pno=_
```

Key in a number for the calculated point and press ENT.

ENT

See next page

PRG

61

1.4-Right angle inter-section

From previous page

```
 P61   10:17

Area=_
```

ENT

Key in the name of the Areafile in which you wish to store the calculated point and press ENT.

```
 P61   10:17
Pcode=
```

ENT

Here you have the opportunity to choose a Pcode for the calculated point. In this case we choose the call the point "TP".

```
 P61   10:17
Pcode=TP
ELE=?
```

ENT

Do you wish to add an elevation to the point before you store it? If so, press ENT, otherwise press NO.

```
 P61   10:17
Pcode=TP
ELE=12.125
```

ENT

Accept the keyed in elevation with ENT or press NO to reenter it.

See next page

PRG

61

1.4-Right angle inter-section

From previous page

```
  P61   10:17

Point stored
```

```
Select   10:17
1 Int. b/w lines
2 Offs.intersec.
3 Offs. thr. pts
```

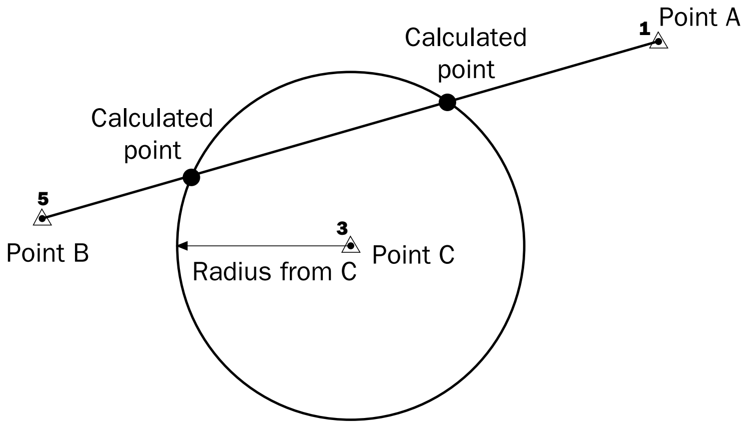
Now you return to the Line intersection menu. If you wish to step to the main menu, press 6.

Curve intersections

PRG

61

Curve inter-sections



2.1 - Points on a curve

This program calculates the intersection between the line A-B and the circle at the center of point C and with a radius of, "Radius from C".

PRG 6 1 ENT

Select program 61 and press ENT.

```
Select  10:17
1 Line intersec.
2 Curve inters.
3 Miscellaneous
```

Select 2 (Curve intersec.).

2

```
Select   10:17
1 Pts on a curve
2 Curve inters.
3 Config
```

Select 1 (Pts on a curve)

1

See next page

PRG

61

2.1-Points on a curve

From previous page

```
 P61  10:17
Point A
Pno=_
```

Key in the point number for point A and press ENT.

1 ENT

```
Enter Area &
Select device
```

```
 P61  10:17
Ok?
N=88345.862
E=99136.879
```

Press ENT the accept the chosen point or NO to choose another point.

ENT

```
 P61  10:17
Point B
Pno=_
```

Key in the point number for point B and press ENT.

5 ENT

See next page

PRG

61

2.1-Points on a curve

From previous page

```
Enter Area &
Select device
```

```
 P61   10:17
Ok?
N=88279.753
E=99153.375
```

Press ENT the accept the chosen point or NO to choose another point.

ENT

```
 P61   10:17
Point C
Pno=
```

Key in the point number for point C and press ENT.

3 ENT

```
Enter Area &
Select device
```

See next page

PRG

61

2.1-Points on a curve

From previous page

```
 P61   10:17
Ok?
N=88313.151
E=99157.173
```

Press ENT the accept the chosen point or NO to choose another point.

ENT

```
 P61   10:17
Radius from C
Radius=
```

Key in the radius from C, and press ENT. If the radius is to small, that is if the circle does not intersect with the line AB, you will get an error message. In this example we key in 25m.

2 5 ENT

```
 P61   10:17
N=88311.700
E=99140.412
Store?
```

This is the first calculated point coordinates. Press ENT to store the point or NO to cancel. In this example we choose only to store the second point.

NO

```
 P61   10:17
N=88288.901
E=99151.092
Store?
```

This is the second calculated point coordinates. Press ENT to store the point or NO to cancel. In this example we choose to store it with ENT.

ENT

See next page

PRG

61

2.1-Points on a curve

From previous page

```
P61   10:17

Pno=_
```

Key in a number for the calculated point and press ENT.

ENT

```
P61   10:17

Area=_
```

Key in the name of the Areafile in which you wish to store the calculated point and press ENT.

ENT

```
P61   10:17
Pcode=
```

Here you have the opportunity to choose a Pcode for the calculated point. In this case we choose the call the point "TP".

ENT

```
P61   10:17
Pcode=TP
ELE=?
```

Do you wish to add an elevation to the point before you store it? If so, press ENT, otherwise press NO.

ENT

See next page

PRG

61

2.1-Points on a curve

From previous page

```
 P61   10:17
Pcode=TP
ELE=12.125
```

Accept the keyed in elevation with ENT or press NO to reenter it.

ENT

```
 P61   10:17

Point stored
```

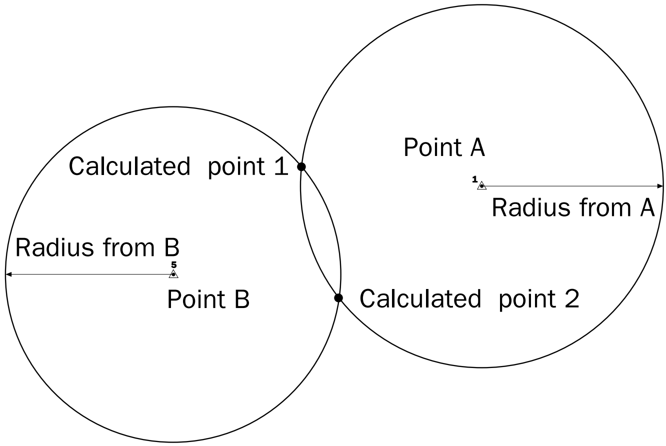
```
Select   10:17
1 Pts on a curve
2 Curve inters.
3 Config
```

Now you return to the Curve intersection menu. If you wish to step to the main menu, press 4.

PRG

61

2.2-Curve inter-section



2.2 - Curve intersection

This program calculates the intersection between the circle at the center of Point A and with a radius of "Radius from A", and the circle at the center of Point B and with a radius of "Radius from B".

PRG 6 1

ENT

Select program 61 and press ENT.

```
Select   10:17
1 Line intersec.
2 Curve inters.
3 Miscellaneous
```

Select 2 (Curve inters.)

2

```
Select   10:17
1 Pts on a curve
2 Curve inters.
3 Config
```

Select 2 (Curve inters.)

2

See next page

PRG

61

2.2-Curve inter-section

From previous page

```
 P61  10:17
Point A
Pno=_
```

Key in the point number for point A and press ENT.

1 ENT

```
Enter Area &
Select device
```

```
 P61  10:17
Ok?
N=88345.862
E=99136.879
```

Press ENT the accept the chosen point or NO to choose another point.

ENT

```
 P61  10:17
Point B
Pno=_
```

Key in the point number for point B and press ENT.

5 ENT

See next page

PRG

61

2.2-Curve inter-section

From previous page

```
Enter Area &
Select device
```

```
 P61   10:17
Ok?
N=88279.753
E=99153.375
```

Press ENT the accept the chosen point or NO to choose another point.

ENT

```
 P61   10:17
Curve inters.
Radius from A
Radius=
```

Key in the radius from A, and press ENT. In this example we key in 50m.

5 0 ENT

```
 P61   10:17
Curve inters.
Radius from B
Radius=
```

Key in the radius from B and press ENT. In this example we key in 20m.

2 0 ENT

See next page

PRG

61

2.2-Curve inter-section

From previous page

```
 P61   10:17
N=88296.111
E=99141.868
Store?
```

This is the first calculated point coordinates. Press ENT to store the point or NO to cancel. In this example we choose only to store the second point.

NO

```
 P61   10:17
N=88299.599
E=99155.847
Store?
```

This is the second calculated point coordinates. Press ENT to store the point or NO to cancel. In this example we choose to store it with ENT.

ENT

```
 P61   10:17

Pno=_
```

Key in a number for the calculated point and press ENT.

ENT

```
 P61   10:17

Area=_
```

Key in the name of the Areafile in which you wish to store the calculated point and press ENT.

ENT

See next page

PRG

61

2.2-Curve inter-section

From previous page

```
 P61   10:17
Pcode=
```

Here you have the opportunity to choose a Pcode for the calculated point. In this case we choose the call the point "TP".

ENT

```
 P61   10:17
Pcode=TP
ELE=?
```

Do you wish to add an elevation to the point before you store it? If so, press ENT, otherwise press NO.

ENT

```
 P61   10:17
Pcode=TP
ELE=12.125
```

Accept the keyed in elevation with ENT or press NO to reenter it.

ENT

```
 P61   10:17

Point stored
```

```
Select   10:17
1 Pts on a curve
2 Curve inters.
3 Config
```

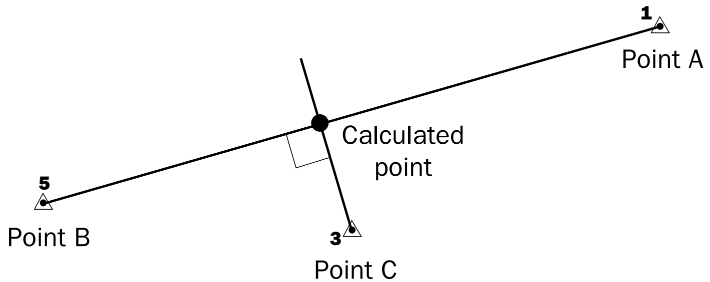
Now you return to the Curve intersection menu. If you wish to step to the main menu, press 4.

Miscellaneous

PRG

61

Miscel-laneous



3.1 - Perpendicular offset

This program calculates the intersection between the line A-B and the line perpendicular to line A-B going through point C.

PRG 6 1 ENT

Select program 61 and press ENT.

```
Select  10:17
1 Line intersec.
2 Curve inters.
3 Miscellaneous
```

Select 3 (Miscellaneous).

3

```
Select   10:17
1 Perpend.offset
2 Cent.of circle
3 Stn and offset
```

Select 1 (Perpend.offset)

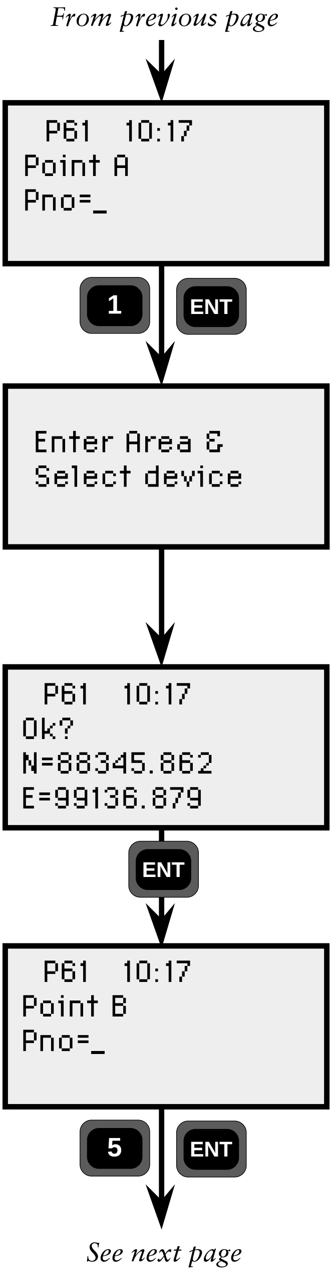
1

See next page

PRG

61

3.1-Perpendicular offset



Key in the point number for point A and press ENT.

Press ENT the accept the chosen point or NO to choose another point.

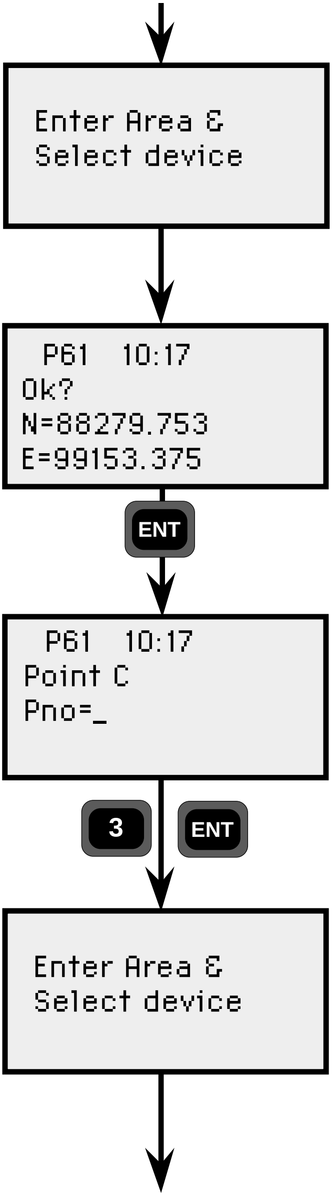
Key in the point number for point B and press ENT.

PRG

61

3.1-Perpendicular offset

From previous page



Press ENT the accept the chosen point or NO to choose another point.

Key in the point number for point C and press ENT.

See next page

PRG

61

3.1-Perpendicular offset

From previous page

```
 P61   10:17
Ok?
N=88313.151
E=99157.173
```

Press ENT the accept the chosen point or NO to choose another point.

ENT

```
 P61   10:17
N=88310.301
E=99145.752
Store?
```

This is the calculated point coordinates. Press ENT to store the point or NO to cancel.

ENT

```
 P61   10:17

Pno=_
```

Key in a number for the calculated point and press ENT.

ENT

```
 P61   10:17

Area=_
```

Key in the name of the Areafile in which you wish to store the calculated point and press ENT.

ENT

See next page

PRG

61

3.1-Perpendicular offset

From previous page

```
 P61   10:17
Pcode=
```

Here you have the opportunity to choose a Pcode for the calculated point. In this case we choose the call the point "TP".

ENT

```
 P61   10:17
Pcode=TP
ELE=?
```

Do you wish to add an elevation to the point before you store it? If so, press ENT, otherwise press NO.

ENT

```
 P61   10:17
Pcode=TP
ELE=12.125
```

Accept the keyed in elevation with ENT or press NO to reenter it.

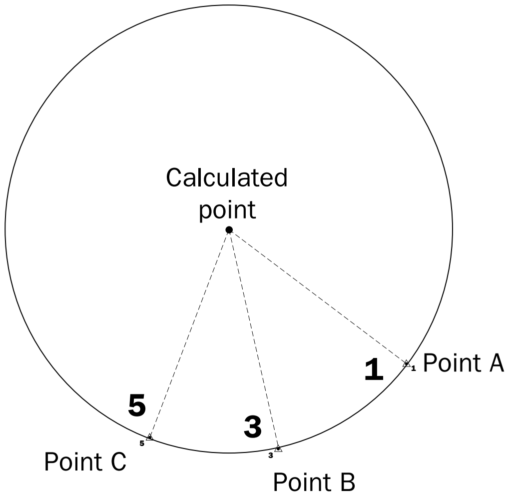
ENT

```
 P61   10:17

Point stored
```

```
Select   10:17
1 Perpend.offset
2 Cent.of circle
3 Stn and offset
```

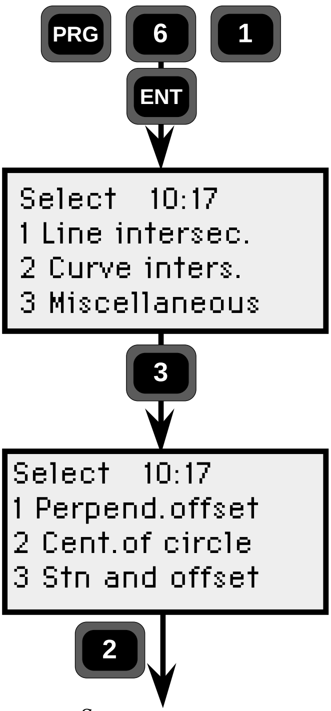
Now you return to the Miscellaneous menu. If you wish to step to the main menu, press 6.

3.2-Center of circle



3.2 - Center of circle

This program calculates the center of a circle going through the points A, B and C.



Select program 61 and press ENT.

Select 3 (Miscellaneous).

Select 2 (Cent.of circle)

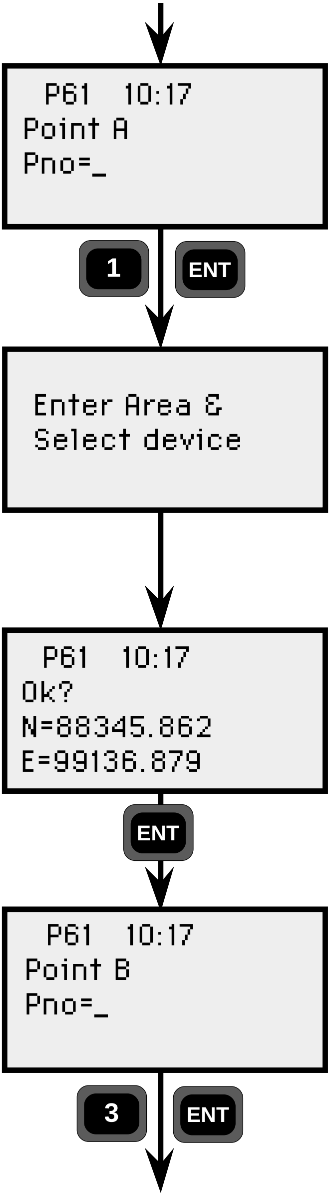
See next page

PRG

61

3.2-Center of circle

From previous page



Key in the point number for point A and press ENT.

Press ENT the accept the chosen point or NO to choose another point.

Key in the point number for point B and press ENT.

See next page

PRG

61

3.2-Center of circle

From previous page

```
Enter Area &
Select device
```

```
 P61   10:17
Ok?
N=88313.151
E=99157.173
```

Press ENT the accept the chosen point or NO to choose another point.

ENT

```
 P61   10:17
Point C
Pno=_
```

Key in the point number for point C and press ENT.

5 ENT

```
Enter Area &
Select device
```

See next page

PRG

61

3.2-Center of circle

From previous page

```
 P61   10:17
Ok?
N=88279.753
E=99153.375
```

Press ENT the accept the chosen point or NO to choose another point.

ENT

```
 P61   10:17
N=88302.364
E=99103.277
Store?
```

This is the calculated point coordinates. Press ENT to store the point or NO to cancel.

ENT

```
 P61   10:17

Pno=_
```

Key in a number for the calculated point and press ENT.

ENT

```
 P61   10:17

Area=_
```

Key in the name of the Areafile in which you wish to store the calculated point and press ENT.

ENT

See next page

PRG

61

3.2-Center of circle

From previous page

```
 P61   10:17
Pcode=
```

Here you have the opportunity to choose a Pcode for the calculated point. In this case we choose the call the point "TP".

ENT

```
 P61   10:17
Pcode=TP
ELE=?
```

Do you wish to add an elevation to the point before you store it? If so, press ENT, otherwise press NO.

ENT

```
 P61   10:17
Pcode=TP
ELE=12.125
```

Accept the keyed in elevation with ENT or press NO to reenter it.

ENT

```
 P61   10:17

Point stored
```

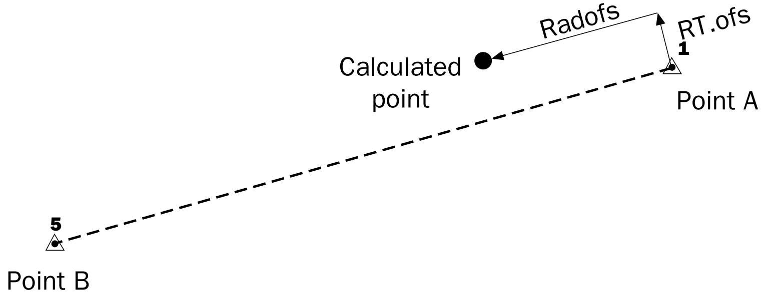
```
Select   10:17
1 Perpend.offset
2 Cent.of circle
3 Stn and offset
```

Now you return to the Miscellaneous menu. If you wish to step to the main menu, press 6.

PRG

61

3.3-Station and offset



3.3 - Station and offset

This program calculates a point which lies at an Right angle offset and a Radial offset from the line A-B.

PRG 6 1

ENT

Select program 61 and press ENT.

```
Select  10:17
1 Line intersec.
2 Curve inters.
3 Miscellaneous
```

Select 3 (Miscellaneous).

3

```
Select  10:17
1 Perpend.offset
2 Cent.of circle
3 Stn and offset
```

Select 3 (Stn and offset)

3

See next page

PRG

61

3.3-Station and offset

From previous page

```
P61   10:17
Point A
Pno=_
```

Key in the point number for point A and press ENT.

1 ENT

```
Enter Area &
Select device
```

```
P61   10:17
Ok?
N=88345.862
E=99136.879
```

Press ENT the accept the chosen point or NO to choose another point.

ENT

```
P61   10:17
Point B
Pno=_
```

Key in the point number for point B and press ENT.

5 ENT

See next page

PRG

61

3.3-Station and offset

From previous page

```
Enter Area &
Select device
```

```
 P61   10:17
Ok?
N=88279.753
E=99153.375
```

Press ENT the accept the chosen point or NO to choose another point.

ENT

```
 P61   10:17
Stn and offset
Radofs=_
```

Key in the radial offset from point A and press ENT. A positive value means that the offset is towards point B. In this example we have chosen the offset of +30m.

3 0 ENT

```
 P61   10:17
Stn and offset
Radofs=30
RT.ofs=_
```

Key in the right angle offset from point A and press ENT. A positive value means that the offset is at the right from point A. In this example we have chosen the offset of +10m.

1 0 ENT

See next page

PRG

61

3.3-Station and offset

From previous page

```
 P61  10:17
N=88310.301
E=99145.752
Store?
```

This is the calculated point coordinates. Press ENT to store the point or NO to cancel.

ENT

```
 P61  10:17

Pno=_
```

Key in a number for the calculated point and press ENT.

ENT

```
 P61  10:17

Area=_
```

Key in the name of the Areafile in which you wish to store the calculated point and press ENT.

ENT

```
 P61  10:17
Pcode=
```

Here you have the opportunity to choose a Pcode for the calculated point. In this case we choose the call the point "TP".

ENT

See next page

PRG

61

3.3-Station and offset

From previous page

```
 P61   10:17
Pcode=TP
ELE=?
```

Do you wish to add an elevation to the point before you store it? If so, press ENT, otherwise press NO.

ENT

```
 P61   10:17
Pcode=TP
ELE=12.125
```

Accept the keyed in elevation with ENT or press NO to reenter it.

ENT

```
 P61   10:17

 Point stored
```

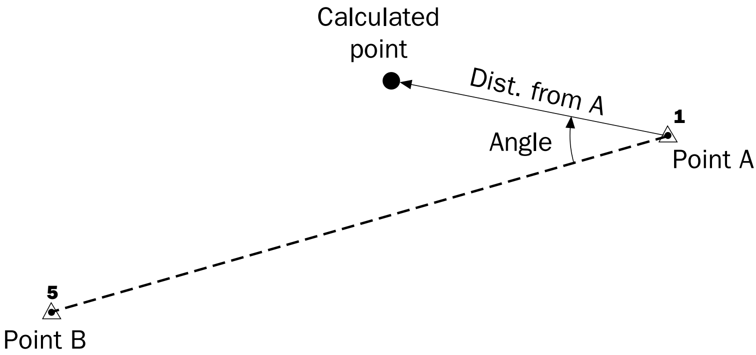
```
Select   10:17
1 Perpend.offset
2 Cent.of circle
3 Stn and offset
```

Now you return to the Miscellaneous menu. If you wish to step to the main menu, press 6.

PRG

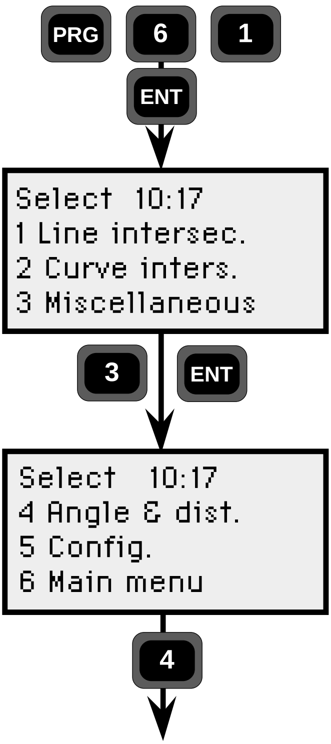
61

3.4-Angle and distance



3.4 - Angle and distance

This program calculates a point which lies at an certain angle and a certain offset from the line A-B.



Select program 61 and press ENT.

Select 3 (Miscellaneous) and press ENT.

Select 4 (Angle & dist.)

See next page

PRG

61

3.4-Angle and distance

From previous page

```
 P61   10:17
Point A
Pno=_
```

Key in the point number for point A and press ENT.

1 ENT

```
Enter Area &
Select device
```

```
 P61   10:17
Ok?
N=88345.862
E=99136.879
```

Press ENT the accept the chosen point or NO to choose another point.

ENT

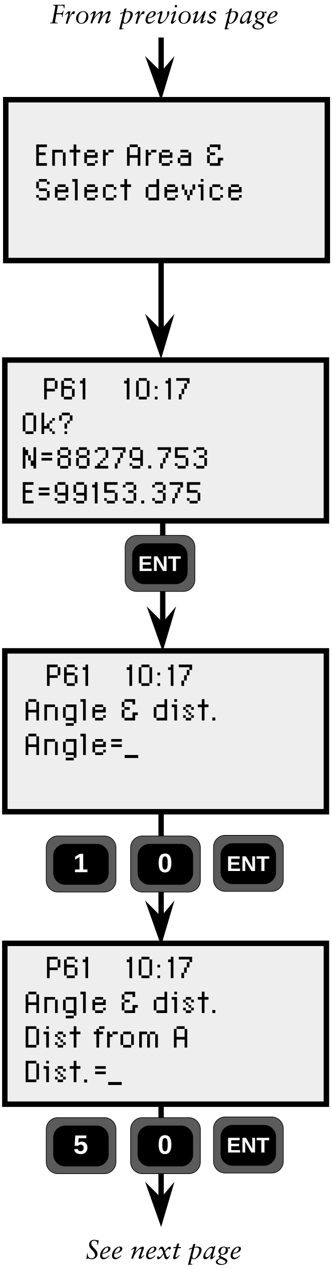
```
 P61   10:17
Point B
Pno=_
```

Key in the point number for point B and press ENT.

5 ENT

See next page

3.4-Angle and distance



Press ENT the accept the chosen point or NO to choose another point.

Key in the angle from point A and press ENT. A positive value means a clockwise angle. In this example we have chosen the angle of +10 gon.

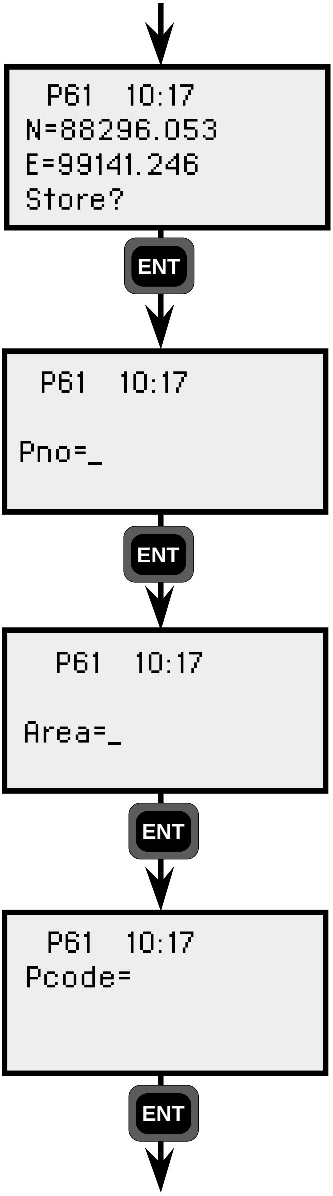
Key in the distance from point A and press ENT. A positive value means that the offset is towards point B. In this example we have chosen the offset of +50m.

PRG

61

3.4-Angle and distance

From previous page



This is the calculated point coordinates. Press ENT to store the point or NO to cancel.

Key in a number for the calculated point and press ENT.

Key in the name of the Areafile in which you wish to store the calculated point and press ENT.

Here you have the opportunity to choose a Pcode for the calculated point. In this case we choose the call the point "TP".

See next page

PRG

61

3.4-Angle and distance

From previous page

```
 P61   10:17
Pcode=TP
ELE=?
```

Do you wish to add an elevation to the point before you store it? If so, press ENT, otherwise press NO.

ENT

```
 P61   10:17
Pcode=TP
ELE=12.125
```

Accept the keyed in elevation with ENT or press NO to reenter it.

ENT

```
 P61   10:17

Point stored
```

```
Select   10:17
1 Perpend.offset
2 Cent.of circle
3 Stn and offset
```

Now you return to the Miscellaneous menu. If you wish to step to the main menu, press 6.

Configuration

PRG

61

Configu-ration

To speed up the program you can configure it so it fits your needs. The configuration part can be accessed from every section of the program, under menu option 5 from the line intersection menu, under menu option 3 from the curve intersection menu and under menu option 5 from the miscellaneous menu.
Here follows an explanation of the feature.

```
Config.  10:17
1 Area change?Yes
2 Store all?  No
3 Set out?    No
```

ENT

```
Config.  10:17
4 Confirm?   Yes
5 Keep AB?   No
```

Press the option number you wish to change.
Press NO to step from the second screen to the first again.

Area change
If this is enabled, you are prompted to key in a new area file for each point you enter. If this is disabled, you will only be prompted for the area for the first point.

Store all
If this is enabled, the program automatically stores all keyed in point coordinates.

Set out
If this is enabled, the program gives you the opportunity to turn to set out mode for each point that is calculated. Set out is similar to program 23.

Confirm
If this is enabled, you are prompted to confirm the coordinates for each point that has been fetched from the area file.

Keep AB (does not work in 2, Circle intersections or 3.2 Center of an circle)
If this is enabled, the program remembers the coordinates for the first line between A and B.

PRG

32

Program 32 - Angle Measurement Plus

With Angle Meas Plus you can measure multiple rounds of angles, with automatic calculation of "station mean values". The measured angles will be reduced to a final result where you can get a standard deviation for the sightings.
You can also configure your own limits for horizontal and vertical angle errors.

It is possible to choose between manual or automatic aiming towards the targets to measure. In the latter case you'll need a Remote Target (RMT) at every point to measure.

In automatic mode you can choose to get the slope distance also in C2.

Configuration

PRG

32

Configu-ration

To speed up the program you can configure it so it fits your needs. The configuration part can be accessed by a long press on the PRG-key. Then choose program 32, Angle Meas Plus and press ENT. Choose option 2, Config and then 2 Options.

```
  P32  10:17
Error limits HA
Point=0.0200
```

If you get a deviation larger than this value the program will show an error message. This error limit is only to make shure that you measure towards the correct target.

ENT

```
  P32  10:17
Error limits HA
Point=0.0200
Set=0.0020
```

One set= one measurement towards one point i both faces. If you get a difference between two sets that is larger than this value the program will show an error message.

ENT

```
  P32  10:17
Error limits VA
Point=0.0200
```

If you get a deviation larger than this value the program will show an error message. This error limit is only to make shure that you measure towards the correct target.

ENT

```
  P32  10:17
Error limits VA
Point=0.0200
Set=0.0020
```

One set= one measurement towards one point i both faces. If you get a difference between two sets that is larger than this value the program will show an error message.

ENT

See next page

PRG

32

Configu-ration

From previous page

```
  P32  10:17
Aim offset
Offset=0.0500
```

This tells how much the instrument will point aside the point to measure, in order to force the user to do the fine adjustment when using a servo driven instrument.

Finally choose Exit and then Exit again to quit or Run to start the program.

How to use

PRG

32

How to use

PRG 3 2

ENT

Select program 32 and press ENT.

```
Switches      10:17
1 Elevation? Yes
2 Pcode? Yes
3 Sightings>1 No
```

First you will step through a number of switches that you can configure. If you wish to change a switch, press the corresponding number and ENT, otherwise press only ENT.

ENT

```
Switches      10:17
4 Reg HD/VD?   No
5 Set-transit? Yes
6 Aim offset?  Yes
```

ENT

```
Switches 10:17
7 Adjust HA? Yes
8 Maxmin?   Yes
```

1. To get questions about IH and SH.
2. Set a point code for each point.
3. Enable this if you wish to do more than one adjustment towards each point in a set.
4. Store Horizontal and Vertical distances instead of SD. (Not possible if you want to measure a distance in CII, Automatic mode.)
5. Enable this if you want the instrument to automatically switch to face 1 between each set. If you wish to runt automatic mode this this must be enabled.
6. Enable this if you want the instrument to point beside each point so that you can do the fine adjustment yourself (only servo).
7. Enable this if you want a new horizontal angle for every set according to the formula 200 gon (180°)/no of series.
8. Enable this if you want to get the difference between the highest and lowest measured value. In other case you will get the standard deviation.

ENT

```
   P32  10:17

 No. of points=2
```

Enter the number of points (2-10) in the set and press ENT.

ENT

See next page

PRG

32

How to use

From previous page

```
   P32   10:17

No. of series=2
```

Key in the number of repeted measurements you wish to perform and press ENT.

ENT

```
Select P32 10:17
1 Automatic
2 Manual
```

Choose 1 Automatic and you'll only have to aim once at the target, then the program will automatically switch face and perform the number of remeasurements you set.
In this case we will choose 2 Manual.

See page 4.3.321 for 1 Automatic

1 → *See page 4.3.321*

2

```
   P32   10:17
1 Std
2 D_bar
```

Choose which mode you wish to measure in, STD or D-bar.

2

GDM 640, 650 and Bergstrand only

```
   P32   10:17
1 Normal
2 High res.
```

This display will only appear if you have a Geodimeter 640, 650 or Bergstrand. Read more about this in the Geodimeter System 600 User Manual.

1

See next page

PRG

32

How to use - Manual

From previous page

```
Stn     10:17
Stn=1000
```

Enter the station number and press ENT.

ENT

```
Stn     10:17
Stn=1000
Pcode=1
```

Enter a point code for the station and press ENT.

1 ENT

```
Stn     10:17
Stn=1000
Pcode=1
IH=X.XXX
```

Enter an instrument height and press enter.

ENT

```
Point 1  10:17
Point=2000
```

Key in a name for the first point and press ENT.

ENT

See next page

PRG

32

How to use - Manual

From previous page

```
Point 1  10:17
Point=2000

Incr?
```

Do you wish to increment the point number for each new point, press YES or ENT, otherwise press NO.

ENT

```
Point 1  10:17
Point=2000
Pcode=2
```

Here you have the opportunity to choose a Pcode for the first point. If you don't wish to have any Pcode leave the line blank and press ENT.

2 ENT

```
Point 1  10:17
Point=2000
Pcode=2
SH=X.XXX
```

Key in the signal height for the first point and press ENT.

ENT

```
Point 2  10:17
Point=2001
```

Key in a name for the second point and press ENT.

ENT

See next page

PRG

32

How to use - Manual

From previous page

```
Point 2  10:17
Point=2001
Pcode=3
```

Here you have the opportunity to choose a Pcode for the second point. If you don't wish to have any Pcode leave the line blank and press ENT.

3 ENT

```
Point 2  10:17
Point=2001
Pcode=3
SH=X.XXX
```

Key in the signal height for the second point and press ENT.

ENT

```
   P32  10:17

Job No=2
```

Choose in which Job file you wish to store your angle measurements and press ENT.

ENT

```
   P32  10:17
1:Imem on
2:Xmem off
3:Serial off
```

Here you select which memory device you wish to store the Job file in by choosing the appropriate number and pressing ENT.

ENT

See next page

PRG

32

How to use - Manual

From previous page

```
   P32  10:17
Aim to point
2000
Press ENT
```

Make a coarse aiming towards the first point and press ENT.

ENT

```
   P32  10:17
HA:  368.0832
HA ref: 0.0000
```

Key in a starting (first) reference angle and press ENT.
Note. This will only appear if you have answered YES to AdjustHA in the menu Switches.

ENT

```
D   0  10:17*
HA:   0.0021
VA:  102.2821
```

Do the fine adjustment towards the point and…
…press A/M to measure or REG to store without measuring.
In the second case you will be prompted the following:

```
No meas. made
REG OK?
```

Press YES or ENT to accept or NO to cancel.

A/M

C1, Point 2000

```
D   0  10:17*
HA:   0.0021
VA:  102.2821
SD:  244.903
```

This is the first sighting towards point 2000 in face 1. Press REG to store the measurement.

REG

See next page

PRG

32

How to use - Manual

From previous page

```
D    0   10:17x

Another sighting?
```

If you have enabled switch no 3 this display will appear. Press YES or ENT to make another sighting or NO to cancel.

NO

```
   P32  10:17
Aim to point
2001
Press ENT
```

Make a coarse aiming towards the second point and press ENT.

ENT

```
D    0   10:17x
HA:    6.8596
VA:  101.1072
```

Do the fine adjustment towards the point and…
…press A/M to measure or REG to store without measuring.
In the second case you will be prompted the following:

```
No meas. made
REG OK?
```

Press YES or ENT to accept or NO to cancel.

A/M

C1, Point 2001

```
D    0   10:17x
HA:    6.8596
VA:  101.1072
SD:  372.290
```

This is the first sighting towards point 2001 in face 1. Press REG to store the measurement.

REG

See next page

PRG

32

How to use - Manual

From previous page

```
D    0   10:17×

Another sighting?
```

If you have enabled switch no 3 this display will appear. Press YES or ENT to make another sighting or NO to cancel.

NO

Switch to face 2 (automatic if you have a servo instrument).

The following display appears if you have a mechanical instrument (disappears when you get within 1gon of the point):

```
  P32       10:17
Aim to point
2001
dHA:199  dVA:197
```

C2, Point 2001

or A/M

Aim towards the second point 2001 in face 2 and press the A/M key on the back of the instrument.

C2, Point 2000

or A/M

Aim towards the first point 2000 in face 2 and press the A/M key on the back of the instrument.

If switch no 5 is enabled the instrument will automatically switch to face no 1 (servo only).

```
D    0/1 10:17×
HA:  100.0021
VA:  102.2815
```

Press A/M to measure or REG to store without measuring.
In the second case you will be prompted the following:

```
No meas. made
REG OK?
```

Press YES or ENT to accept or NO to cancel.

A/M

See next page

PRG

32

How to use - Manual

From previous page

C1, Point 2000

```
D    0/1 10:17x
HA:  100.0021
VA:  102.2815
SD:  244.903
```

This is the second measurement towards point 2000 in face 1. Press REG to store the measurement.

REG

```
D    0/1 10:17x
HA:  106.8589
VA:  101.1072
```

Press A/M to measure or REG to store without measuring.
In the second case you will be prompted the following:

```
No meas. made
REG OK?
```

Press YES or ENT to accept or NO to cancel.

A/M

C1, Point 2001

```
D    0/1 10:17x
HA:  106.8589
VA:  101.1072
SD:  372.290
```

This is the second measurement towards point 2001 in face 1. Press REG to store the measurement.

REG

Switch to face 2 (automatic if you have a servo instrument).

The following display appears if you have a mechanical instrument (disappears when you get within 1gon of the point):

```
  P32    10:17
Aim to point
2001
dHA:199  dVA:197
```

C2, Point 2001

or A/M

Aim towards the second point 2001 in face 2 and press the A/M key on the back of the instrument.

See next page

PRG

32

How to use - Manual

C2, Point 2000

From previous page

or A/M

Aim towards the first point 2000 in face 2 and press the A/M key on the back of the instrument.

If switch no 5 is enabled the instrument will automatically switch to face no 1 (servo only).

```
Point 1  10:17
Diff HA:0.0011
Diff VA:0.0004
Diff SD:0.000
```

Here are the differences for the first point (if you have 3 or more points this will be presented as standard deviations). If you wish to view all the deviations press YES or ENT, otherwise press NO. When running the program you will get an error message as soon as the program discovers a difference larger than the limits you have set.

ENT

```
Point 2  10:17
Diff HA:0.0010
Diff VA:0.0004
Diff SD:0.000
```

Here are the differences for the second point. Press ENT to continue.

ENT

```
     P32  10:17

Sort JOB file?
```

Do you wish to sort the measured data pointwise in the chosen Job-file, press YES or ENT, otherwise press NO.

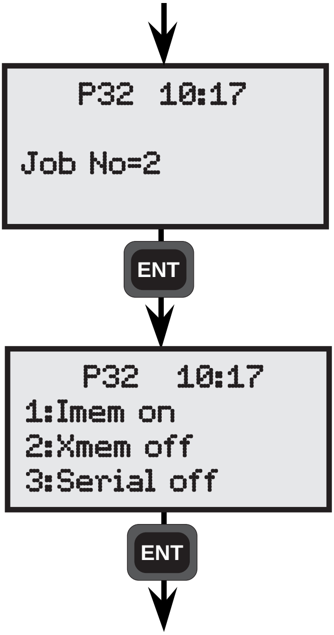
A final reduction will automatically be stored in the Job file.

ENT

See next page

How to use - Manual

From previous page



P0

Choose a Job file to store the sorted data in.

Here you select which memory device you wish to store the Job file in by choosing the appropriate number and pressing ENT.

PRG

32

How to use - Autom.

From page 4.3.311

Note - In this mode you'll need at least one Remote Target.

```
P32  10:17

No. of remeas.=2
```

Enter the number of remeasurements that will be carried out if the measured values lies outside the limits specified in the configuration part of the program (see page 4.3.308) or if the target is temporarily hidden.

ENT

```
P32  10:17

Dist. C2?
```

Do you wish to get the distance measured in C2? If so press YES or ENT.

ENT

PRG

32

How to use - Autom.

From previous page

```
Stn     10:17
Stn=1000
```

Enter the station number and press ENT.

ENT

```
Stn     10:17
Stn=1000
Pcode=1
```

Enter a point code for the station and press ENT.

1 ENT

```
Stn     10:17
Stn=1000
Pcode=1
IH=X.XXX
```

Enter an instrument height and press enter.

ENT

```
Point 1  10:17
Point=2000
```

Key in a name for the first point and press ENT.

ENT

See next page

PRG

32

How to use - Autom.

From previous page

```
Point 1  10:17
Point=2000

Incr?
```

Do you wish to increment the point number for each new point, press YES or ENT, otherwise press NO.

ENT

```
Point 1  10:17
Point=2000
Pcode=2
```

Here you have the opportunity to choose a Pcode for the first point. If you don't wish to have any Pcode leave the line blank and press ENT.

2 ENT

```
Point 1  10:17
Point=2000
Pcode=2
SH=X.XXX
```

Key in the signal height for the first point and press ENT.

ENT

```
Point 2  10:17
Point=2001
```

Key in a name for the second point and press ENT.

ENT

See next page

PRG

32

How to use - Autom.

From previous page

```
Point 2  10:17
Point=2001
Pcode=3
```

Here you have the opportunity to choose a Pcode for the second point. If you don't wish to have any Pcode leave the line blank and press ENT.

3 ENT

```
Point 2  10:17
Point=2001
Pcode=3
SH=X.XXX
```

Key in the signal height for the second point and press ENT.

ENT

```
   P32  10:17

Job No=2
```

Choose in which Job file you wish to store your angle measurements and press ENT.

ENT

```
   P32  10:17
1:Imem on
2:Xmem off
3:Serial off
```

Here you select which memory device you wish to store the Job file in by choosing the appropriate number and pressing ENT.

ENT

See next page

PRG

32

How to use - Autom.

From previous page

```
   P32  10:17
Aim to point
2000
Press ENT
```

Make a coarse aiming towards the first point and press ENT.

ENT

```
   P32  10:17
HA:  368.0832
HA ref: 0.0000
```

Key in a starting (first) reference angle and press ENT.
Note. This will only appear if you have answered YES to AdjustHA in the menu Switches.

ENT

```
  P32  10:17
Searching
Please wait
```

The instrument is searching for the target.

```
  P32  10:17

Measuring
```

When target is found the instrument starts the measurement.

See next page

PRG

32

How to use - Autom.

From previous page

```
   P32  10:17
Aim to point
2001
Press ENT
```

Make a coarse aiming towards the second point and press ENT.

ENT

```
  P32   10:17
Searching
Please wait
```

The instrument is searching for the target.

```
  P32   10:17

Measuring
```

When target is found the instrument starts the measurement.

See next page

PRG

32

How to use - Autom.

From previous page

```
Point 1  10:17
MaxMinHA:0.0006
MaxMinVA:0.0018
MaxMinSD:0.000
```

Here are the resulting differences for the first point. When running the program you will get an error message as soon as the program discovers a difference larger than the limits you have set.

ENT

```
Point 2  10:17
MaxMinHA:0.0011
MaxMinVA:0.0004
MaxMinSD:0.000
```

Here are the resulting differences for the second point. Press ENT to continue.

ENT

```
    P32  10:17

Remeasure?
```

Press YES or ENT to remeasure and the program will automatically remeasure all targets.

NO

See next page

PRG

32

How to use - Autom.

From previous page

```
    P32  10:17

Sort JOB file?
```

Do you wish to sort the measured data pointwise in the chosen Job-file, press YES or ENT, otherwise press NO.

```
   P32  10:17

Job No=2
```

Choose a Job file to store the sorted data in.

ENT

```
   P32  10:17
1:Imem on
2:Xmem off
3:Serial off
```

Here you select which memory device you wish to store the Job file in by choosing the appropriate number and pressing ENT.

ENT

P0

PRG

32

Registered data

Text	Label
Job No	50=32
Stn No	2=1000
Pcode	4=1
IH	3=1.573
Pno	5=2000
Pcode	4=2
SH	6=1.453
HA	7=0.0021
VA	8=102.2819
SD	9=244.9033
Pno	5=2001
Pcode	4=2
SH	6=1.526
HA	7=6.8596
VA	8=101.1070
SD	9=372.2901
Pno	5=2001
HAII	17=206.8614
VAII	18=298.8936
SD*	9=180.9999
Pno	5=2000
HAII	17=200.0037
VAII	18=297.7190
SD*	9=120.1256
Pno	5=2000
HA	7=100.0016
VA	8=102.2813
SD	9=244.9033
Pno	5=2001
HA	7=106.8588
VA	8=101.1071
SD	9=372.2900
Pno	5=2001
HAII	17=306.8603
VAII	18=298.8926
SD*	9=111.0009
Pno	5=2000
HAII	17=300.0037
VAII	18=297.7183
SD*	9=145.9997
Info	0=RESULT
Pno	5=2000
Pcode	4=2
SH	6=1.453
HA	7=0.0028
VA	8=102.2814
SD	9=244.9033
Info	0=S_devHA:0.0011
Info	0=S_devVA:0.0004
Info	0=S_devSD:0.0000
Pno	5=2001
Pcode	4=2
»»»»»»»»»	»»»»»»»»»

Text	Label
SH	6=1.526
HA	7=6.8600
VA	8=101.1069
SD	9=372.2900
Info	0=S_devHA:0.0010
Info	0=S_devVA:0.0004
Info	0=S_devSD:0.0000
Info	0=REDUCED
Pno	5=2000
Pcode	4=2
SH	6=1.453
HA	7=0.0000
VA	8=102.2814
Pno	5=2001
Pcode	4=2
SH	6=1.526
HA	7=6.8572
VA	8=101.1069
SD	9=372.2900
Info	0=SORTED
Pno	5=2000
Pcode	4=2
SH	6=1.453
HA	7=0.0021
VA	8=102.2819
SD	9=244.9033
HAII	17=200.0037
VAII	18=297.7190
SD*	9=201.8769
HA	7=100.0016
VA	8=102.2813
SD	9=244.9033
HAII	17=300.0037
VAII	18=297.7183
SD*	9=201.8876
Pno	5=2001
Pcode	4=2
SH	6=1.526
HA	7=6.8596
VA	8=101.1070
SD	9=372.2901
HAII	17=206.8614
VAII	18=298.8936
SD*	9=300.4655
HA	7=106.8588
VA	8=101.1071
SD	9=372.2900
HAII	17=306.8603
VAII	18=298.8926
SD*	9=344.8777

** only in Automatic mode if Distance C2 is chosen.*

In general

PRG

60

In general

Program 60, Athletics, is a program designed for athletics competitions. It can be used for measuring distances in various events such as javelin, discus and hammer.

Before you start the program you must enter the following label texts using program 41, Enter Labels:

Label	Text	Description
90	ROUND	enter the current round, e.g. javelin1
91	NO	the number of the entrant
92	LENGTH	the measured distance of the throw, only in meters
93	OFFSET	radial offset for current event, only in meters

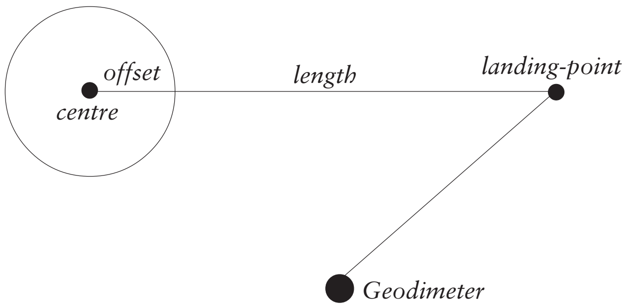
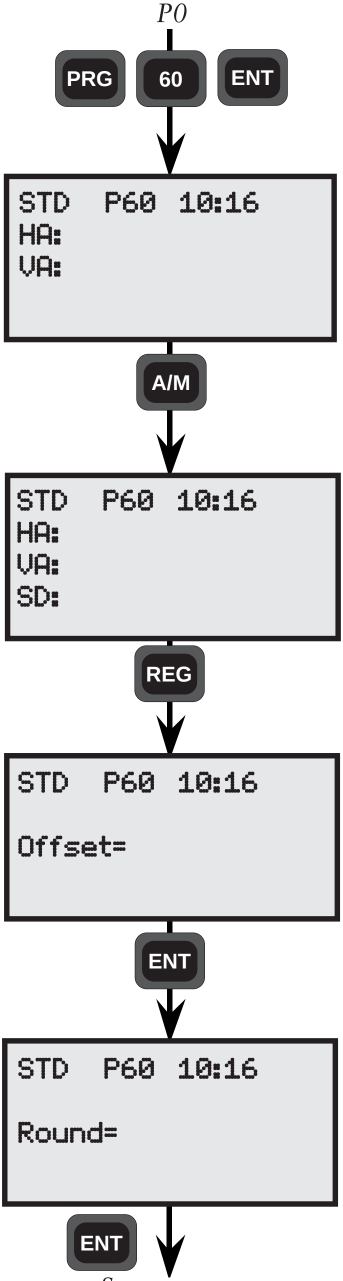


Fig. 1 Distance definitions.

How to use

PRG
60
How to use



Locate the instrument on a suitable point and start program 60. Enter in which Jobfile and in which unit you wish to save the measured data.

Aim towards the centre, see fig. on the previous page, and press A/M to measure the point.

Press REG to registrate the measurement.

Enter the radial offset and press ENT.
Javelin=8.00 m
Hammer=1.068 m
Discus=1.25 m

Enter the round of the event and press ENT, e.g. Hammer round 2 can be expressed as Hammer2.

See next page

PRG

60

Athletics

```
STD   P60  10:16
Entrant
No=
```

Enter the number of the entrant and press ENT.

ENT

Measuring mode

```
STD   P60  10:16
HA:
VA:
```

You are now in theodolite mode and can start measuring by pressing the A/M key.

A/M

```
STD   P60  10:16
HA:
VA:
SD:
```

Press REG to registrate the measurement.

REG

```
STD   P60  10:16
No=
Length=
Store ?
```

The program has now calculated the length. Round off the length to a lower cm, e.g. 95.158=95.15. Press YES or ENT to store the result or NO to continue without storing.

YES

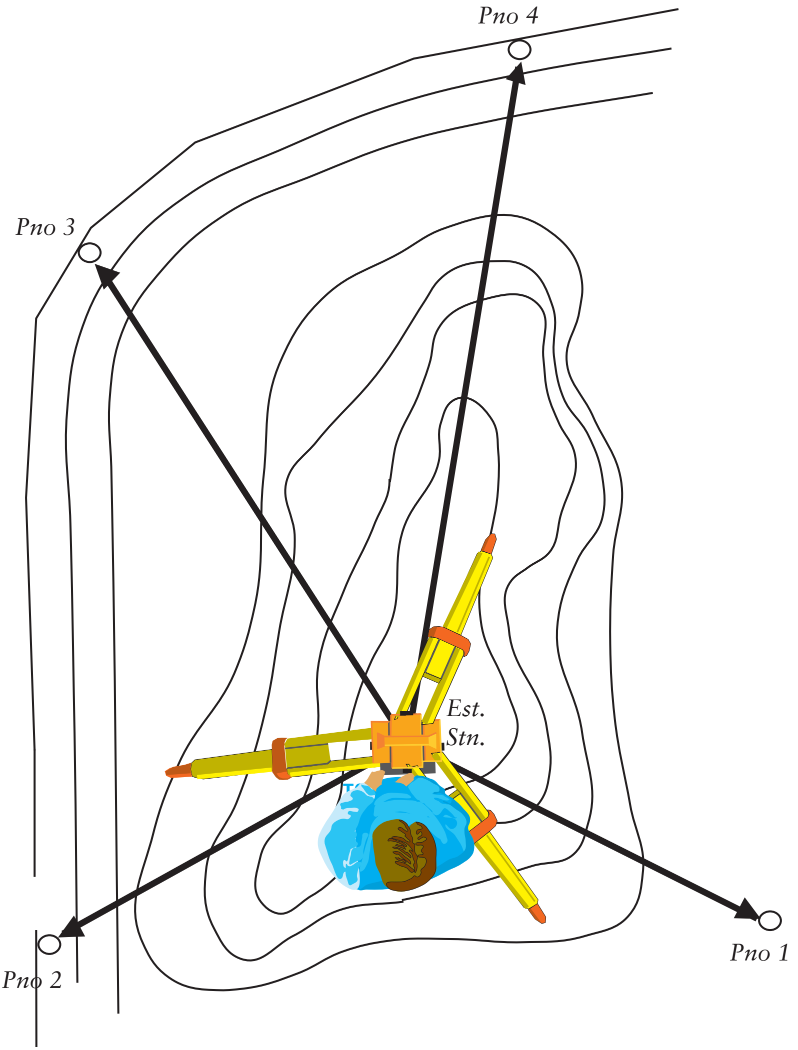
```
STD   P60  10:16

Round=
```

Do you wish to continue with a new measurement, press ENT. Otherwise press PRG and 0 to exit the program.

PRG 0

PRG

30

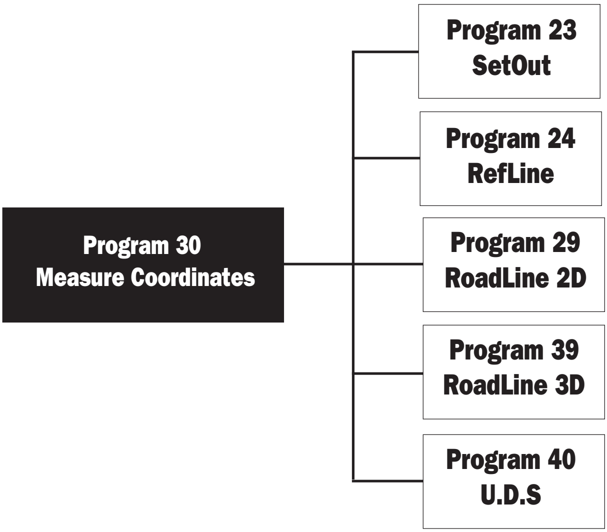


In general

PRG
30
In general

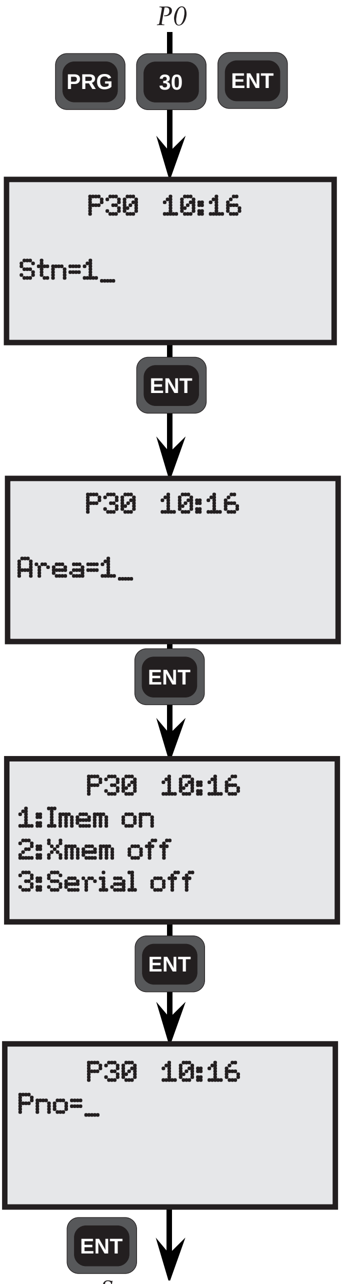
With Program 30, Measure Coordinates, you can measure and store your coordinates directly to an Area file, i.e you don't have to store the coordinates in a Job file and then transfer them to an Area file. The coordinates can then be used for new station establishments.

Program 30 is included in the following programs:



How to use

How to use



Assuming that Station Establishment has been carried out at your station point press PRG 30 and ENT to start program 30.

The text "Measure Coord" will briefly show on the display and then your Stn number is shown. Press ENT.

Note ! ☛ ***Note! If the station hasn't been established you're taken to Program 20, Station Establishment.***

Enter the name of the Area file in which you want to store your coordinates.

Choose what memory unit you'll use. Toggle between on and off by pressing the corresponding numeric key. Confirm with ENT.

Enter the number of the point to be measured.
Confirm with ENT.

See next page

PRG

30

Measure Coordinates

```
   P30  10:16
Pno=5
Pcode=_
```

Enter a Pcode and press ENT.

ENT

```
   P30  10:16
Pno=5
Pcode=5
SH=0.000_
```

Enter the signal height for the point to be measured and press ENT.

Note ! ☛ Only shown if heights are used.

ENT

```
STD  P30  10:16x
HA:  123.4567
VA:   98.7654
```

Aim towards the point to be measured and press A/M.

Note ! ☛

Note. It is possible to choose any measurement mode: STD, TRK or D-bar, one or two-face.

A/M

```
STD  P30  10:16x
N  :1887910.683
E  :3950613.782
ELE:   111.125
```

The coordinates for your measured point are shown in the display. Press REG to store them in the selected Area file.

Note ! ☛ Only shown if heights are used.

REG

```
STD  P30  10:16

more?
```

Do you want to measure and register more points? In this example we will measure one more point. Press ENT.

ENT

See next page

PRG

30

Measure Coordinates

```
STD  P30  10:16
Pno=6
```

Enter the number of the point to be measured. (Pno is automatically incremented by 1 for each new point. You can, however, choose whatever number you want).
Confirm with ENT.

ENT

```
STD  P30  10:16
Pno=6
Pcode=5
```

Enter a Pcode for the new point and press ENT. (The previously used Pcode is shown default. You have to change this manually). We choose 6 in this example. Press 6 and ENT.

ENT

```
     P30  10:16
Pno=6
Pcode=6
SH=1.800_
```

Note ! ☛ Only shown if heights are used.

Enter the signal height for the point to be measured and press ENT. (The previously used SH is shown default).

ENT

```
STD  P30  10:16×
HA:  234.5678
VA:   88.7654
```

Note ! ☛

Aim towards the new point to be measured and press A/M.

Note. It is possible to choose any measurement mode: STD, TRK or D-bar, one or two-face.

A/M

```
STD  P30  10:16×
N :1887832.876
E :3950413.456
ELE:    89.125
```

Note ! ☛ Only shown if heights are used.

The coordinates for your secont point are shown in the display. Press REG to store them in the selected Area file.

REG

See next page

PRG

30

Measure Coordinates

```
STD   P30  10:16

more?
```

Do you want to measure and register more points? In this example we are satisfied with two points. Press NO.

NO

```
    P0   10:16

Temp=20.0
```

You are now taken to P0.

Area File	Label No.
Stn	2
Stn Coordinates	37,38,(39)
RefObj	62
RefObj Coords	37,38,(39)
HA_ref*	21
HD	11
IH	3
Info, measured point	0
Pno	5
Pcode	4
SH	6
Raw data	7,8,9
Measured Coords	37,38,(39)
Next Pno	5
.	4
.	6
.	7,8,9
.	37,38,(39)
.	.

Here are the data that can be stored in the Area file you have choosen.

** HA_ref for Known Station = calculated and Set HA,*
HA_ref for Free Station and Known Station+ = Current instrument direction when exiting P20.

PRG

33

Program 33 - Robotic Lite

Robotic Lite is a program for collecting large amounts of data for volume calculations, terrain models or hydrographic applications.
With Robotic Lite you can collect data as a single user. The only requirements are that you have a servo instrument with a tracker and a remote target (RMT). The instrument will follow the RMT and store data with preset intervals. These can either be in form of the time between measurements or the time you have held the RMT still.
You need to prepare a UDS before you start Program 33 and the UDS must collect Point number, Pcode, Signal height etc. with automatic incr. and automatic dup.

PRG

33

The program is divided in two parts:

1. Time & Dist
Enter a time, e.g. 10 seconds and a distance, e.g. 2 meters and the instruments will register data every 10th second, under the condition that you have moved not less than 2 meters from the last point of registration.

2. Stop & Go
Enter a time, e.g. 2 seconds and a distance, e.g. 2 meters and the instrument will register data when you have moved more than two meters under the condition that you have held your target still for not less than 2 seconds.

A useful function in Stop&Go is that the tracklight is automatically switched on when the program is initiated and starts flashing. When a registration is made the flash stops for 2 seconds and you get a confirmation that the registration is done when the flash starts again.

Automatic search
If the instrument looses contact with the remote target, it will automatically start searching for the target until it regains contact and locks on to it.

Default settings
When the program is started it will automatically set the instrument in the following modes:
• tracking
• auto centering
• auto search

How to use

PRG

33

How to use

PRG 3 3

ENT

Select program 33 and press ENT.

```
Stn estab.    10:17
1 Ok
2 Known Station
3 Free Station
```

ENT

Here you can perform station establishment if you wish. In this case we choose not to and press 1 Ok.

```
Stn estab.    10:17
4 Known Station+
```

1

```
Select        10:17
1 Time & Dist
2 Stop & Go
```

Choose between 1 Time & Dist and 2 Stop & Go. In this case we will choose 1 Time & Dist.

1

```
Time&Dist     10:17
Time = 10
```

Enter the time interval that must have passed since the last registration in order to get a new registration.

ENT

See next page

PRG

33

How to use

From previous page

```
Time&Dist   10:17
Time = 10
Dist.= 5
```

Enter the distance that you must have moved since the last registration in order to get a new registration.

ENT

```
Time&Dist   10:17
Time = 10
Dist.= 5
UDS=
```

Enter the UDS you wish to use for your measurement.

Now you are ready to set a search sector.

ENT

```
Time&Dist   10:17

Aim to A
Press ENT
```

Aim the instrument towards the first sector limit and press ENT.

ENT

```
Time&Dist   10:17

Aim to B
Press ENT
```

Aim the instrument towards the second sector limit and press ENT.

The sector will automatically be centered if you loose contact with the RMT.

ENT

See next page

PRG

33

How to use

Note !
This is only an example UDS.

From previous page

```
UDS P3       10:17

Job no=_
```

Key in the Job file in which you wish to store the registrations.

ENT

```
UDS P3       10:17
1 Imem ON
2 Xmem OFF
3 Serial OFF
```

Select in which memory unit you wish to store the data and press ENT. In this case we select 1 Imem.

1 ENT

```
UDS P3       10:17
STEP1    Set
Pno=1
```

This is the first step in the example UDS. Enter the first Point number and press ENT.
Set Pno in Auto Incr./Decr.

ENT

```
UDS P3       10:17
STEP2    Set
Pcode=1
```

Enter a Pcode for the first point and press ENT.
Set Pcode in Auto Dup.

ENT

See next page

PRG

33

How to use

From previous page

```
UDS P3      10:17
STEP3   Set
SH=1.000
```

Enter the signal height for the first point and press ENT.
Set SH in Auto Dup.

ENT

```
TRK P3      10:17

Target not found
```

Aim to a point where you want to start the measurement. Walk to the point and the instrument will automatically lock on to the RMT and starts to follow.

```
TRK P3 10:17 Am+
Pcode:1
Pno:4
SH=1.000
```

As soon as the target is found and the first registration is performed you can see the information in the display.

You are now ready to move on to the next point to measure.

To end the program press PRG and 0. Otherwise continue and collect more points.

PRG

0

P0

Appendix A – Label List

No.	Text	Description
0	Info	Information
1	Data	Data used in INFO/DATA combination
2	Stn	Station No
3	I H	Instrument Height
4	Pcode	Point Code
5	Pno	Point Number
6	SH	Signal Height
7	HA	Horizontal Angle
8	VA	Vertical Angle
9	SD	Slope distance
10	DHT	Vertical Distance (IH and SH not included)
11	HD	Horizontal distance
12	SqrAre	Area of an surface (Result from Program 25)
13	Volume	Volume (Result from Program 25)
14	Grade	Percent of grade ((DHT/HD) 100)
15	Area	Area file
16	dH	Difference between C1 and C2 horizontal angles**
17	HAII	Horizontal angle which was measured in C2 and stored**
18	VAII	Vertical Angle which was measured in C2 and stored**
19	dV	Difference between C2 and C1 vertical angles**
20	Offset	Offset constant. Can be added to or subtracted from the SD
21	HAref	Horizontal Reference Angle
22	Comp	Compensator ON=1, OFF=0
23	Units	Status of unit set, e.g. Status=3214 (Mills Meter Fahr InchHg)
24	HAI	Horizontal angle which was measured in C1
25	VAI	Vertical angle which was measured in C1
26	SVA	Setting out vertical angle
27	SHA	Setting out horisontal angle
28	SHD	Setting out horizontal distance
29	SHT	Setting out height
30	PPM	Atmospheric Correction, parts per million (PPM)
31	BM ELE	Benchmark elevation
33	PrismC	Prism constant
35	S	Info about Sections (Length tables) in P39 RoadLine
37	N	Northing coordinates.*
38	E	Easting coordinates.*
39	ELE	Elevation coordinates.*(39=49+STN HT)
40	dN	Relative to stored X (N) coord of set out point (P23)
41	dE	Relative to stored Y (E) coord of set out point (P23)
42	dELE	Relative to stored Z (ELE) coord of set out point (P23)
43	UTMSC	Universal Transverse Mercator Scale Factor.
44	Slope	Slope inclination
45	dHA	Correction value of the calculated bearing (P20)

**Cleared when power OFF* ***Only Geodimeter Instrument*

Appendix A – Label List

No.	Text	Description
46	S_dev	Standard deviation
47	Nr	Rel. North Coord.
48	Er	Rel. East Coord.
49	VD	Vertical distance (IH and SH included) (49 = 10+3-6)
50	JOB No	Job No file for storage of raw and calculated data.
51	Dat.	Date
52	Time	Time
53	Operat	Operator identification
54	Proj	Project identification
55	Inst.No	Instrument Number
56	Temp	Temperature
57	Blank	Empty row in UDS's where it is convenient to have a blank line.
58	EA Rad	Earth Radius
59	Refrac	Refraction
60	ShotID	Shot Identity
61	Activ	Activity Code
62	Ref Obj	Reference Object
63	Diam	Diameter
64	Radius	Radius
65	h%	Relative humidity in %
66	t'	Wet temperature
67	SON	Northing Coordinate of setting out point
68	SOE	Easting Coordinate of setting out point
69	SHT	Elevation of setting out point
70	Radoffs	Keyed in radial offset dimension
71	Rt.offs	Keyed in right angle offset dimension
72	Radoffs	Calculated radial offset dimension in setting out program.
73	Rt.offs	Calculated right angle offset dimension in setting out program
74	Press	Air Pressure
75	dHT	Diff. between ELE and SHT (75=29-39)
76	dHD	Diff. between setting out distance and measured distance
77	dHA	Diff. between setting out bearing and the present instr. pointing
78	Com	Communication protocol parameter settings.
79	END	Signifies the end of the User Definable Sequence
80	Sec	Section or Length table in P39 RoadLine
81	A-param	A-parameter
82	SecInc	Section Interval
83	Cl.ofs.	Center line offset
84	PCoeff.	Parabola coefficient
85	PHt	Point Height difference
86	Layer	Layer number
87	LayerH	Layer height
88	Profil	Profile number
89	Dist.	Distance from Def.point to Ref.point
90-99	–	Labels which can be defined by the user

The following pages will describe the different info codes that can appear in Your Geodimeter. If an error appears frequently the instrument should be left to authorized service.
In some cases the info code also includes a device code, e.g 22.3. The most frequent codes are:
1=Serial, 2=Imem, 3=Xmem, 6=Radio, 7=Distance meter
If a device code appears, check the info code description. If the code is not described the error is internal and the instrument should be left to authorized service.

Info 1 – Compensator out of range

Cause: The instrument is tilted too much. The dual-axis compensator can not compensate for the inclination.

Action: Level the instrument or disconnect the dual-axis compensator.

Info 2 – Wrong face

Cause: The operation was carried out while the instrument was in an illegal mode. E.g: Trying to measure in the wrong face.

Action: Change to face 1, showing angles in the display and retry.

Info 3 – Distance already recorded

Cause: The distance to the current object has already been registered.

Action: If a new registration is required a new measurement must be carried out.

Info 4 – Invalid measurement

Cause:
- The measurement is invalid, e.g. several measurements towards the same point or the measured points lies 200 gon from each other, P20, Free Station.
- Trying to perform a calculation which is dependent from a distance without having measured any distance, P20 Free Station and Z/IZ.

Action:
- Check that the circumstances above does not occur and redo the measurement.

Info 5 – Undefined mode or table

Cause: Tries to use a display- or output-table that does not exist.

Action: Choose another table or create a new.

Info 6 – Vertical angle less than 15gon from horizontal angle

Cause: The vertical angle is less than 15gon from the horizontal angle when performing a Tilt Axis Calibration.

Action: Redo the calibration with an increased horizontal angle.

Info 7 – Distance not yet measured

Cause: Tries to register without having performed a distance measurement. E.g: when using an U.D.S. which includes labels that are dependent from a distance.

Action: Perform a distance measurement before registration.

Info 8 – Bat Low

Cause: The connected battery is drained.

Action: Replace the battery with a new and connect the drained battery to a charger.

Info 9 – Bat Low in the external unit (Geodat 500)

Cause: The battery connected to the external unit is drained.

Action: Replace the battery with a new and connect the drained battery to a charger.

Info 10 – No active device

Cause: Tries to register in an U.D.S. without having defined a storage unit.

Action: Check that the U.D.S. includes a logon procedure. Restart the U.D.S. and choose a storage unit (IMEM, XMEM or Serial).

Info 15 – Not correct section

Cause: You have entered a incorrect section in Program 39.

Action: Check that the given section contains a horizontal and a vertical alignment.

Info 16 – Remote Active

Cause: Trying to run Program 22 or Program 28 in remote mode.

Action: Switch to manual mode and start the program again.

Info 17 – Autolock Active

Cause: Trying to run Program 22 or Program 28 with Autolock on.

Action: Switch to manual mode and start the program again.

Info 18 – CU not on alidad

Cause: Trying to make a collimation measurement in remote mode. Collimation measurements can only be made from the instrument

Action: Start the collimation measurement from the instrument.

Info 19 – Communication error

Cause:
- The cables are not connected correctly or are damaged.
- The battery is drained.
- The data for transfer contains errors.

Action:
- Check that the cables are connected properly.
- Check that the batteries are not drained.
- Run the transfer again and check if any error appears. If so check the file for any errors and correct them.

Info 20 – Label error

Cause: You have entered a wrong labelnumber. The label does not exist, is not correct or does not contain any data.

Info 21

21.1 – Overrun error
21.2 – Parity error
21.4 – Framing error
21.8 – Received brake

Combinations are possible, e.g. 21.12 means info 21.4 and info 21.8

Cause:
- Wrong communication parameters (label 78).
- The cables are not connected correctly or are damaged.
- The battery is drained.

Action:
- Check that the same parameters are set in the target unit as in the source unit.
- Check that the cables are connected properly.
- Check that batteries are not drained.

Info 22 – No or wrong device connected

Cause: Tries to access a device that is not connected or working.

Info 23 – Time out

Cause: An error occured during a communication session.

Action:
- Check that the batteries are not drained.
- Check that the cables are connected properly.

Info 24 – Illegal communication mode

Cause: The operation was carried out while the instrument was in an illegal mode.

Action: Set the instrument in face 1, press STD, TRK or D_bar and retry.

Info 25 – Real time clock error

Action: Try to set date and time. If that does not help the instrument should be left to authorized service.

Info 26 – Change backup battery

Action: The instrument can be used but should be left to authorized service for replacement of the battery. There is a risk for total loss of memory.

Info 27 – Option not installed

Cause:
- Tries to select a program which is not installed in the instrument.
- Wrong configuration. E.g. if you try to perform operations that demands a radio side cover, without having such.

Action:
- Choose another program or contact Your local Geodimeter dealer for a program installation.
- Upgrade your instrument with the radio option.

Info 29 – The current table can not be changed

Cause: Tries to modify the current display- or output-table.

Action: To be able to modify the current table, you must first select another table to be the current.

Info 30 – Syntax error

Cause: Tries to send a command with illegal syntax on the serial channel.

Action: Check the command and change the syntax. Note that only big letter commands are allowed.

Info 31 – Out of range

Cause:
- Tries to choose an illegal display- or output-table.
- Tries to choose a display- or output-table that does not exist.
- Tries to create an illegal U.D.S.

Info 32 – Not found

Cause:
- Tries to access a Job- or Area-file that does not exist.
- Tries to access an illegal program.

Info 33 – File record exist

Cause: Illegal way of creating a Job- or Area-file

Info 34 – Illegal record separator

Cause: Tries to insert a label in the editor when you have a Job No or Area No in the display.

Info 35 – Data error

Cause: Wrong data input, e.g. value out of range or alpha sign in a numeric value.

Info 36 – Memory full

Cause:
- Too many point codes in the point code library (Program 45) or too many characters in the point codes.
- Too long display- or output-table.
- Internal memory full.

Action:
- Use less characters in the point codes.
- Shorten the tables or use fewer tables.
- Install more memory at your local dealer or delete unused files.

Info 41 – Wrong label type

Cause: This label type can not be attached to this specific label.

Action: Choose another label or use another label type.

Info 42 – U.D.S. program memory full

Action: Delete unused U.D.S. programs or shorten the programs.

Info 43 – Calculation error

Action: Redo the procedure.

Info 44 – Not enough data for calculation

Cause: The program needs more points for the calculation, P20, Free Station.

Action: Measure more points and redo the calculation.

Info 45 – Incompatible device

Cause: The unit is not compatible. Tries to change format to a Geodat 402/500.

Info 46 – GDM power error

Cause: RPU can not switch on GDM.

Action: Redo the procedure. If the error appears again leave the instrument to authorized service.

Info 47 – U.D.S call stack error

Cause: You have used call in too many steps (max 4 steps).

Action: Check the U.D.S's and decrease the number of calls.

Info 48 – No or wrong station establishment

Cause:
- The station labels has been changed since the station was established.
- The station is not established.

Action: Perform a station establishment.
If using a RPU and if the station has been established earlier, fetch station data with menu 66 .

Info 49 – No GDM connected

Cause: Trying to run a function or an application from a detached keyboard unit without having contact with an instrument.

Info 51 – Memory lost

Action: Leave the instrument to authorized service.

Info 53 – A/D overrange (A/D=Analog/Digital converter circuit)

Cause: Error in the angle measurement system.

Action: If the error appears frequently leave the instrument to authorized service.

Info 54 – Memory lost

Action: Leave the instrument to authorized service.

Info 103 – No carrier

Cause: Disturbance or no contact over the telemetry link.

Action: Change channel or decrease the distance between the RPU and the GDM.

Info 107 – Channel busy over the telemetry link

Action: Change channel.

Info 122.6 – Radio not connected (Can also show info 22.6)

Cause:
- The radio is not connected to the Geodimeter.
- The radio is not switched on.
- The battery in the radio is drained.
- The cables are not connected properly or are damaged.

Action: Connect the radio to the Geodimeter and switch on the radio.

Info 123 – Time out (Can also show info 23.6)

Cause:
- The battery in the radio is drained.
- The cables are not connected properly or are damaged.

Action: Check the cable connections and examine the radio battery.

Info 125 – Invalid channel

Cause: You have chosen a radio channel that cannot be accessed.

Action: Choose another channel and retry.

Info 153 – Limit switch engaged

Cause: Tries to position the instrument to an illegal angle.

Info 155 – The horizontal positioning is not good enough

Action: If this error appears frequently leave the instrument to authorized service.

Info 156 – The vertical positioning is not good enough

Cause: If this error appears frequently leave the instrument to authorized service.

Info 157 – The horizontal & vertical positioning isn't good enough

Action: If this error appears frequently leave the instrument to authorized service.

Info 158 – Can not find the target

Cause:
- The aiming from the RPU is bad.
- The measuring distance is too long.
- The measuring beam was obstructed.

Action: Try to aim the RPU towards the Station more accurate and remove any obstructing object. If possible try to reduce the measuring distance.

Info 161 – The target is lost

Cause:
- The aiming from the RPU is bad.
- The measuring beam is obstructed.
- The target was moved too fast.

Action: Try to aim the RPU towards the Station more accurate and remove any obstructing object. If not in tracking mode, it is important to hold the target still while measuring.

Info 162 – Syntax error (see Info 30)

Info 166 – No measuring signal from prism

Cause: The distance meter in the instrument or the prism is obstructed.

Action: Remove any obstructing object from the instrument and the prism.

Info 167 – Collimation error too large

Cause: The collimation error during a test measurement was too large.

Action: Increase the measuring distance. It is important to keep the RPU held still during the measurement. If the error does not disappear leave the instrument to authorized service.

Info 174.7 – Distance measurement error

Action: Redo measurement.

Info 201 – Calculation error (see Info 43)

Info 207 – Process queue overflow

Cause: Too many commands sent too fast on the serial channel.

Action: Wait for the result of one command before you send the next one.

Info 217 – RS-232 Buffer Overflow

Cause: Data was sent without an end sign.

Action: Make sure that the command contains an end sign.

Info 218 – Input string too long

Cause: A command that is too long was sent on the serial channel.

Action: Send a shorter command.

Info 241 – The RMT needs index

Cause: The control unit doesn't receive angle reference from RMT600TS

Action: Tilt RMT600TS past the vertical plumb line and back again. Press the A/M key again.

---

* * *