Leica TPS1200

Technical Reference Manual

Version 5.5
English

- when it has to be **right**

Leica Geosystems

Introduction

Purchase

Congratulations on the purchase of a TPS1200 series instrument.

To use the product in a permitted manner, please refer to the detailed safety directions in the User Manual.

Product identification

The type and the serial number of your product are indicated on the type plate.
Enter the type and serial number in your manual and always refer to this information when you need to contact your agency or Leica Geosystems authorized service workshop.

Type: ______________________________

Serial No.: ______________________________

Symbols

The symbols used in this manual have the following meanings:

Type	Description
☞	Important paragraphs which must be adhered to in practice as they enable the product to be used in a technically correct and efficient manner.

Trademarks

- CompactFlash and CF are trademarks of SanDisk Corporation
- Bluetooth is a registered trademark of Bluetooth SIG, Inc

All other trademarks are the property of their respective owners.

Table of Contents

In this manual

1 Instrument Protection with PIN

Description

- The instrument can be protected by a **P**ersonal **I**dentification **N**umber.
- If the PIN protection is activated, the instrument will always prompt for a PIN code entry after starting up and before **TPS1200 Main Menu** comes up.
- If a wrong PIN has been typed in five times, a **P**ersonal **U**nbloc**K**ing code is required.
- Refer to "18.6 Start Up & Power Down" for information on activating PIN protection.
- This chapter explains the workflow of entering PIN and PUK.

Access

- **TPS1200 Enter Security PIN Code** is automatically accessed during starting up the instrument when **<Use PIN: Yes>** in **CONFIGURE Start Up & Power Down**, **PIN Code** page and a PIN has been defined before. Refer to "18.6 Start Up & Power Down".
- **TPS1200 Enter Security PUK Code** is automatically accessed during starting up the receiver when a wrong PIN code has been typed in five times.

TPS1200
Enter Security PIN Code

OK (F4)
To accept the PIN code and to continue with the subsequent screen.

SHIFT QUIT (F6)
To turn off the instrument.

Description of fields

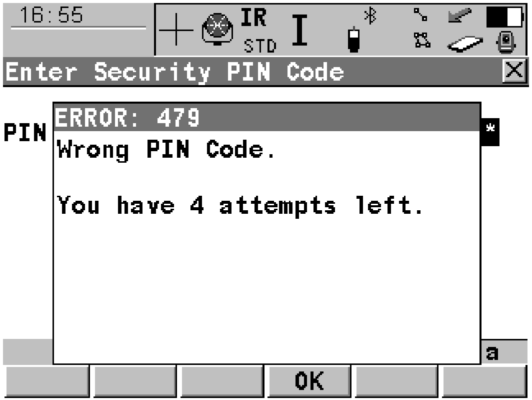
Field	Option	Description
PIN Code	User input	The PIN code as previously defined in **CONFIGURE Start Up & Power Down**, **PIN Code** page. The correct PIN code must be typed in within five attempts or the PUK code is required.

Next step

IF the PIN code entered is	THEN
correct	**TPS1200 Main Menu** is displayed. Refer to "4 Main Menu".

IF the PIN code entered is	THEN
wrong	refer to paragraph " TPS1200 Enter Security PIN Code Error: 479".
wrong the fifth time	the PUK code is required. Refer to paragraph " TPS1200 Enter Security PIN Code Error: 478".

TPS1200 Enter Security PIN Code Error: 479



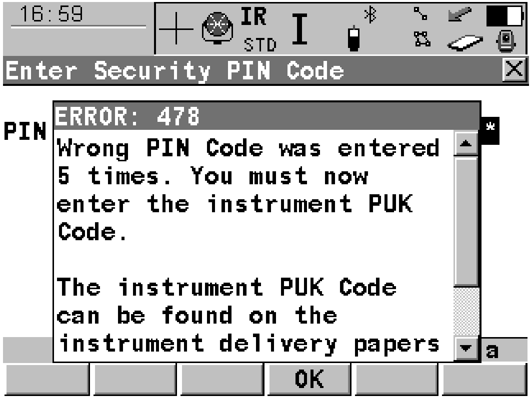
OK (F4)
To return to **TPS1200 Enter Security PIN Code** where a PIN code can be typed in again.

Next step

IF the PIN code entered is	THEN
correct	**TPS1200 Main Menu** is displayed. Refer to "4 Main Menu".

IF the PIN code entered is	THEN
wrong the fifth time	the PUK code is required. Refer to paragraph " TPS1200 Enter Security PIN Code Error: 478".

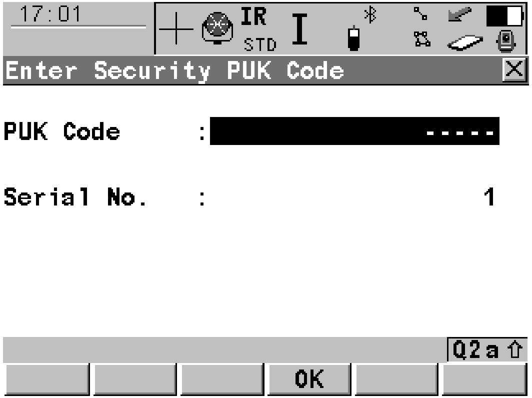
TPS1200
Enter Security PIN Code
Error: 478



OK (F4)
To continue with the subsequent screen.

Next step
OK (F4) to access **TPS1200 Enter Security PUK Code**.

TPS1200 Enter Security PUK Code



OK (F4)
To accept the PUK code and to continue with the subsequent screen.

SHIFT QUIT (F6)
To turn off the receiver.

Description of fields

Field	Option	Description
PUK Code	User input	The PUK code as generated by Leica Geosystems. • For receivers delivered with firmware version 2.10 or higher, the PUK code comes with the receiver. • For receivers delivered with firmware versions lower than v2.10, contact a Leica representative to obtain a PUK code.
Serial No.	Output	The serial number of the receiver. This is needed to obtain PUK from Leica Geosystems.

Next step

IF the PUK code entered is	THEN
correct	the old PIN code is cleared and the PIN protection is deactivated. **TPS1200 Main Menu** is displayed. Refer to "4 Main Menu".
wrong	GPS1200 keeps asking for the correct PUK code. **SHIFT QUIT (F6)** to turn off the receiver.

2 Configurable Keys

2.1 Hot Keys

Description

- Two levels of hot keys exist:
  - The first level are the keys **F7, F8**, ..., **F12**
  - The second level is the combination of **SHIFT** and **F7, F8**, ..., **F12**

Functionality

- Hot keys provide a shortcut for quickly and directly carrying out functions or starting application programs assigned to the keys. The assignment of functions and application programs to hot keys is user configurable.
- Refer to "18.2 Hot Keys & User Menu" for the configuration of hot keys.

Using the hot keys

- The first level is accessed by pressing **F7**, **F8**, ..., **F12** directly.
- The second level is accessed by pressing **SHIFT** first followed by **F7**, **F8**, ..., **F12**
- Hot keys can be pressed at any time. It is possible that a function or application program assigned to a hot key cannot be executed in certain situations.

Define hot key/user menu step-by-step

This step-by-step description shows how to assign the **CONFIGURE Coding & Linework** screen to the **F7** key and to the first line of **TPS1200 User Menu: Job Name**.

Step	Description
1.	Select **Main Menu: Config...\General Settings...\Hot Keys & User Menu**.
2.	**CONFIGURE Hot Keys & User Menu** For **Hot Keys/Shift Hot Keys** select **<F7: CONF Coding & Linework Settings>**.

Step	Description
	For **User Menu** select **<1: CONF Coding & Linework Settings>**.
3.	**CONT (F1)**.
4.	**CONT (F1)**.
5.	Press **F7** to access **CONFIGURE Coding & Linework**. OR Press **USER** and 1 to access **CONFIGURE Coding & Linework**.

2.2 USER Key

Description

The **USER** key opens the user defined menu.

User defined menu

The user defined menu can be configured to contain the most used functions or application programs. The user defined menu can not be accessed while in a **CONFIGURE XX** screen. Refer to "18.2 Hot Keys & User Menu" for the configuration of the user defined menu.

Functionality of the user defined menu

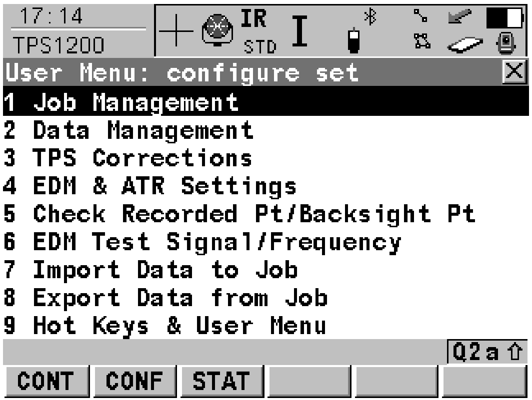
Selecting an option in the menu carries out the function or starts the application program assigned to the option.

Access

Press **USER** to access **TPS1200 User Menu: Job Name**.

TPS1200 User Menu: Job Name

This is an example of what a user defined menu can look like. The softkeys and their order is fixed. The functions and application programs which are assigned to the individual places in the user defined menu can differ depending on the configuration.



CONT (F1)
To execute the selected function.

CONF (F2)
To configure the user menu.

STAT (F3)
To access the **Status Menu**.

Define USER key step-by-step

To define the **USER** key is the same as for the hot keys. Refer to paragraph "Define hot key/user menu step-by-step".

3 Quick Settings - SHIFT USER

3.1 Overview

Description

Frequently used settings can be accessed quickly and changed with three key strokes. For example press **SHIFT USER** and **1** to turn the ATR on or off. The change is immediately applied and the screen where **QUICK SET Change Settings to:** was accessed from opens. The workflow is not interrupted.

This screen displays the possible settings to change to. All possible settings have two states and allow very quick setting changes. Highlight a field and press **ENTER** to change to the displayed setting or press the number next to the function.

☞ Changes made on the **QUICK SET Change Settings to:** screen are stored in the active configuration set.

3.2 QUICK SET Change Settings to:

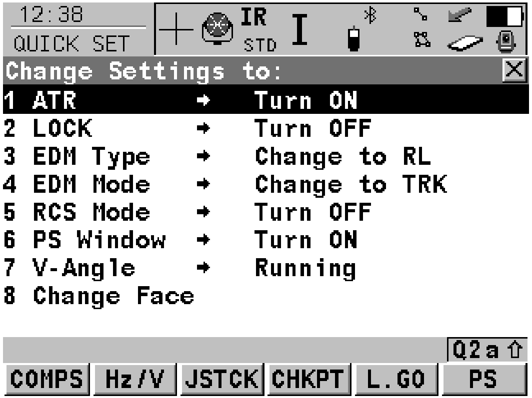
Access

Press **SHIFT USER**.

QUICK SET Change Settings To:

The appearance of the **QUICK SET Change Settings to:** screen may change, depending on whether the instrument is equipped with motorisation, ATR, reflectorless EDM or Power-Search.

Refer to "32 Functions" for information on functions and to "17 Config...\Instrument Settings..." for information on instrument settings.



COMPS (F1)
To turn the instrument using compass readings.

Hz/V (F2)
To turn the instrument to a specific entered position.

JSTCK (F3)
To turn the instrument using the arrow keys.

CHKPT (F4)
To check a point or the instrument orientation.

L.GO (F5) or **L.INT (F5)**
Unavailable for SmartStation.
L.GO (F5) to start an ATR search, to set **<Automation: LOCK>** and to lock onto the reflector.
L.INT (F5) to interrupt LOCK.

PS (F6)
Starts a prism search with PowerSearch.

Description of fields

Field	Option	Description
ATR	→ **Turn ON**	To activate ATR, **<Automation: ATR>.**
	→ **Turn OFF**	To deactivate ATR, **<Automation: None>**.
LOCK		Unavailable for SmartStation.
	→ **Turn ON**	To activate LOCK, **<Automation: LOCK>**.
	→ **Turn OFF**	To deactivate LOCK, **<Automation: None>**.
EDM Type	→ **Change to IR**	To activate measurements to reflectors, **<EDM Type: Reflector (IR)>**.
	→ **Change to RL**	To activate reflectorless measurements, **<EDM Type: Reflctrless (RL)>**. Deactivates ATR and LOCK, **<Automation: None>**.
EDM Mode	→ **Change to TRK**	To activate tracking with continuous measurements, **<EDM Mode: Tracking>**.
	→ **Change to STD**	To activate single measurements, **<EDM Mode: Standard>**.
RCS Mode	→ **Turn ON**	To activate RCS mode and LOCK, **<Use Interface: Yes>** in **CONFIGURE RCS Mode, <Automation: LOCK>**.
	→ **Turn OFF**	To deactive RCS mode, **<Use Interface: No>** in **CONFIGURE RCS Mode**.

Field	Option	Description
PS Window	→ **Turn ON**	To activate the PowerSearch window, **<PS Window: On>**. Prisms are searched for with PowerSearch in the PS window when **PS (F6)** is pressed.
	→ **Turn OFF**	To deactivate the PowerSearch window **<PS Window: Off>**. A 360° search is performed when **PS (F6)** is pressed.
V-Angle	→ **Hold**	The displayed value for the vertical angle is held after **DIST (F2)** and until **REC (F3)** is pressed, **<V-Angle: Hold after DIST>**.
	→ **Running**	The displayed value for the vertical angle is updated after **DIST (F2)** is pressed, **<V-Angle: Running>**. Be aware that after restarting the instrument this setting remains and is not changed.
Change Face	no choices	To change the face of the telescope.

Next step

IF	THEN
a setting is to be changed	type the selection number in front of the item or highlight the item and press **ENTER**.

IF	THEN
the instrument is to be automatically turned to a specific position	**COMPS (F1)**, **Hz/V (F2)** or **JSTCK (F3)** to access the subsequent screen. Refer to "3.3 Quick Setting Functions".
a point or the instrument orientation is to be checked	**CHKPT (F4)** to access the **QUICK SET Check Recorded Pt/Backsight Pt** screen. Refer to "3.3 Quick Setting Functions".
prism is to be locked onto	press **L.GO (F5)** to activate LOCK and start an ATR search. Refer to "3.3.5 L.GO (F5)/L.INT (F5)".
LOCK is to be interrupted	press **L.INT (F5)** to interrupt LOCK. Refer to "3.3.5 L.GO (F5)/L.INT (F5)".
PowerSearch is to be started	**PS (F6)** to search for a prism with PowerSearch. Refer to "3.3.6 PS PowerSearch".

3.3 Quick Setting Functions

3.3.1 Orientation With Compass

Description

By using a conventional magnetic compass while remotely controlling the instrument, it is possible to determine the general direction towards which the instrument should turn in order to perform a target search to locate the prism.

Access

Press **COMPS (F1)** in the **QUICK SET Change Settings to:** screen. Refer to "3.2 QUICK SET Change Settings to:".

OR

Press a hot key configured to access the screen **QUICK SET Orientation With Compass**. Refer to "2.1 Hot Keys" for information on hot keys.

The instrument must be connected to a radio to be remote controlled with the RX1200.

Orientation with compass step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	**PROG**. Select Setup application program to set up the instrument.	45
2.	**Main Menu: Survey** **CONT (F1)** to access **SURVEY Survey Begin**.	
3.	**CONT (F1)** to access **SURVEY Survey: Job Name**. Turn the telescope until **<Hz: 0.0000 g>**.	

Step	Description	Refer to chapter
4.	Look through the telescope with **<Hz: 0.0000 g>** to select an object which is easily recognisable.	
5.	Standing at the instrument point the compass to the selected object and turn the rotating dial until the "N" lines up with the north end of the compass needle. The compass dial must not be turned once the "N" is lined up with the north end of the compass needle.	
6.	Go to the reflector.	
7.	**SHIFT USER** to access **QUICK SET Change Settings to:**.	
8.	**QUICK SET Change Settings to:** **COMPS (F1)** to access **QUICK SET Orientation With Compass**.	3.3.1
9.	**QUICK SET Orientation With Compass** From the reflector aim the "N" of the compass towards the instrument. Read the horizontal angle as pointed to by the north end of the compass needle. **<Hz-Compass:>** The horizontal angle read from the compass while aiming to the instrument. **<V-Compass:>** If the compass works as a clinometer, those values can also be used. The horizontal and vertical angle reads from the compass are always displayed in degree regardless of the system settings.	

Step	Description	Refer to chapter
10.	**CONT (F1)** to access **SURVEY Survey: Job Name**. The instrument turns to the reflector. For **<Automation: ATR>** an ATR measurement is performed. If no prism was found, the instrument turns to the position typed in for **<Hz-Compass:>** and **<V-Compass:>**. For **<Automation: LOCK>** the instrument locks on the prism and the LOCK icon is displayed. Refer to "TPS1200 System Field Manual" for information on icons. If no prism was found, the instrument turns to the position typed in for **<Hz-Compass:>** and **<V-Compass:>**.	

3.3.2 Positioning Hz/V

Description

The **QUICK SET Positioning Hz/V** screen is used when the instrument is remote controlled and the telescope should be turned to a certain direction.
On the **Absolute** page, angular values for **<Hz-Angle:>** and **<V-Angle:>** related to the set orientation can be typed in.
On the **Relative** page, angular difference values for **<ΔHz:>** and **<ΔV:>** relative to the current telescope position can be typed in.These values are added to the current telescope position to calculate the new direction for the telescope to turn to.

Access

Press **Hz/V (F2)** in the **QUICK SET Change Settings to:** screen. Refer to "3.2 QUICK SET Change Settings to:".

OR

Press a hot key configured to access the screen **QUICK SET Positioning Hz/V**. Refer to "2.1 Hot Keys" for information on hot keys.

Hz/V positioning step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description
1.	**QUICK SET Change Settings to:**
2.	**Hz/V (F2)** to access **QUICK SET Positioning Hz/V, Absolute** page.
3.	• To position with absolute Hz/V angles continue with step 4. • To position with relative Hz/V angles continue with step 6.
4.	**QUICK SET Positioning Hz/V, Absolute** page **<Hz-Angle:>** Oriented horizontal direction for the instrument to turn to.

Step	Description
	<V-Angle:> Vertical direction for the instrument to turn to>.
5.	Continue with step 8.
6.	**PAGE (F6)** to access **QUICK SET Positioning Hz/V, Relative** page.
7.	**QUICK SET Positioning Hz/V, Relative** page **<ΔHz:>** Angular difference for the horizontal angle to turn to. **<ΔV:>** Angular difference for the vertical angle to turn to.
8.	**CONT (F1)**. The instrument turns to the reflector. For **<Automation: ATR>** an ATR measurement is performed. If no prism was found, the instrument turns to the position typed in for **<Hz-Angle:>** and **<V-Angle:>** or **<ΔHz:>** and **<ΔV:>**. For **<Automation: LOCK>** the instrument locks on the prism and the LOCK icon is displayed. Refer to "TPS1200 System Field Manual" for information on icons. If no prism was found, the instrument turns to the position typed in for **<Hz-Angle:>** and **<V-Angle:>** or **<ΔHz:>** and **<ΔV:>**.

3.3.3 Move by Joystick

Description

In **QUICK SET Move by Joystick** the instrument can be turned using the arrow keys on the keyboard of the instrument or the RX1200 or the arrow keys displayed on the touch screen.
When **QUICK SET Move by Joystick** is accessed, the EGL is turned on automatically. When leaving the screen, the EGL is turned off.

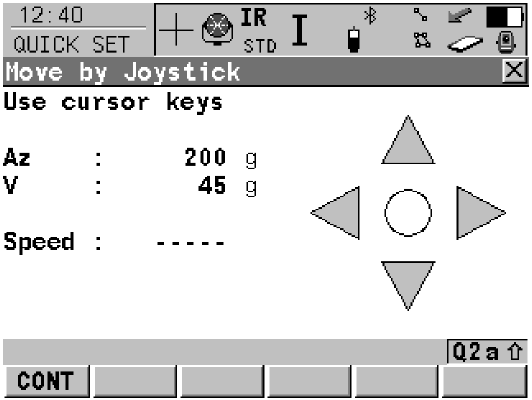
Access

Press **JSTCK (F3)** on the **QUICK SET Change Settings to:** screen. Refer to "3.2 QUICK SET Change Settings to:".

OR

Press a hot key configured to access the screen **QUICK SET Move by Joystick**. Refer to "2.1 Hot Keys" for information on hot keys.

QUICK SET Move by Joystick



CONT (F1)
To exit **QUICK SET Move by Joystick**.

Description of fields

Field	Option	Description
Speed	Output	Displays the rotating speed of the instrument. Press the same arrow key to change the speed from ----- to slow to medium to fast.

Next step

CONT (F1) to exit the **QUICK SET Move by Joystick** screen.

Move by joystick step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description
1.	**QUICK SET Change Settings to:**
2.	**JSTCK (F3)** to access **QUICK SET Move by Joystick**.
3.	**QUICK SET Move by Joystick** Use the arrow keys to start the telescope movement. Press an arrow key again to speed up the movement. Press any of the other arrow keys while the instrument turns to stop the movement.
☞	The behaviour of the touch screen when working with the RX1200 is similar. Additional to the arrow keys a stop key is displayed as a round key in the middle of the arrow keys. Press the stop key to stop the instrument movement.

3.3.4 Check Recorded Point / Backsight Point

Description

- The **QUICK SET Check Recorded Pt/Backsight Pt** screen is to check if a measured point is identical to a point already stored in the job or if the instruments orientation to a backsight point is still correct.
-

Access

Press **SHIFT USER** and **CHKPT (F4)**.

OR

Press a hot key configured to access **QUICK SET Check Recorded Pt/Backsight Pt**.

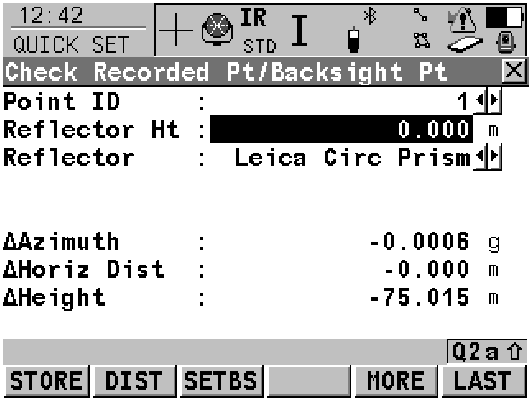
Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**.

Refer to "2.2 USER Key" for information on the **USER** key.

QUICK SET Check Recorded Pt/Backsight Pt



STORE (F1)
To exit **QUICK SET Check Recorded Pt/Backsight Pt**.

DIST (F2)
To measure a distance.

SETBS (F3)
To set the station and orientation of the instrument by taking a single measurement to a known backsight point. Refer to "45.6.3 Known Backsight Point".

MORE (F5)
To display additional information.
LAST (F6)
To recall **<Point ID:>** of the last checked point.
SHIFT POSIT (F4)
To position to the selected point.
For **<Automation: ATR>,** the instrument does an ATR search.
For **<Automation: LOCK>** the instrument tries to lock on to a reflector.

Next step
Refer to paragraph "Check point step-by-step" for information on how to check a recorded point.

Check point step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description
1.	**QUICK SET Change Settings to:**
2.	**CHKPT (F4)** to access **QUICK SET Check Recorded Pt/Backsight Pt**.
3.	**QUICK SET Check Recorded Pt/Backsight Pt** **<Point ID:>** Point ID to be checked. **<Calculated Az:>** Calculated azimuth between station and backsight point. **<Current Az:>** Current orientation. **<ΔAz:>** Difference between calculated azimuth and current orientation.

Step	Description
4.	**POSIT (F5)** to position to the point.
5.	**DIST (F2)** to measure a distance.
	SETBS (F3) to set the station and orientation of the instrument by taking a single measurement to a known backsight point.
6.	**CONT (F1)** to return to the screen **QUICK SET Change Settings to:** was accessed from.

If a stored point was checked, the **<Point ID:>** for that point is remembered and recalled when **LAST (F6)** is pressed.

3.3.5 L.GO (F5)/L.INT (F5)

L.GO (F5)

When **L.GO (F5)** is pressed, an ATR search is performed, the instrument locks onto the reflector without a measurement. **<Automation: LOCK>** is set. Unavailable for Smart-Station.

L.GO (F5) can be used to lock onto a prism located on an unstable surface for example on a boat or near to the instrument.

L.INT (F5)

When the instrument is locked onto the prism this lock can be interrupted with pressing **L.INT (F5)**. Unavailable for SmartStation.

L.INT (F5) can be used to interrupt the instrument from being locked onto the reflector, for example, to mark a ground point.

Distances to side shot points cannot be measured while the lock mode is interrupted with **<Automation: LOCK>**.

3.3.6 PS PowerSearch

Description

When **PS (F6)** is pressed, the instrument searches for the prism with PowerSearch. Refer to "32.2.2 PowerSearch" for more information on the functionality of PowerSearch.

3.4 Working examples

3.4.1 Working Example 1 - ATR

Description

Application:	Measure points with ATR.
Working technique:	Application program Survey.
Goal:	Find prism with ATR.

Requirement

<Automation: ATR>.

Prism search with ATR step-by-step

Step	Description
1.	Press **ALL(F1)** in **SURVEY Survey: Job Name**. ☞ Press **DIST (F2)** to measure a distance.
2.	The instrument searches for the prism with ATR search in the ATR window.
3.	If a prism was found • Distance and angles are measured and stored. • The instrument points in the direction of the prism and does not follow the prism when it is moving.
4.	If no prism was found • The instrument turns to the starting position of the ATR search.

3.4.2 Working Example 2 - LOCK

Description

Application:	Measure points with LOCK.
Working technique:	Application program Survey.
Goal:	Find prism with LOCK activated.

Requirement

<Automation: LOCK>.
This working example can also be applied if the instrument is remotely controlled by an RX1200.
This working example can not be applied for if the instrument is remotely controlled by an SmartStation.

Prism search with LOCK step-by-step

Step	Description
1.	Press **ALL(F1)** in **SURVEY Survey: Job Name**. Press **DIST (F2)** to measure a distance. Press **L.GO (F5)** to lock onto the reflector without measurement.
2.	The instrument searches for the prism with ATR search in the ATR window.
3.	If a prism was found • Distance and angles are measured and stored. • The instrument locks on to the prism and follows its movements. The LOCK icon is displayed.
4.	If no prism was found • The instrument turns to the starting position of the ATR search.

3.4.3 Working Example 3 - Loss of LOCK

Description

Application:	Points were measured with LOCK until loss of lock.
Working technique:	Application program Survey.
Goal:	Prism search after loss of lock.

Requirements

- **<Automation: LOCK>**
- The instrument is locked onto the prism.
- The instrument is remotely controlled by an RX1200.
- **<Predict for: 3 s>**

Prism search after loss of LOCK step-by-step

Step	Description
1.	Move the prism behind an object to make the instrument lose lock.
2.	The prism path is predicted for three seconds. The instrument turns with the calculated velocity and direction of the lost prism during this time.
3.	If a prism was found during prediction, • the instrument locks on to the prism and follows its movements. The LOCK icon is displayed.

Step	Description
4.	If no prism was found during prediction, a search is started depending on the setting of **<Search with:>** in **CONFIGURE Automatic Prism Search** • For **<Search with: No Search>**: No search is started. • For **<Search with: ATR>**: An ATR search is started in a dynamic ATR window which is calculated depending on the velocity of the prism. • For **<Search with: PowerSearch>** and **<PS Window: On>**: The prism is searched for with PowerSearch in the PS window. • For **<Search with: PowerSearch>** and **<PS Window: Off>**: The prism is searched for with PowerSearch in a dynamic PS window
5.	If prism was not found with **<Search with:>**, • The instrument telescope stays at the end position of prediction. • The EGL is activated.
☞	Refer to "3.4.2 Working Example 2 - LOCK" for information on how to enable lock.

3.4.4 Working Example 4 - PS

Description

Application:	Search for a prism with PowerSearch.
Working technique:	Application program Survey.
Goal:	Find prism with PowerSearch.

Requirement

<PS Window: Off>

Prism search with PS step-by-step

Step	Description
1.	**QUICK SET Change Settings to:** **PS (F6)**.
2.	The instrument searches for the prism with PowerSearch. The search consists of a short swing in anti-clockwise direction followed by a complete 360° turn in the other direction.
3.	If a prism is detected the movement is stopped and an ATR search is performed. For **<Automation: None>** the ATR is turned off again. For **<Automation: ATR>** measurements can be performed. For **<Automation: LOCK>** the instrument locks onto the reflector and follows the movement of the prism.
4.	If no prism was found, the instrument telescope turns to the start position of the search.

4 Main Menu

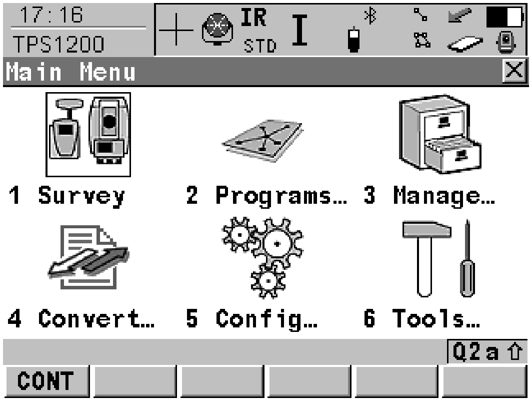
4.1 Main Menu Functions

Description

The main menu is normally the first screen displayed when the instrument is switched on. If the PIN protection is active, **TPS1200 Enter Security PIN Code** is displayed first. After typing in the correct PIN code, the main menu is displayed.

☞ If desired, the instrument can be configured to start up with a user defined screen. Refer to "18.6 Start Up & Power Down".

TPS1200 Main Menu



CONT (F1)
To select the highlighted option and to continue with the subsequent screen.

Description of the main menu functions

Main menu function	Description	Refer to chapter
Survey	• To start measuring.	4.2
Programs...	• To select and start application programs.	4.3
Manage...	• To manage jobs, data, codelists, configurations sets, reflectors and coordinate systems.	4.4
Convert...	• To export data from a job on the instrument to a file on the CompactFlash card in a customised ASCII format or in DXF format. • To import ASCII, GSI or DXF data from a file on the CompactFlash card to a job on the instrument. • To copy points between jobs.	4.5
Config...	• To access all configuration parameters related to a survey, the instrument, the interfaces and SmartStation.	4.6
Tools...	• To format the memory device. • To upload files relevant for the instrument functionality, for example, firmware and language files. • To transfer non data related files between instrument and CompactFlash card. • To perform arithmetic operations such as addition, subtraction, multiplication, division, statistical functions, trigonometric functions, conversions or roots.	4.7

Main menu function	Description	Refer to chapter
	• To view files on the CompactFlash card or the internal memory. • To manually type in a licence key. • To calibrate the instrument.	

4.2 Survey

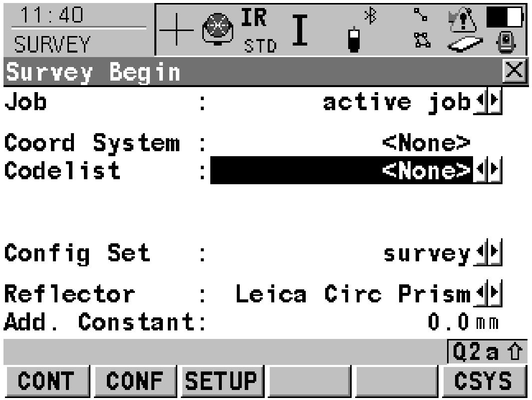
Access

Select **Main Menu: Survey**.

Description

Survey provides the functionality used to perform the survey.

SURVEY Survey Begin



CONT (F1)
To accept settings and to continue with screen **SURVEY Survey: Job Name**.

CONF (F2)
To configure auto point and remote point measurements functionality.

SETUP (F3)
To set up station. Accesses **SETUP Station Setup**.

CSYS (F6)
To change the coordinate system. Refer to "10.4.1 Creating a New Coordinate System" for information on defining a coordinate system.

Next step

For **Main Menu: Survey**	Refer to chapter 47

4.3 Programs...

Access

Select **Main Menu: Programs....**

OR

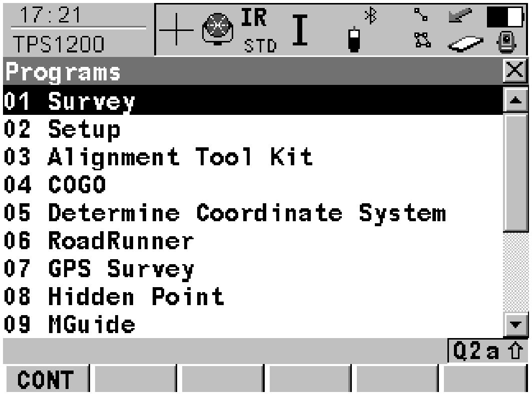
Press **PROG**.

Description

Programs... accesses the application programs menu. The screen of the application programs menu is called **TPS1200 Programs**.

TPS1200 Programs

The application programs menu contains all loaded application programs including Survey and Setup. They are listed in the order in which they were loaded.



CONT (F1)
To select the highlighted option and to continue with the subsequent screen.

Next step

For **Main Menu: Programs...\Survey**	Refer to chapter 47
For **Main Menu: Programs...\Setup**	Refer to chapter 45

For **Main Menu: Programs...\Alignment Tool Kit**	Refer to the separate manual
For **Main Menu: Programs...\COGO**	Refer to chapter 36
For **Main Menu: Programs...\Determine Coordinate System**	Refer to chapter 37
For **Main Menu: Programs...\GPS Survey**	Refer to chapter 40
For **Main Menu: Programs...\Hidden Point**	Refer to chapter 41
For **Main Menu: Programs...\MGuide**	Refer to the separate manual
For **Main Menu: Programs...\Reference Line**	Refer to chapter 42
For **Main Menu: Programs...\Reference Plane**	Refer to chapter 43
For **Main Menu: Programs...\RoadRunner**	
☞ This program could contain the following:	
• RoadRunner	Refer to the separate manual
• RoadRunner Tunnel	Refer to the separate manual
• RoadRunner Rail	Refer to the separate manual
For **Main Menu: Programs...\Sets of Angles**	
☞ This program could contain the following:	
• Sets of Angles	Refer to chapter 44
• Monitoring	Refer to chapter 44
For **Main Menu: Programs...\Stakeout**	Refer to chapter 46
For **Main Menu: Programs...\Survey Cross Section**	Refer to chapter 50
For **Main Menu: Programs...\Traverse**	Refer to chapter 51
For **Main Menu: Programs...\Volume Calculations**	Refer to chapter 52

4.4 Manage...

Access

Select **Main Menu: Manage....**

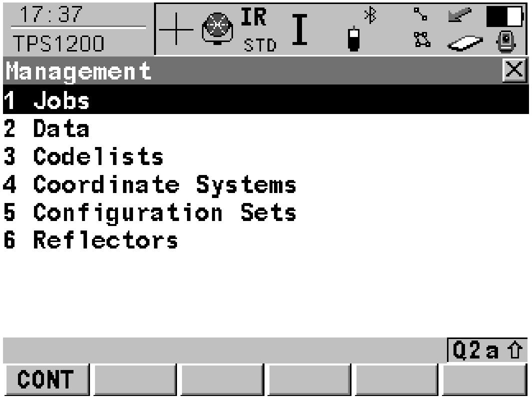
Description

Manage... is used to manage the following:

- jobs.
- data.
- codelists.
- coordinate systems.
- configuration sets.
- reflectors.

Management functions include creating, selecting, editing and deleting.

TPS1200 Management



CONT (F1)
To select the highlighted option and to continue with the subsequent screen.

Next step

For **Main Menu: Manage...\Jobs**	Refer to chapter 5.
For **Main Menu: Manage...\Data**	Refer to chapter 6.
For **Main Menu: Manage...\Codelists**	Refer to chapter 7.
For **Main Menu: Manage...\Coordinate Systems**	Refer to chapter 10.
For **Main Menu: Manage...\Configuration Sets**	Refer to chapter 11.
For **Main Menu: Manage...\Reflectors**	Refer to chapter 12.

4.5 Convert...

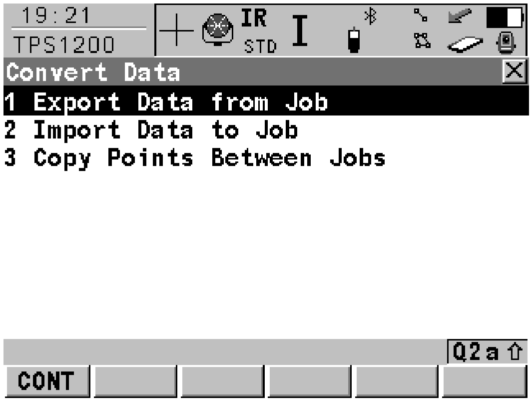
Access

Select **Main Menu: Convert...**.

Description

Convert... provides access to data exchange options.

TPS1200 Convert Data



CONT (F1)
To select the highlighted option and to continue with the subsequent screen.

Next step

For **Main Menu: Convert...\Export Data from Job**	Refer to chapter 13.
For **Main Menu: Convert...\Import Data to Job**	Refer to chapter 14.
For **Main Menu: Convert...\Copy Points Between Jobs**	Refer to chapter 15.

4.6 Config...

Access

Select **Main Menu: Config...**.

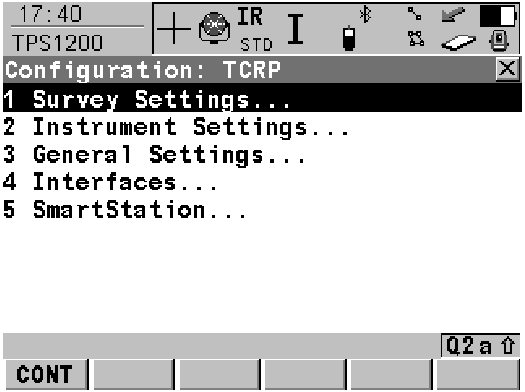
OR

Press **USER** and then **CONF (F2)**.

Description

Config... accesses all configuration parameters related to a survey, the instrument, the interfaces and SmartStation. Any changes made are stored in the configuration set.

TPS1200 Configuration: Configuration Set



CONT (F1)
To select the highlighted option and to continue with the subsequent screen.

Next step

For **Main Menu: Config...\Survey Settings...**	Refer to chapter 16
For **Main Menu: Config...\Instrument Settings...**	Refer to chapter 17
For **Main Menu: Config...\General Settings...**	Refer to chapter 18
For **Main Menu: Config...\Interfaces...**	Refer to chapter 20
For **Main Menu: Config...\SmartStation...**	Refer to chapter 22

4.7 Tools...

Access

Select **Main Menu: Tools....**

Description

Tools... provides functionality which is not directly related to surveying data.

TPS1200 Tools Menu

CONT (F1)
To select the highlighted option and to continue with the subsequent screen.

Next step

For **Main Menu: Tools...\Format Memory Device**	Refer to chapter 23
For **Main Menu: Tools...\Transfer Objects...**	Refer to chapter 24
For **Main Menu: Tools...\Upload System Files...**	Refer to chapter 25
For **Main Menu: Tools...\Calculator**	Refer to chapter 26.
For **Main Menu: Tools...\File Viewer**	Refer to chapter 27.
For **Main Menu: Tools...\Licence Keys**	Refer to chapter 28
For **Main Menu: Tools...\Check & Adjust...**	Refer to chapter 29

5 Manage...\Jobs

5.1 Overview

Description

Jobs
- structure surveying projects.
- contain all points, lines, areas and codes that are recorded and stored.
- can be downloaded to LGO for post-processing or for data transfer to a further program.
- can be uploaded from LGO, for example, for stakeout operations.
- may be stored on the CompactFlash card or internal memory, if fitted.

Type of jobs

- Data jobs. Explained in this chapter.
- DTM jobs. Refer to "46.4.5 Staking Out a DTM".
- Road jobs. Refer to the "TPS1200 RoadRunner Manual".

Default job

A job called **Default** is available on the instrument after formatting the memory device, inserting a previously formatted CompactFlash card or deleting all jobs from **MANAGE Jobs (Device)**.

Active job

The active job is the one data is stored to. One job is always considered the active job. After formatting the memory device, the job **Default** is used until a user defined job is created and selected.

5.2 Accessing Job Management

Access

Select **Main Menu: Manage...\Jobs**.

OR

Press a hot key configured to access the screen **MANAGE Jobs (Device)**.
Refer to "2.1 Hot Keys" for information on hot keys.

OR

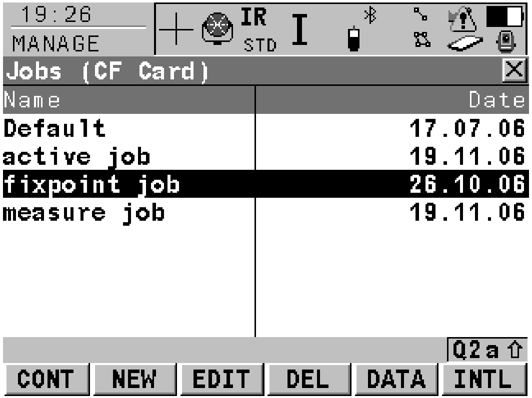
Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

OR

From a choicelist in some screens, e.g. the **XX Begin** screen of application programs.

MANAGE Jobs (Device)

Listed are all jobs stored on the CompactFlash card or in the internal memory, if fitted, depending on the current device.



CONT (F1)
To select the highlighted job and to return to the screen from where this screen was accessed.

NEW (F2)
To create a job. Refer to "5.3 Creating a New Job".

EDIT (F3)
To edit the highlighted job. Refer to "5.4 Editing a Job".

DEL (F4)
To delete the highlighted job.

DATA (F5)
To view, edit and delete points, lines and areas stored with the job. Points, lines and areas are shown on separate pages. Selected sort and filter settings apply. Refer to "6.3 Point Management".

CFCRD (F6) or **INTL (F6)**
Available for instruments with internal memory. To change between viewing jobs stored on the CompactFlash card or internal memory.

Next step

IF a job	THEN
is to be selected	highlight the desired job. **CONT (F1)** closes the screen and returns to the screen from where **MANAGE Jobs (Device)** was accessed.
is to be created	**NEW (F2)**. Refer to "5.3 Creating a New Job".
is to be edited	highlight the job and **EDIT (F3)**. Refer to "5.4 Editing a Job".

5.3 Creating a New Job

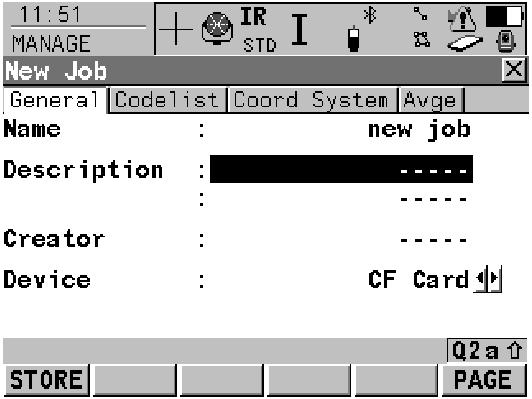
Access

Refer to "5.2 Accessing Job Management" to access **MANAGE Jobs (Device)**.

Create job step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	In **MANAGE Jobs (Device)** highlight a job. The settings of this job are applied to the new job.	5.2
2.	**NEW (F2)** to access **MANAGE New Job**.	



STORE (F1)
To store the settings and to return to the screen from where **MANAGE New Job** was accessed.

PAGE (F6)
To change to another page on this screen.

Step	Description	Refer to chapter
3.	**MANAGE New Job, General** page **<Name:>** A unique name for the new job. The name may be up to 16 characters long and may include spaces. Input required. **<Description:>** Two lines for a detailed description of the job. This can be for example, work to be performed or the classes contained in the job. Input optional. **<Creator:>** The person's name who is creating the new job. Input optional. **<Device:>** The device on which the new job will be stored. Depending on the instrument options, this may be an output field.	
4.	**PAGE (F6)** changes to the **Codelist** page.	
5.	**MANAGE New Job, Codelist** page **<Codelist:>** Choosing a codelist copies the codes to the job.	8
6.	**PAGE (F6)** changes to the **Coord System** page.	
7.	**MANAGE New Job, Coord System** page **<Coord System:>** Choosing a coordinate system attaches it to the job. All other fields on this screen are output fields. They depend on the transformation type of the selected coordinate system.	10.4
8.	**PAGE (F6)** changes to the **Avge** page.	
9.	**MANAGE New Job, Avge** page	

Step	Description	Refer to chapter
	In order to check measurements, the same point can be measured more than once. If activated, an average or an absolute difference is calculated. **<Averaging Mode:>** Defines the averaging principles for multiple measured points. **<Averaging Mode: Average>** computes the average for the position and the height. Points exceeding the defined limits are marked with ! in **MANAGE Edit Point**, **Mean** page. **<Averaging Mode: Absolute Diffs>** computes the absolute differences between two points selected from a list of measured points which are all stored with the same point ID. The selection determines the availability of the subsequent fields for setting the acceptable averaging limits or absolute differences. • For **<Averaging Mode: Average>**: **<Method:>** The method used for computing the average. **<Method: Weighted>** calculates a weighted average while **<Method: No Weighting>** is calculating an arithmetic average. **<Points to Use:>** The type of points which will be taken into account for averaging. **<Avge Limit Pos:>** and **<Avge Limit Ht:>** The acceptable difference for the position and height components. • For **<Averaging Mode: Absolute Diffs>**:	6.3.4

Step	Description	Refer to chapter
	<Points to Use:> The type of points which will be taken into account for absolute differences. From **<Easting:>** to **<Cartesian Z:>** The acceptable absolute differences for each coordinate component. • For **<Averaging Mode: Off>**: No other fields are available.	
10.	**STORE (F1)** creates the new job and returns to **MANAGE Jobs (Device)**.	

5.4 Editing a Job

Access

Refer to "5.2 Accessing Job Management" to access **MANAGE Jobs (Device)**.

Edit job step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	In **MANAGE Jobs (Device)** highlight a job to be edited.	
2.	**EDIT (F3)** to access **MANAGE Edit Job: Job Name, General** page.	
3.	**MANAGE Edit Job: Job Name, General** page **<Name:>** Rename the job. **<Device:>** Cannot be edited. The remaining functionality on this page is identical with the creation of a new job.	5.3
☞	**DATA (F5)** accesses **MANAGE Data: Job Name**. To view, edit and delete points, lines and areas stored with the job. Points, lines and areas are shown on separate pages. Selected sort and filter settings apply.	6.2
☞	**SHIFT LOG (F5)** accesses **MANAGE Data Log: Job Name**. To view, edit and delete points, lines and areas stored with the job. Points, lines and areas are sorted by time in one list.	6.5
4.	**PAGE (F6)** changes to the **Codelist** page.	
5.	Are codes stored in the job?	

Step	Description	Refer to chapter
	• If **no**, continue with step 6. • If **yes**, continue with step 8.	
6.	No codes are stored in the job. **MANAGE Edit Job: Job Name, Codelist** page **<Codelist: <None>>** This default setting can be changed. Choosing a codelist copies the codes to the job. All codelists from **Main Menu: Manage...\Codelists** can be selected.	8
7.	**PAGE (F6)** changes to the **Coord System** page. Continue with step 10.	
8.	Codes are stored in the job. **MANAGE Edit Job: Job Name, Codelist** page **<Codelist:>** If codes had been copied from a System RAM codelist, the name of the codelist is displayed. If codes have been typed in, then the name of the active job is displayed.	
☞	**IMPRT (F2)** adds additional codes from a new codelist to the job. The name of this codelist is copied to the job.	7
☞	**SHIFT EXPRT (F2)** copies codes from the job to an existing or new codelist.	7
☞	**CODES (F4)** views codes currently stored in the job.	5.5
9.	**PAGE (F6)** changes to the **Coord System** page.	
10.	**MANAGE Edit Job: Job Name, Coord System** page	

Step	Description	Refer to chapter
	The functionality on this page is identical with the creation of a new job	5.3
11.	**PAGE (F6)** changes to the **Avge** page.	
12.	**MANAGE Edit Job: Job Name, Avge** page The functionality on this page is identical with the creation of a new job.	 5.3
☞	**DATA (F5)** accesses **MANAGE Data: Job Name**. To view, edit and delete points, lines and areas stored with the job. Points, lines and areas are shown on separate pages. Selected sort and filter settings apply.	6.2
☞	**SHIFT LOG (F5)** accesses **MANAGE Data Log: Job Name**. To view, edit and delete points, lines and areas stored with the job. Points, lines and areas are sorted by time in one list.	6.5
13.	**STORE (F1)** stores the changes and returns to the screen from where **MANAGE Edit Job: Job Name** was accessed.	

5.5 Managing Job Codes

Description

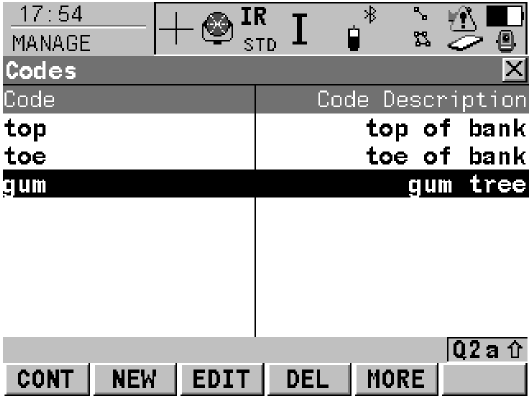
To view, edit, group and sort all codes currently stored in the job. The functionality of this screen is mainly the same as for **MANAGE Codes**. For simplicity, the functionality which is different from **MANAGE Codes** is explained here. Refer to "7.5 Managing Codes" for information on **MANAGE Codes**.

Access step-by-step

Available for jobs which have a codelist attached.

Step	Description
1.	Refer to "5.2 Accessing Job Management" to access **MANAGE Jobs (Device)**.
2.	In **MANAGE Jobs (Device)** highlight a job to be edited.
3.	**EDIT (F3)** to access **MANAGE Edit Job: Job Name**.
4.	In **MANAGE Edit Job: Job Name**, **PAGE (F6)** until the **Codelist** page is active.
5.	**CODES (F4)** to access **MANAGE Job Codes**.

MANAGE Job Codes



CONT (F1)
To return to **MANAGE Edit Job: Job Name**, Codelist page.

NEW (F2)
To create a new code. Refer to "7.5.2 Creating a New Code".

EDIT (F3)
To edit the highlighted code. Accesses **MANAGE Edit Code** where new attributes can be added to a code and line styles can be changed. Refer to paragraph "MANAGE Edit Code".

DEL (F4)
To delete an existing code.

MORE (F5)
To display information about the code group, the code type, the code description and the quick codes if available.

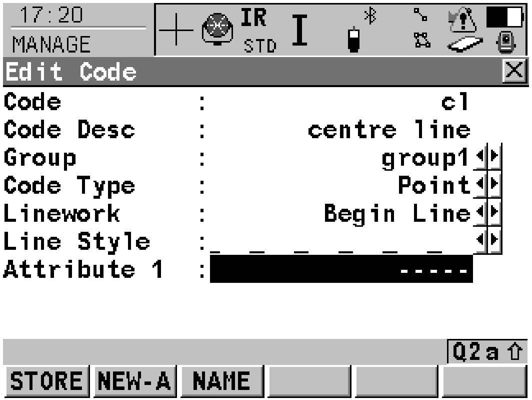
SHIFT GROUP (F4)
To access **MANAGE Code Groups**. To view, create, activate and deactivate code groups. Refer to "7.6 Managing Code Groups".

SHIFT SORT (F5)
To access **MANAGE Sort Codes**. To sort codes by code name, code description, quick code or last used.

Next step

IF	THEN
the job codes do not need to be changed	**CONT (F1)** closes the screen and returns to the screen from where **MANAGE Job Codes** was accessed.
a new job code is to be created	**NEW (F2).** Refer to "7.5.2 Creating a New Code".
an existing job code is to be edited	highlight the job code and **EDIT (F3).** Refer to paragraph "MANAGE Edit Code".

MANAGE Edit Code



STORE (F1)
To store the code including any newly created attributes and to return to the screen from where **MANAGE Edit Code** was accessed.

NEW-A (F2)
To add a new attribute to a code.

NAME (F3) or **VALUE (F3)**
Available for attributes for which an attribute name can be typed in. To highlight **<Attribute n:>** or the field for the attribute value. The name of **<Attribute n:>** can be edited and an attribute value can be typed in.

The behaviour of this screen varies with the type of code to be edited. The differences are explained in the table.

Type of code	Description
Point codes and **Free codes**	• New attributes can be added with **NEW-A (F2)**.
Line codes and **Area codes**	• New attributes can be added with **NEW-A (F2)**. • The line style can be changed. This new line style is stored to the code. It can be decided whether or not to update the line style of all previously stored lines/areas with this code in this job.

6 Manage...\Data

6.1 Overview

Description

- Data is a generic term for points, lines and areas.
- Data management is the administration of data stored in the active job. This includes
  - viewing data with their related information.
  - editing data.
  - creating new data.
  - deleting existing data.
  - filtering existing data.

Objects

- Objects
  - are points, lines and areas.
  - have a unique identification ID. This is the point ID, the line ID and the area ID.
  - may or may not have a code attached. This is either a point code, a line code or an area code depending on the type of object. Refer to "8 Coding" for information on coding.

6.2 Accessing Data Management

Access

Select **Main Menu: Manage...\Data**.

OR

Press a hot key configured to access the screen **MANAGE Data: Job Name**.
Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

OR

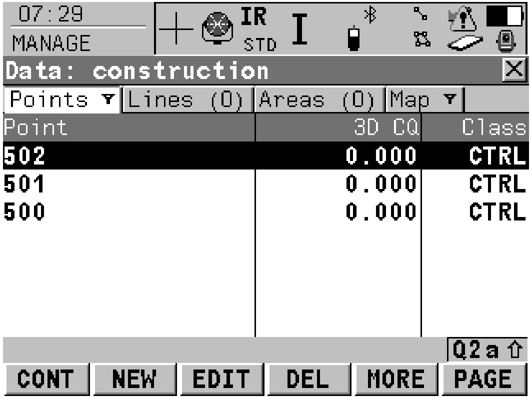
From a choicelist in some screens for example in application programs.

OR

Tap the line/area icon. Refer to the TPS1200 System Field Manual for details on icons.

☞ The objects listed on the pages belong to the currently active job. The objects listed and their order depend on the active sort and filter settings. An active filter for a page is indicated by Y to the right of the name of the page. Refer to "6.6 Point Sorting and Filters" for information about sort and filter settings.

MANAGE
Data: Job Name, Points page



CONT (F1)
To close the screen and return to the screen from where this screen was accessed.

NEW (F2)
To create a point.

EDIT (F3)
To edit the highlighted point.

DEL (F4)
To delete the highlighted point.

MORE (F5)
To display information about the codes if stored with any point, the time and the date of when the point was stored, the 3D coordinate quality, the class and the flag for Linework.

PAGE (F6)
To change to another page on this screen.

SHIFT LOG (F4)
To view points, lines, areas and free codes stored with the job sorted by time. Refer to "6.5 Data Log".

SHIFT FILT (F5)
To define sort and filter settings. Refer to "6.6 Point Sorting and Filters".

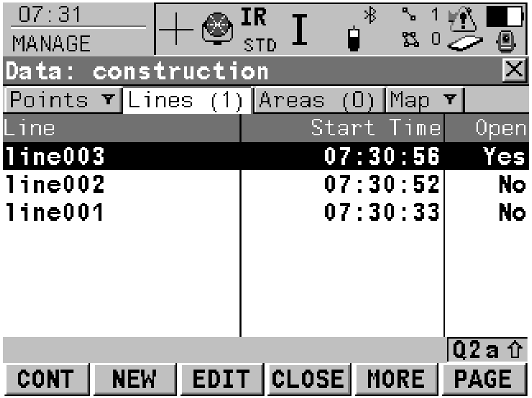
Next step

IF	THEN
a point is to be created	highlight the point and **NEW (F2)**. Refer to "6.3.2 Creating a New Point".
a point is to be edited	highlight the point and **EDIT (F3)**. Refer to "6.3.3 Editing a Point".
a line/area is to be managed	**PAGE (F6)** changes to the **Lines (X)** and **Areas (X)** page. Refer to paragraph "MANAGE Data: Job Name, Lines (X) page; MANAGE Data: Job Name, Areas (X) page".

MANAGE Data: Job Name, Lines (X) page; MANAGE Data: Job Name, Areas (X) page

The explanations for the softkeys given below are valid for both pages.

The number in brackets next to the name of the page indicate the number of open lines/areas. Example: **Lines (2)/Areas (2)** means that two lines/areas are open.



CONT (F1)
To close the screen and return to the screen from where this screen was accessed.

NEW (F2)
To create a line/area. After storing the new line, all existing lines and areas which are open are closed.

EDIT (F3)
To edit the highlighted line/area.

CLOSE (F4) and **OPEN (F4)**
To change between the options in the **Open** column of the highlighted line/area.

MORE (F5)
To display information about the codes if stored with any line/area, the start time, the end time of when the last point was added to the line/area, the length of the line, the perimeter and the area of the area.

PAGE (F6)
To change to another page on this screen.

SHIFT DEL (F4)
To delete the highlighted line/area.

SHIFT FILT (F5)
To define sort and filter settings. Refer to "6.6 Point Sorting and Filters".

Description of columns

Column	Description
Line or **Area**	The listed lines/areas already stored in the active job.
Open	The status of a line/area. • **Yes** The line/area is open. Measured points are assigned to the line/area. • **No** The line/area is closed. Measured points are not assigned to the line/area. **CLOSE (F4)** and **OPEN (F4)** change between the options.

Next step

IF the line/area	THEN
management is completed	**CONT (F1)** closes the screen and returns to the screen from where this screen was accessed.
is to be opened	highlight the line/area and **OPEN (F4)**.
which was last used is to be opened	press a hot key configured to re-open last used line/area. This hot key can be used at any time. Refer to "2.1 Hot Keys" for information on hot keys.
is to be closed	highlight the line/area and **CLOSE (F4)** OR press a hot key configured to close all open lines/areas. This hot key can be used at any time. Refer to "2.1 Hot Keys" for information on hot keys.
is to be created	**NEW (F2)**. Refer to "6.4.2 Creating a New Line/Area".
is to be edited	highlight the line/area and **EDIT (F3)** to access **MANAGE Edit Line: Line ID** or **MANAGE Edit Area: Area ID**. Refer to "6.4.3 Editing a Line/Area".
is to be viewed	**PAGE (F6)** until the **Map** page is active. Refer to "34.5 Map Mode" for information about the functionality and softkeys available on the **Map** page.

6.3 Point Management

6.3.1 Terminology

Description

- This chapter describes technical terms related to data management.

Coordinate triplet

- A measured point consists of three coordinate components - two horizontal components and one vertical component. The generic term for the three coordinate components is coordinate triplet.
- Depending on the class, a point ID can contain more than one coordinate triplet of the same and/or of different classes.

Class

The class describes the type of coordinate triplet.

Description of classes

The following table shows the classes in descending hierarchical order.

Class	Characteristic	Description
CTRL	Type	Control points. Automatically assigned to entered points.
	Instrument source	**TPS**, **GPS** or **LGO**.
	Number of triplets	One.
ADJ	Type	Adjusted points using the adjustment program.
	Instrument source	**LGO**.
	Number of triplets	One.
REF	Type	• Station point set by Setup application program.

Class	Characteristic	Description
		• Reference point received by a real-time rover.
	Instrument source	**TPS**, **GPS** or **LGO**.
	Number of triplets	One.
AVGE	Type	Averaged point calculated when more than one coordinate triplet of class **MEAS** exist for the same point ID unless **<Averaging Mode: Off>**.
	Instrument source	**TPS** or **GPS**.
	Number of triplets	One.
MEAS	Type	• Measured points with angles and distances. • Measured points differentially corrected using real-time phase, real-time code or post-processing. • Calculated from some application programs.
	Instrument source	**TPS**, **GPS** or **LGO**.
	Number of triplets	Multiple. With more than one measured coordinate triplet, the average for the position and the height can be computed.
NAV	Type	Navigated points using uncorrected code solutions of a single epoch or SPP positions.
	Instrument source	**GPS**.
	Number of triplets	Multiple.
EST	Type	Estimated points from LGO.

Class	Characteristic	Description
	Instrument source	**LGO**.
	Possible number of triplets	One.
NONE	Type	Measured points with angles.
	Instrument source	**TPS**.
	Possible number of triplets	Unlimited.

Sub class

The sub class describes certain classes in detail. It indicates the status of the position when a coordinate triplet was measured and how the coordinates were determined.

Sub class	Description	Instrument source
COGO	Indirect coordinate determination with application program COGO.	**GPS** or **TPS**
NONE	Direction is available but no coordinates.	**TPS**
	Height is available but no position coordinates.	**Level**
TPS	Measured with distances and angles.	**TPS**
Fixed (Height)	Manually entered and fixed in height.	**GPS** or **TPS**
Fixed (Position)	Manually entered and fixed in position.	**GPS** or **TPS**
Fixed (Pos & Ht)	Manually entered and fixed in position and height.	**GPS** or **TPS**
GPS Code Only	Direct coordinate determination with code solution.	**GPS**

Sub class	Description	Instrument source
GPS Fixed	Direct coordinate determination with phase fixed solution.	**GPS**
GPS Float	Direct coordinate determination with autonomous solution coming from LGO.	**GPS**
Hidden Point	Indirect coordinate determination with hidden point measurements.	**GPS** or **TPS**
Additional sub classes for SmartStation with the ATX1230 GG antenna:		
GNSS Code Only	Direct coordinate determination with code solu-tion.	**GPS**
GNSS Fixed	Direct coordinate determination with phase fixed solution.	**GPS**
GNSS Float	Direct coordinate determination with autonomous solution coming from LGO.	**GPS**

Source

The source describes the application program or functionality that generated a coordinate triplet and the method with which it was created.

Source	Originated from application program/functionality	Instrument source
ASCII File	Convert Data, Import ASCII/GSI Data to Job	**GPS** or **TPS**
Arc Base Pt	COGO, Arc Calculation - Base Point	**GPS** or **TPS**
Arc Centre Pt	COGO, Arc Calculation - Centre Point	**GPS** or **TPS**
Arc Offset Pt	COGO, Arc Calculation - Offset Point	**GPS** or **TPS**

Source	Originated from application program/functionality	Instrument source
Arc Segmt Pt	COGO, Arc Calculation - Segmentation	**GPS** or **TPS**
Backward Brg-Dist	Hidden point measurements, Backward Bearing and Distance	**GPS**
Bearing-Distance	Hidden point measurements, Bearing and Distance	**GPS**
Chainage-Offset	Hidden point measurements, Chainage and Offset	**GPS**
COGO Area Divsn.	COGO Area Division	**GPS** or **TPS**
COGO Shift/Rtn	COGO, Shift, Rotate & Scale (Manual) COGO, Shift, Rotate & Scale (Match Pts)	**GPS** or **TPS**
COGO Traverse	COGO, Traverse	**GPS** or **TPS**
Copied Point	Convert Data, Copy points between jobs	**GPS** or **TPS**
Cross Section	Survey Cross Section	**GPS** or **TPS**
Double Bearing	Hidden point measurements, Double Bearing	**GPS**
Double Distance	Hidden point measurements, Double Distance	**GPS**
GSI File	Convert Data, Import ASCII/GSI Data to Job	**GPS** or **TPS**
Hidden Point	Hidden Point, auxiliary points	**TPS**
Intsct (Brg Brg)	COGO, Intersection - Bearing - Bearing	**GPS** or **TPS**
Intsct (Brg Dst)	COGO, Intersection - Bearing - Distance	**GPS** or **TPS**
Intsct (Dst Dst)	COGO, Intersection - Distance - Distance	**GPS** or **TPS**
Intsct (4 Pts)	COGO, Intersection - By points	**GPS** or **TPS**

Source	Originated from application program/functionality	Instrument source
LandXML	Design to Field in LGO converting data from LandXML software to be used in the field	**LGO**
Line Base Pt	COGO, Line Calculation - Base Point	**GPS** or **TPS**
Line Offset Pt	COGO, Line Calculation - Offset Point	**GPS** or **TPS**
Line Segmt Pt	COGO, Line Calculation - Segmentation	**GPS** or **TPS**
None	No information on the source is available	**GPS** or **TPS**
RefLine (Grid)	Reference Line, staked out in a defined grid	**GPS** or **TPS**
RefLine (Meas)	Reference Line, measured	**GPS** or **TPS**
RefLine (Stake)	Reference Line, staked out	**GPS** or **TPS**
Ref Plane (Meas)	Reference Plane, measured	**GPS** or **TPS**
Ref Plane (Scan)	Reference Plane, scan	**TPS**
Road Runner	Road Runner	**GPS** or **TPS**
Sets of Angles	Sets of Angles	**TPS**
Setup (Known BS)	Setup, Known Backsight Point	**TPS**
Setup (Loc Rsct)	Setup, Local Resection	**TPS**
Setup (Ori&Ht)	Setup, Orientation and Height Transfer	**TPS**
Setup (Resect)	Setup, Resection	**TPS**
Setup (Resect H)	Setup, Resection Helmert	**TPS**
Setup (Set Az)	Setup, Set Azimuth	**TPS**

Source	Originated from application program/functionality	Instrument source
Srvy Auto Offset	Survey Auto Points, automatically recorded with offsets	**GPS** or **TPS**
Stakeout	Stakeout	**GPS** or **TPS**
Survey	Survey, measured	**TPS**
Survey (Auto)	Survey Auto Points, automatically recorded	**TPS**
Survey (Event)	Survey, Event input	**GPS**
Survey (Instant)	Survey, measured with **<Pt Occupation: Instantaneous>** in **CONFIGURE Point Occupation Settings**	**GPS**
Survey (Rem Pt)	Survey, Remote Point	**TPS**
Survey (Static)	Survey, measured with **<Pt Occupation: Normal>** in **CONFIGURE Point Occupation Settings**	**GPS**
Traverse	Traverse	**TPS**
Unknown	-	**GPS** or **TPS**
User Application	Customised application programs	**GPS** or **TPS**
User Entered	Manually entered point	**GPS** or **TPS**

Instrument source

The instrument source describes where the coordinate triplet was measured or entered. The options are **GPS**, **TPS**, **LGO** or **Level**.

Coordinate quality

Description

The **C**oordinate **Q**uality is an indicator for the estimated quality of the point coordinates. The coordinate quality of the measurements is used in point averaging.

Column	Description
Est 3D CQ	Estimated 3D coordinate quality of computed position.
Est 2D CQ	Estimated plan coordinate quality of computed position.
Est 1D CQ	Estimated height coordinate quality of computed position.

Vertical angles are always assuming Zenith angles and not elevation angles. Standard deviations of circle readings relate to one face measurements.

$$\rho = \frac{200}{\pi}$$

TPS12_075

Standard deviation of circle reading

$$\sigma_{Hz,\,V}\,[rad] = \frac{\sigma_{Hz,\,V}\,[gon]}{\rho}$$

TPS12_076

$\sigma_{Hz,V}$ Standard deviation of circle reading if $\sigma_{Hz} = \sigma_V$.
σ_{Hz}: Standard deviation of horizontal circle reading.
σ_V: Standard deviation of vertical circle reading.

Standard deviation of distance measurement

$$\sigma_D = c_D + ppm * D$$

TPS12_077

σ_D	Standard deviation of distance measurement.
c_D	Constant part of EDM accuracy.
ppm	ppm part of EDM accuracy.
D	Slope Distance.

1D estimated coordinate quality

$$1D\ CQ = \sqrt{\sigma^2{}_D * \cos^2 V + \sigma^2{}_{Hz,\ V} * D^2 * \sin^2 V}$$

TPS12_072

1D CQ	Estimated coordinate quality of the height.
V	Zenith angle.

2D estimated coordinate quality

$$2D\ CQ = \sqrt{\sigma^2{}_D * \sin^2 V + \sigma^2{}_{Hz,\ V} * D^2}$$

TPS12_073

2D CQ	Estimated horizontal coordinate quality.

3D estimated coordinate quality

$$3D\ CQ = \sqrt{\sigma^2{}_D + \sigma^2{}_{Hz,\ V} * D^2 * (1 + \sin^2 V)}$$

TPS12_074

3D CQ	Estimated spatial coordinate quality.

Working Example 1

Instrument:	TXA1202
Angular accuracy:	2" = $6.1728 * 10^{-4}$ gon => σHz,V = 2"*$\sqrt{2}$
EDM accuracy:	2 mm + 2 ppm for an IR measurement
Slope distance:	150 m
Hz:	210 gon
V:	83 gon

1D CQ = 0.00207 m ≅ 2.1 mm
2D CQ = 0.00303 m ≅ 3.0 mm
3D CQ = 0.00367 m ≅ 3.7 mm

Working Example 2

Instrument:	TXA1202
Angular accuracy:	2" = $6.1728 * 10^{-4}$ gon => σHz,V = 2"*$\sqrt{2}$
EDM accuracy:	2 mm + 2 ppm for an IR measurement
Slope distance:	7000 m
Hz:	210 gon
V:	83 gon

1D CQ = 0.0927 m
2D CQ = 0.0972 m
3D CQ = 0.1343 m

6.3.2 Creating a New Point

Access

Refer to "6.2 Accessing Data Management" to access **MANAGE Data: Job Name**.

Create point step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	**MANAGE Data: Job Name**, **Points** page	
2.	**NEW (F2)** to access **MANAGE New Point**.	
3.	**MANAGE New Point**, **Coords** page **<Point ID:>** The name of the new point. The configured point ID template is used. The ID can be changed. • To start a new sequence of point ID's overtype the point ID. • For an individual name independent of the ID template **SHIFT INDIV (F5)**. **SHIFT RUN (F5)** changes back to the next ID from the configured ID template. Enter a point ID and the coordinates.	
	COORD (F2) views other coordinate properties.	
	Negative geodetic coordinates are interpreted as being of the opposite hemisphere or other side of the central meridian. For example, entering -25 °N will be stored as 25 °S, entering -33 °E will be stored as 33 °W.	

Step	Description	Refer to chapter
☞	**NORTH (F3)** or **SOUTH (F3)**. Available for local geodetic or WGS 1984 geodetic coordinates when **<Local Lat:>** or **<WGS 1984 Lat:>** is highlighted. Changes between North and South latitude.	
☞	**EAST (F3)** or **WEST (F3)**. Available for local geodetic or WGS 1984 geodetic coordinates when **<Local Long:>** or **<WGS 1984 Long:>** is highlighted. Changes between East and West longitude.	
☞	**SHIFT ELL H (F2)** or **SHIFT ORTH (F2)**. Available for local coordinates. Changes between the ellipsoidal and the orthometric height.	
4.	**PAGE (F6)** changes to the **Code** page.	
5.	**MANAGE New Point**, **Code** page The setting for **<Thematc Codes:>** in **CONFIGURE Coding Settings** determines the availability of the subsequent fields and softkeys. • For **<Thematc Codes: With Codelist>**: The codes from the job codelist are used. **<Point Code:>** All point codes of the job codelist can be selected. The description of the code is shown as an output field. The attributes are shown as output, input or choicelist fields depending on their definition.	16.3

Step	Description	Refer to chapter
	• For **<Thematc Codes: Without Codelist>**: Codes for points can be typed in but not selected from a codelist. **<Point Code:>** The code to be stored with the point. A check is performed to see if a point code of this name already exists in the job. If so, the according attributes are shown. **<Attribute n:>** Up to eight attribute values are available.	
6.	Is **<Thematc Codes: With Codelist>**? • If **yes**, continue with the next row. • If **no**, continue with step 7.	
	NEW-A (F2) allows additional attributes to be created for this point code.	
	NAME (F3) or **VALUE (F3)** Available for attributes for which an attribute name can be typed in. To highlight **<Attribute n:>** or the field for the attribute value. The name of **<Attribute n:>** can be edited and an attribute value can be typed in.	
	LAST (F4) recalls the last used attribute values which were stored with this point code.	
	DEFLT (F5) recalls the default attribute values for the selected code.	
7.	**STORE (F1)** stores the new point entered and all associated information and returns to **MANAGE Data: Job Name, Points** page. The properties stored with the point are:	

Step	Description	Refer to chapter
	Class: **CTRL** Sub class: **Fixed (Pos & Ht)** Source: **User Entered** Instrument source: **TPS**	
	It may happen that a point with the same point ID exists in the job. If the codes and/or attribute values of the new and the existing point do not match, a screen opens where they can be corrected.	8.6

6.3.3 Editing a Point

Access

Refer to "6.2 Accessing Data Management" to access **MANAGE Data: Job Name**.

Edit point step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	In **MANAGE Data: Job Name**, **Points** page highlight a point to be edited.	
2.	**EDIT (F3)** to access **MANAGE Edit Point: Point ID**. ☞ The visible pages on this screen depend on the properties of the point being edited.	
3.	**MANAGE Edit Point: Point ID**, **Coords** page It is possible to edit the point ID and for points of **<Class: CTRL>** and **<Class: EST>** also the coordinates. Other point related data is shown in output fields. ☞ Points of **<Class: REF>** cannot be renamed. ☞ Changing the point ID for a point of any class applies this new point ID to all other points with the same original name, regardless of class.	6.3.1
☞	**MORE (F5)** displays information about class, sub class, estimated 3D coordinate quality, time and date of when point was stored, instrument source and source.	6.3.1
☞	**COORD (F2)** views other coordinate types.	

Step	Description	Refer to chapter
☞	**SHIFT ELL H (F2)** or **SHIFT ORTH (F2)**. Available for local coordinates. Change between the option to enter an ellipsoidal or an orthometric height. Changing the height type does not edit the point.	
4.	Is **<Class: MEAS>**? • If **yes**, continue with step 5. • If **no**, continue with step 7.	
5.	The edited point is **<Class: MEAS>**. **PAGE (F6)** changes to the **Obs** page.	
6.	**MANAGE Edit Point: Point ID**, **Obs** page **For TPS points** It is possible to edit the reflector height. The station from where the point was measured is shown in an output field. ☞ The reflector height is shown and may be edited. Changing the reflector height recalculates the point height. The reflector type is shown in an output field. The distance variables **Δ**Hz, **Δ**V, **Δ**Slop Dist are shown in an output field, whenever a measurement has been taken in both faces. **For GPS points**	

Step	Description	Refer to chapter
	The name of the real-time reference station from where the GPS point was measured, the name of antenna used to measure the point and the baseline values are shown in output/observations fields.	
	MORE (F5) Available for TPS points. Displays the horizontal angle or the azimuth from the point to the instrument.	
7.	**PAGE (F6)** changes to the **Code** page.	
8.	**MANAGE Edit Point: Point ID**, **Code** page The point code can be edited. All point codes in the job can be selected. The description of the code is shown as an output field. The attributes are shown as output, input or choicelist fields depending on their definition. The attribute values shown depend on **<Attributes:>** in **CONFIGURE Coding & Linework**. **<Attributes: Last Used>** shows the last used attribute values which are stored for this point code in the active codelist. **<Attributes: Default Values>** shows the default attribute values for this point code if existing.	8.2 and 8.3
	NEW-A (F2) allows additional attributes to be created for this point code.	

Step	Description	Refer to chapter
☞	**NAME (F3)** or **VALUE (F3)** Available for attributes for which an attribute name can be typed in. To highlight **<Attribute n:>** or the field for the attribute value. The name of **<Attribute n:>** can be edited and an attribute value can be typed in.	
☞	**LAST (F4)** recalls the last used attribute values which were stored with this point code.	
☞	**DEFLT (F5)** recalls the default attribute values for the selected code.	
9.	Is **<Class: MEAS>** and no offset point or **<Class: NAV>**? • If **yes**, continue with step 11. • If **no**, continue with step 10.	
10.	Is **<Class: AVGE>**? • If **yes**, continue with step 13. • If **no**, continue with step 15.	
11.	The edited point is **<Class: MEAS>** and no offset point or **<Class: NAV>**. **PAGE (F6)** changes to the **Annots** page.	
12.	**MANAGE Edit Point: Point ID, Annots** page The comments to be stored with the point can be edited. Continue with step 15.	
13.	The edited point is **<Class: AVGE>**.	

Step	Description	Refer to chapter
	PAGE (F6) changes to the **Mean** page.	
14.	**MANAGE Edit Point: Point ID**, **Mean** page All points of **<Class: MEAS>** of the same point ID are listed sorted by time. The settings in the **Use** column can be edited. All functionality and keys are explained in a separate section.	6.3.4
15.	**STORE (F1)** stores the changes and returns to **MANAGE Data: Job Name**. An edited point retains the creation value for **<Time:>**. Changing coordinates of a point which has been previously used in other application programs, for example COGO, does not update the application results.	
	It may happen that a point with the same point ID exists in the job. If the codes and/or attribute values of the new and the existing point do not match, a screen opens where they can be corrected.	8.6

6.3.4 Mean Page

Description

- In order to check measurements, the same point can be measured more than once. These measured points are assigned the class **MEAS**. The various measured coordinate triplets for one point can be recorded using the same point ID. If the averaging mode is activated, an average is calculated when more than one measured coordinate triplet is available for the same point ID.
- The averaged point is given the class **AVGE**. It is checked if the deviations of each single point are within the limits configured in **MANAGE New Job, Avge** page or in **MANAGE Edit Job: Job Name, Avge** page.
- After averaging, the **Mean** page becomes available in **MANAGE Edit Point: Point ID** and accessible from the Survey application program **SURVEY Survey: Job Name, Survey** page.
- Available functionality on the **Mean** page depends on the selected averaging mode.

Averaging

Averaging Mode

The averaging mode defines the checks which are performed when more than one set of measured coordinates are recorded for the same point. The selected averaging mode also affects the behaviour of the instrument when editing a point and calculating averages.

Defining the averaging mode and configuring the limits

The averaging mode and the limits are configured in **MANAGE New Job, Avge** page or in **MANAGE Edit Job: Job Name, Avge** page. Refer to "5.3 Creating a New Job" and to "5.4 Editing a Job".

Description of averaging modes

Averaging mode	Description
Average	When more than one measured coordinate triplet is recorded for the same point, the average for the position and the height is computed. Depending on the selected averaging method, the average will be computed weighted or arithmetic (no weighting). The class **AVGE** is assigned to the averaged point. The horizontal and height distances from the measured points to the average are computed and displayed on the **Mean** page. A check is performed that the differences for the position and height components between the **averaged point** and the point being stored does not exceed the defined limits.
Absolute Diffs	What is described above for **Average** applies for **Absolute Diffs.** Additionally, the **absolute difference** between two points selected from a list of measured points which are all stored with the same point ID are computed and checked for being within the defined limits.
Off	Averaging functionality is turned off. With more than one measured coordinate triplet recorded for the same point, no average for the position and the height is computed.

Averaging with position only or height only points

Position only points, height only points and points with full coordinate triplets are handled in the averaging.

Access step-by-step

The **Mean** page can be accessed if

<Averaging Mode: Average> or **<Averaging Mode: Absolute Diffs>** is configured in **MANAGE New Job, Avge** page or in **MANAGE Edit Job: Job Name, Avge** page.

AND

more than one measured coordinate triplet is recorded for the same point using the same point ID.

Access within data management

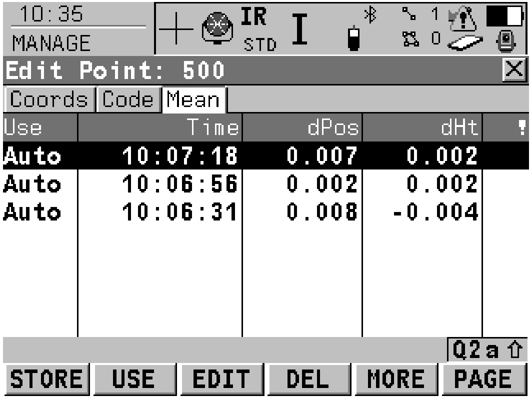
Step	Description
1.	Refer to "6.2 Accessing Data Management" to access **MANAGE Data: Job Name**.
2.	In **MANAGE Data: Job Name**, **Points** page highlight a point to be edited.
3.	**EDIT (F3)** to access **MANAGE Edit Point: Point ID, Mean** page.

Access within Survey

Step	Description
1.	**Main Menu: Survey** to access **SURVEY Survey Begin**.
2.	**CONT (F1)** to access **SURVEY Survey: Job Name**, **Survey** page.
3.	**SHIFT AVGE (F2)** or **SHIFT ABS (F2)** to access **SURVEY Edit Point: Point ID**, **Mean** page.

MANAGE
Edit Point: Point ID, Mean page

All measured coordinate triplets recorded using the same point ID are shown.



STORE (F1)
To store the changes and to return to the screen from where this screen was accessed.

USE (F2)
To change between the options in the **Use** column for the highlighted coordinate triplet. To include or exclude this triplet in or from the calculation of the average. Refer to " Description of columns" below.

EDIT (F3)
To view and edit the highlighted measured coordinate triplet. It is possible to edit the point ID and the reflector height without impact on all other classes of the point with the same original name. The coordinates are updated. Codes cannot be changed. The average point has the higher priority. A change in codes must be an overall change for the average point.
Example: One of the measured coordinate triplets has a wrong point ID and should not be included in the average. By editing the point ID, the point is renamed and no longer contributes to the average.

DEL (F4)
To delete the highlighted coordinate triplet. The average is recomputed.

MORE (F5)
To change between time and date of when the point was stored and the 3D coordinate quality.

PAGE (F6)
To change to another page on this screen.

SHIFT DIFFS (F5)
Available for **<Averaging Mode: Absolute Diffs>** and **Yes** is set in the **Use** column for exactly two measurements. To display the absolute coordinate differences. Differences exceeding the defined limit are indicated by !.

Description of columns

Column	Description
Use	The use of a measured coordinate triplet in the averaging. • **Auto** The coordinate triplet is included in the averaging computation if within the averaging limit defined in **MANAGE New Job, Avge** page or in **MANAGE Edit Job: Job Name, Avge** page. • **Yes** The coordinate triplet is always included in the averaging computation even if it would fall outside the averaging limit defined in **MANAGE New Job, Avge** page or in **MANAGE Edit Job: Job Name, Avge** page.

Column	Description
	• **No** The coordinate triplet is never included in the averaging computation. • ----- The coordinate triplet cannot be included in the averaging computation. Automatically set by the system. **USE (F2)** changes between the options.
Time	The time the measured coordinate triplet was stored.
Date	The date the measured coordinate triplet was stored. The format is as defined in **CONFIGURE Units & Formats**, **Time** page.
dPos	The horizontal distance from the measured coordinate triplet to the average. **<dPos: ----->** indicates unavailable information, for example for a height only point.
dHt	The height distance from the measured coordinate triplet to the average. **<dHt: ----->** indicates unavailable information, for example for a position only point.
!	Available for measured coordinate triplets with **Auto** or **Yes** in the **Use** column if **<Averaging Mode: Average>**. Indicates an exceeding of the limits.

Next step

IF a measured coordinate triplet	THEN
is not to be viewed	**STORE (F1)** stores the changes and returns to **MANAGE Data: Job Name**.
is to be viewed	highlight a measured coordinate triplet and **EDIT (F3)**.

6.4 Line/Area Management

6.4.1 Overview

Description

A line/area consists of points and can be created/edited in **MANAGE Data: Job Name**. The individual points are measured within any application program. These can be all points. Points can be simultaneously assigned to one or more lines and/or areas.

A line/area can have

- a style for display in MapView.
- a code independent of the point code of the points comprising the line/area.

☞ Points are assigned to a line/area when the line/area is open. Refer to "6.2 Accessing Data Management" for information on how to open a line/area.

6.4.2 Creating a New Line/Area

☞ The functionality of all screens and fields are similar for the creation of both lines and areas. The step-by-step instructions for creating a new line can be applied for areas.

Access

Refer to "6.2 Accessing Data Management" to access **MANAGE Data: Job Name**.

OR

Press a hot key configured to access the screen **MANAGE New Line/MANAGE New Area**. Refer to "2.1 Hot Keys" for information on hot keys.

Create line step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	**MANAGE Data: Job Name**	
2.	**PAGE (F6)** until the **Lines (X)** page is active.	
3.	**MANAGE Data: Job Name**, **Lines (X)** page	
4.	**NEW (F2)** to access **MANAGE New Line**.	
5.	**MANAGE New Line, General** page **<Line ID:>** The name of the new line. The configured ID template for lines is used. The ID can be changed. • To start a new sequence of line ID's overtype the line ID. • For an individual name independent of the ID template **SHIFT INDIV (F5)**. **SHIFT RUN (F5)** changes back to the next ID from the configured ID template.	

Step	Description	Refer to chapter
	<Pts to Store:> The type of points which are used to form the line during a survey. Select between all points, measured points, auto points and offset points of type 1 or 2. **<Line Style:>** This is the line style in which lines/areas are represented in MapView and LGO. For **<Line Code: <None>>** on the Code page a line style can be selected from a choicelist. Otherwise the line style as defined for the selected line code is shown. Type in a number for the line, select the points to be stored with the line and select a line style if necessary.	48.1, 48.4
6.	**PAGE (F6)** changes to the **Code** page.	
7.	**MANAGE New Line**, **Code** page The setting for **<Thematc Codes:>** in **CONFIGURE Coding & Linework** determines the availability of the subsequent fields and softkeys. • For **<Thematc Codes: With Codelist>**: The codes from the job codelist are used. **<Line Code:>** All line codes of the job codelist can be selected. The description of the code is shown as an output field. The line style is shown as defined for the selected line code. It is the style in which lines/areas are represented in MapView and LGO. For **<Line Code: <None>>**, it can be changed. The attributes are shown as output, input or choicelist fields depending on their definition.	16.3

Step	Description	Refer to chapter
	• For **<Thematc Codes: Without Codelist>**: Codes for lines can be typed in but not selected from a codelist. **<Line Code:>** The line code to be stored with the point. A check is performed to see if a line code of this name already exists in the job. If so, the according attributes are displayed. **<Attribute n:>** Up to eight attribute values are available. Type in a code.	
8.	Is **<Thematc Codes: With Codelist>**? • If **yes**, continue with the next row. • If **no**, continue with step 9.	
☞	**NEW-A (F2)** allows additional attributes to be created for this line code.	
☞	**NAME (F3)** or **VALUE (F3)** Available for attributes for which an attribute name can be typed in. To highlight **<Attribute n:>** or the field for the attribute value. The name of **<Attribute n:>** can be edited and an attribute value can be typed in.	
☞	**LAST (F4)** recalls the last used attribute values which were stored with this line code.	
☞	**DEFLT (F5)** recalls the default attribute values for the selected code.	
9.	**STORE (F1)** stores the new line entered and all associated information and returns to **MANAGE Data: Job Name, Lines (X)** page.	

Step	Description	Refer to chapter
	The value for **<Start Time:>** with which the line is stored is the time when **STORE (F1)** was pressed. The same value is assigned to the value for **<End Time:>** until a point is added to the line.	6.4.3
	Any existing lines and areas which are open are closed.	

Creating lines/areas most efficiently

IF the task is to create	THEN
multiple lines/areas with subsequent line/area ID's	use the hot key/user menu function **FUNC Create New Line (Quick)**/**FUNC Create New Area (Quick)**. Pressing the hot key or selecting the function from the user menu creates and immediately stores the new line/area. For the line/area ID, the line/area ID template as defined in **CONFIGURE ID Templates** is used. The code and attributes are taken over from the last created line/area.
lines/areas with certain codes	use quick coding. The job codelist must contain quick codes for lines/areas. By tying the quick code a new line/area is created and immediately stored with that line/area code and attributes. For the line/area ID, the line/area ID template as defined in **CONFIGURE ID Templates** is used.

6.4.3 Editing a Line/Area

☞ The functionality of all screens and fields are similar for the editing of both lines and areas. The step-by-step instructions for editing a new line can be applied for areas.

Access

Refer to "6.2 Accessing Data Management" to access **MANAGE Data: Job Name**.

Edit line step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	**MANAGE Data: Job Name**	
2.	**PAGE (F6)** until the **Lines** page is active.	
3.	In **MANAGE Data: Job Name**, **Lines** page highlight a line to be edited.	
4.	**EDIT (F3)** to access **MANAGE Edit Line: Line ID**.	
5.	**MANAGE Edit Line: Line ID**, **General** page The line ID and the type of points which are used to form the line during a survey can be edited. Other line related data is shown in output fields. **<No. of Pts:>** The number of points contained within the line. **<Length:>** The sum of the distances between the points in the sequential order in which they are stored for the line. This can be a horizontal grid distance or a geodetic distance on the WGS 1984 ellipsoid.	

Step	Description	Refer to chapter
	<Start Time:> and **<Start Date:>** The time/date when the line was created. A line cannot be renamed to an already existing line ID.	
	MORE (F5) displays **<End Time:>** and **<End Date:>**. This is the time/date when the last point was added to the line. This can be different to the time the point was created. The values do not change after deleting the last added point or after editing unless an additional point is added to the line.	
6.	**PAGE (F6)** changes to the **Points** page.	
7.	**MANAGE Edit Line: Line ID**, **Points** page All points belonging to the line are listed. The point that was added last to the line is at the top of the list.	
	ADD (F2) Accesses **MANAGE Select Point** with the **Points** and **Map** page. To add an existing point from the active job to the line. A new point is added above the point which was highlighted when **ADD (F2)** was pressed.	6.2.
	EDIT (F3) edits the highlighted point.	6.3.3.
	REMOV (F4) removes the highlighted point from the line. The point itself is not deleted.	
	MORE (F5) displays information about the point codes if stored with the line, the time and the date of when the line was stored, the 3D coordinate quality, the class and the flag for Linework.	6.3.1

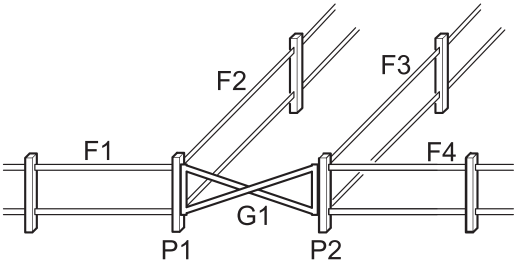
Step	Description	Refer to chapter
8.	**PAGE (F6)** changes to the **Code** page.	
9.	**MANAGE Edit Line: Line ID**, **Code** page The line code can be edited. All line codes can be selected. For **<Line Code: <None>>**, the line style can be changed. The description of the code is shown as an output field. The attributes are shown as output, input or choicelist fields depending on their definition.	8
☞	**NEW-A (F2)** allows additional attributes to be created for this line code.	
☞	**NAME (F3)** or **VALUE (F3)** Available for attributes for which an attribute name can be typed in. To highlight **<Attribute n:>** or the field for the attribute value. The name of **<Attribute n:>** can be edited and an attribute value can be typed in.	
☞	**LAST (F4)** recalls the last used attribute values which were stored with this line code.	
☞	**DEFLT (F5)** recalls the default attribute values for the selected code.	
10.	**STORE (F1)** stores the changes and returns to **MANAGE Data: Job Name, Lines** page.	
☞	An edited line retains the creation value for **<Start Time:>**. The value for **<End Time:>** changes when a point was added to the line.	

6.4.4 Working Example

Description

Application:	Pick up points along fence lines with a gate. The gate can also be represented as a line. Some points belong to more than one line.
Setting:	**F7** is configured to access the **MANAGE Data: Job Name** screen. Refer to "2.1 Hot Keys" on how to configure hot keys.
Goal:	Each point is to be picked up once.

Diagram



GPS12_079

P1 Gate post
P2 Gate post
F1 First fence line
F2 Second fence line
F3 Third fence line
F4 Fourth fence line
G1 Gate

Field procedure step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Create the lines F1, F2 and G1.	6.4.2

Step	Description	Refer to chapter
2.	Start Survey application program.	47.1
3.	Press **F7.**	
4.	**MANAGE Data: Job Name, Lines (X)** page The line F1 must be open, the lines F2 and G1 must be closed. To open/close a line, highlight the line and **CLOSE (F4)** and **OPEN (F4)**.	
5.	**CONT (F1)**	
6.	**SURVEY Survey: Job Name** Measure points along fence line F1 until the last point before P1. These points are automatically added to line F1.	
☞	Points can be coded separately.	
7.	Press **F7.**	
8.	**MANAGE Data: Job Name, Lines (X)** page Highlight the line F2. **OPEN (F4)** to open the line.	
9.	Highlight the line G1. **OPEN (F4)** to open the line.	
☞	Line F1 stays open.	
10.	**CONT (F1)**	
11.	**SURVEY Survey: Job Name**	47.1

Step	Description	Refer to chapter
	Measure P1. This point is automatically added to all three lines open at that time.	
12.	Press **F7.**	
13.	**MANAGE Data: Job Name, Lines (X)** page Highlight the line F1. **CLOSE (F4)** to close the line.	
14.	Highlight the line F2. **CLOSE (F4)** to close the line.	
	Line G1 stays open.	
15.	**CONT (F1)**	
16.	**SURVEY Survey: Job Name** Measure points along gate G1. These points are automatically added to line G1.	47.1
17.	After finishing the survey, import the data into a CAD package. If the line codes required by the CAD package were used, the lines are automatically connected and the point symbols are automatically set.	

6.5 Data Log

Description

A list of all objects and free codes in the active job is displayed in order of time.

Access step-by-step

Access within data management

Step	Description
1.	Refer to "6.2 Accessing Data Management" to access **MANAGE Data: Job Name**.
2.	In **MANAGE Data: Job Name** on the **Points** page, **SHIFT LOG (F4)** to access **MANAGE Data Log: Job Name**.

Access within job management

Step	Description
1.	**Main Menu: Manage...\Jobs** to access **MANAGE Jobs (Device)**. Refer to "5.2 Accessing Job Management" for further options to access this screen.
2.	In **MANAGE Jobs (Device)** highlight a job to be edited.
3.	**EDIT (F3)** to access **MANAGE Edit Job: Job Name**.
4.	**SHIFT LOG (F5)** to access **MANAGE Data Log: Job Name**.

Access by hot key

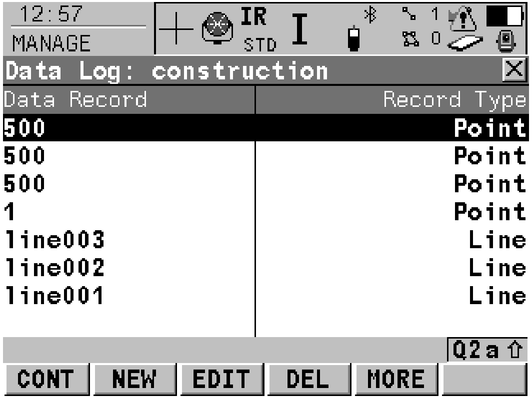
Press a hot key configured to access the screen **MANAGE Data Log: Job Name**. Refer to "2.1 Hot Keys" for information on hot keys.

Access by user defined menu

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

MANAGE
Data Log: Job Name

In the column **Data Record**, all points, lines and areas as well as free codes stored within the active job are displayed. They are always sorted by time with the most recent record at the top. For lines and areas, the value for **<Start Time:>** is relevant.



CONT (F1)
To close the screen and return to the screen from where this screen was accessed.

NEW (F2)
To insert a free code below, this means time-wise before, the currently highlighted object or record. The functionality of inserting a free code is identical to the functionality of entering a free code during a survey. Refer to "8.3 Free Coding".

EDIT (F3)
To edit the highlighted object or free code. Refer to "6.3.3 Editing a Point", "6.4.3 Editing a Line/Area". The functionality of editing a free code is identical to the functionality of entering a free code during a survey. Refer to "8.3 Free Coding" .

DEL (F4)
To delete the highlighted object or free code.

MORE (F5)
To display information about the type of data recorded, the time and the date of when it was stored or for lines and areas when they were created and the codes if stored with any object.

Next step
CONT (F1) returns to the screen from where **MANAGE Data Log: Job Name** was accessed.

6.6 Point Sorting and Filters

6.6.1 Sorting and Filters for Points, Lines and Areas

Description

The sort settings define the order of the objects in the active job. The filter settings define the objects to be viewed.

Three types of filters are available:

Point filter:	An active point filter shows selected points in **MANAGE Data: Job Name**, **Points** page.
Line filter:	An active line filter shows selected lines in **MANAGE Data: Job Name**, **Lines (X)** page.
Area filter:	An active area filter shows selected areas in **MANAGE Data: Job Name**, **Areas (X)** page.

The sort and filter settings are stored in the job. They are remembered after turning off the instrument.

Changing the active job does influence the sort settings for the objects. The filter settings are set to those of the selected job.

An active filter for an object is indicated in **MANAGE Data: Job Name** by located on the right hand side of the page name.

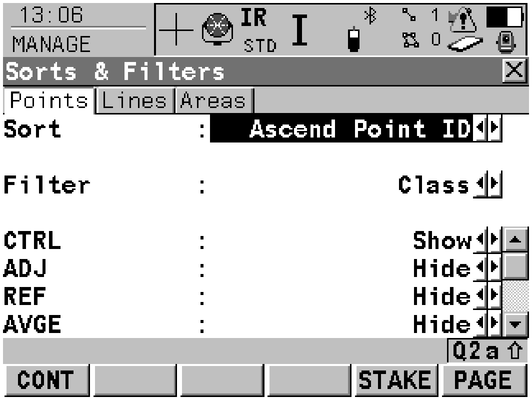
Access step-by-step

Step	Description
1.	Refer to "6.2 Accessing Data Management" to access **MANAGE Data: Job Name**.

Step	Description
2.	In **MANAGE Data: Job Name** on the **Points**, **Lines** or **Areas** page, **SHIFT FILT (F5)** to access **MANAGE Sorts & Filters**.
3.	**MANAGE Sorts & Filters** This screen consists of three pages, one for each type of object. The page for an object is displayed when the equivalent page is displayed in **MANAGE Data: Job Name**.

MANAGE Sorts & Filters, Points page

The available fields on this screen depend on the selected setting for **<Filter:>**.



CONT (F1)
To close the screen and return to the screen from where this screen was accessed. The selected sort and filter settings are applied.

STAKE (F5)
To filter points for the Stakeout application program. Refer to "6.6.3 Stakeout Filter".

PAGE (F6)
To change to another page on this screen.

Description of fields

Field	Option	Description
<Sort:>	**Ascend Point ID**, **Descend Point ID**, **Forward Time** or **Backward Time**	Always available. The method points are sorted by.
<Filter:>		Always available. The method the points are filtered by.
	No Filter	Shows all points.
	Highest Class	Shows points of highest class.
	Range of Pt ID's	Shows points with point ID's between the entered start and end ID. The points are left aligned and sorted by the first digit.
	Pt ID Wildcard	Shows points with point ID's matching the wild-card.
	Time	Shows points which were recorded within a defined time window.
	Class	Shows points of the selected class.
	Instrument	Shows points originating from the selected instrument or software program type.
	Coordinate Type	Shows points of the selected type of coordi-nates.

Field	Option	Description
	Point Code	Shows points with selected codes attached. Refer to "6.6.2 Point, Line and Area Code Filter".
	Radius From Pt	Shows points within the defined radius from a particular point. The radius is the horizontal distance.
	Individual Line	Shows points forming a selected line. This may for example be useful during stakeout.
	Individual Area	Shows points forming a selected area. This may for example be useful during stakeout.
<Start ID:>	User input	Available for **<Filter: Range of Pt ID's>**. The first point to be displayed.
<End ID:>	User input	Available for **<Filter: Range of Pt ID's>**. The last point to be displayed.
<Wildcard:>	User input	Available for **<Filter: Pt ID Wildcard>**. * and ? are supported. * indicates an undefined number of unknown characters. ? indicates a single unknown character.
<Start Date:>	User input	Available for **<Filter: Time>**. The date of the first point to be displayed.
<Start Time:>	User input	Available for **<Filter: Time>**. The time of the first point to be displayed.

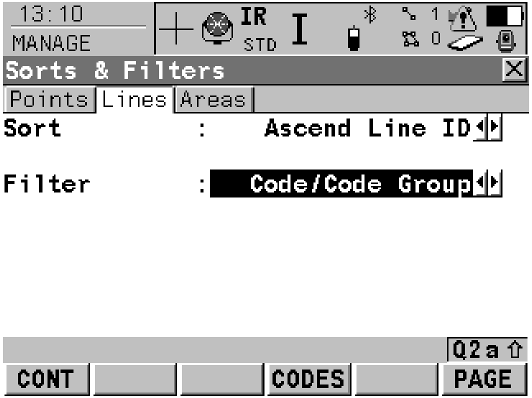
Field	Option	Description
<End Date:>	User input	Available for **<Filter: Time>**. The date of the last point to be displayed.
<End Time:>	User input	Available for **<Filter: Time>**. The time of the last point to be displayed.
<CTRL:>, <ADJ:>, <REF:>, <AVGE:>, <MEAS:>, <NAV:>, <EST:>, <NONE:>	**Show** or **Hide**	Available for **<Filter: Class>**. Defined classes are shown or hidden.
<View:>		Available for **<Filter: Class>**.
	Highest Triplet	The coordinate triplets of the highest class are shown.
	All Triplets	All classes for one coordinate triplet are shown.
<Instrument:>	**All**, **TPS**, **GPS**, **LEICA Geo Office**, **Level**, **Data Logger**, **Third Party SW** or **Unknown**	Available for **<Filter: Instrument>**. Points originating from this instrument type are shown.
<Type:>	**WGS84 Only** or **Local Only**	Available for **<Filter: Coordinate Type>**. Points from the chosen coordinate type are shown.

Field	Option	Description
<Point ID:>	Choicelist	Available for **<Filter: Radius From Pt>**. The point to which the radius is applied. Opening the choicelist opens **MANAGE Data: Job Name**. Refer to "6.2 Accessing Data Management".
<Radius:>	User input	Available for **<Filter: Radius From Pt>**. The radius of the circle within which the points are shown.
<Line ID:>	Choicelist	Available for **<Filter: Individual Line>**. Opening the choicelist opens **MANAGE Data: Job Name**. Refer to "6.2 Accessing Data Management".
<Area ID:>	Choicelist	Available for **<Filter: Individual Area>**. Opening the choicelist opens **MANAGE Data: Job Name**. Refer to "6.2 Accessing Data Management".

Next step

PAGE (F6) changes to the **Lines** page. Refer to paragraph "MANAGE Sorts & Filters, Lines page".

MANAGE Sorts & Filters, Lines page



CONT (F1)
To close the screen and return to the screen from where this screen was accessed. The selected sort and filter settings are applied and the lists in **MANAGE DATA: Job Name** are updated.

CODES (F4)
Available for **<Filter: Code/Code Group>**. To select the line codes to be used.

PAGE (F6)
To change to another page on this screen.

Description of fields

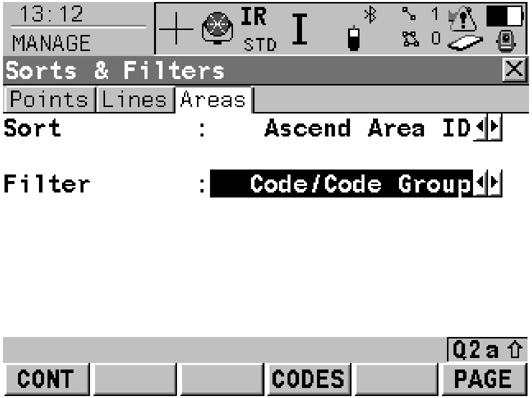
Field	Option	Description
<Sort:>	**Ascend Line ID**, **Descend Line ID**, **Fwrd Start Time**, **Bwrd Start Time**, **Fwrd End Time** or **Bwrd End Time**	Always available. The method the lines are sorted by.
<Filter:>		Always available. The method by which the lines are filtered.
	No Filter	Shows all lines.

Field	Option	Description
	Code/Code Group	Shows lines with selected codes attached. Refer to "6.6.2 Point, Line and Area Code Filter" since the functionality is identical to the point code filter.

Next step

PAGE (F6) changes to the **Areas** page. Refer to paragraph "MANAGE Sorts & Filters, Areas page".

MANAGE Sorts & Filters, Areas page



CONT (F1)
To close the screen and return to the screen from where this screen was accessed. The selected sort and filter settings are applied and the lists in **MANAGE DATA: Job Name** are updated.

CODES (F4)
Available for **<Filter: Code/Code Group>**. To select the area codes to be used.

PAGE (F6)
To change to another page on this screen.

Description of fields

The functionality of setting the filters is identical to those on the **Lines** page. Refer to paragraph "MANAGE Sorts & Filters, Lines page".

Next step

CONT (F1) returns to the screen from where **MANAGE Sorts & Filters** was accessed.

6.6.2 Point, Line and Area Code Filter

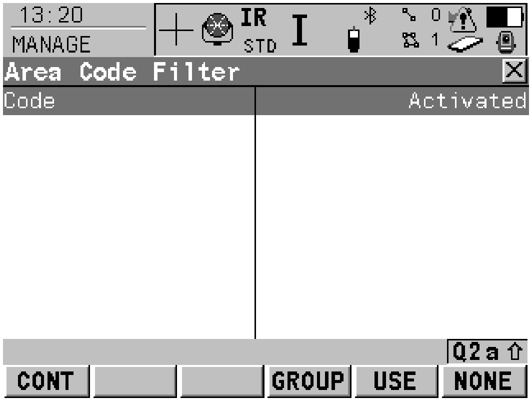
For each object, a code filter exists. The point, line and area code filters are independent from each other. The functionality is identical. For simplicity, the point code filter is explained.

Access step-by-step

Step	Description
1.	Refer to "6.6.1 Sorting and Filters for Points, Lines and Areas" to access **MANAGE Sorts & Filters**.
2.	Select **<Filter: Point Code>**.
3.	**CODES (F4)** to access **MANAGE Point Code Filter**.

MANAGE Point Code Filter

This screen shows the point codes from the active job and codes currently used as filter. Point codes are sorted according to the settings in **MANAGE Sort Codes**.



CONT (F1)
To close the screen and return to the screen from where this screen was accessed.

GROUP (F4)
To activate and deactivate code groups. Accesses **MANAGE Code Groups**. Any code group that have been previously deactivated are displayed as deactivated here. Codes belonging to a deactivated code group are not displayed in **MANAGE Code Filter**. Refer to "7.6 Managing Code Groups".

USE (F5)
To activate and deactivate the filter for the highlighted code.

NONE (F6) or **ALL (F6)**
To deactivate or activate all point codes.

SHIFT SORT (F5)
To define the order of the codes. Accesses **MANAGE Sort Codes**.

6.6.3 Stakeout Filter

Description

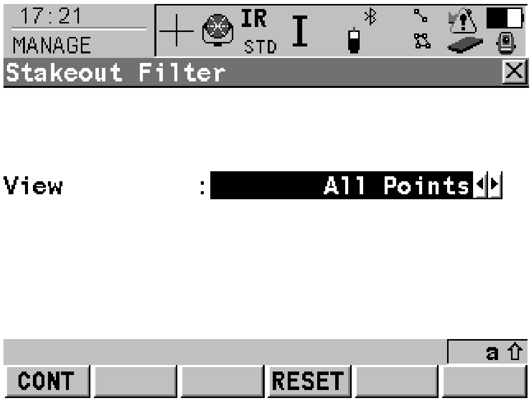
The settings on this screen define a filter for the Stakeout application program, for example to show points which are already staked or points that are still to be staked.

☞ The stakeout filter acts in addition to any other filter set in **MANAGE Sorts & Filters**. For example, points still to be staked out with a particular code can be filtered.

Access step-by-step

Step	Description
1.	Refer to "6.6.1 Sorting and Filters for Points, Lines and Areas" to access **MANAGE Sorts & Filters**.
2.	In **MANAGE Sorts & Filters**, **PAGE (F6)** until the **Points** page is active.
3.	**STAKE (F5)** to access **MANAGE Stakeout Filter**.

MANAGE Stakeout Filter



CONT (F1)
To close the screen and return to the screen from where this screen was accessed.

RESET (F4)
To reset the staked flag for all points of the currently active job.

Description of fields

Field	Option	Description
<View:>	**All**	Shows all points.
	Pts to Stakeout	Shows points not yet staked out.
	Staked Points	Shows points which are already staked out.

7 Manage...\Codelists

7.1 Terminology

Description

This chapter describes technical terms related to codes and codelists.

☞ The values for code groups, codes and attributes are case sensitive. For example the code group Tree is not the same as the code group TREE.

Object

For coding, points, lines and areas have the same behaviour. In this chapter, object is used as generic term for points, lines and areas.

Code group

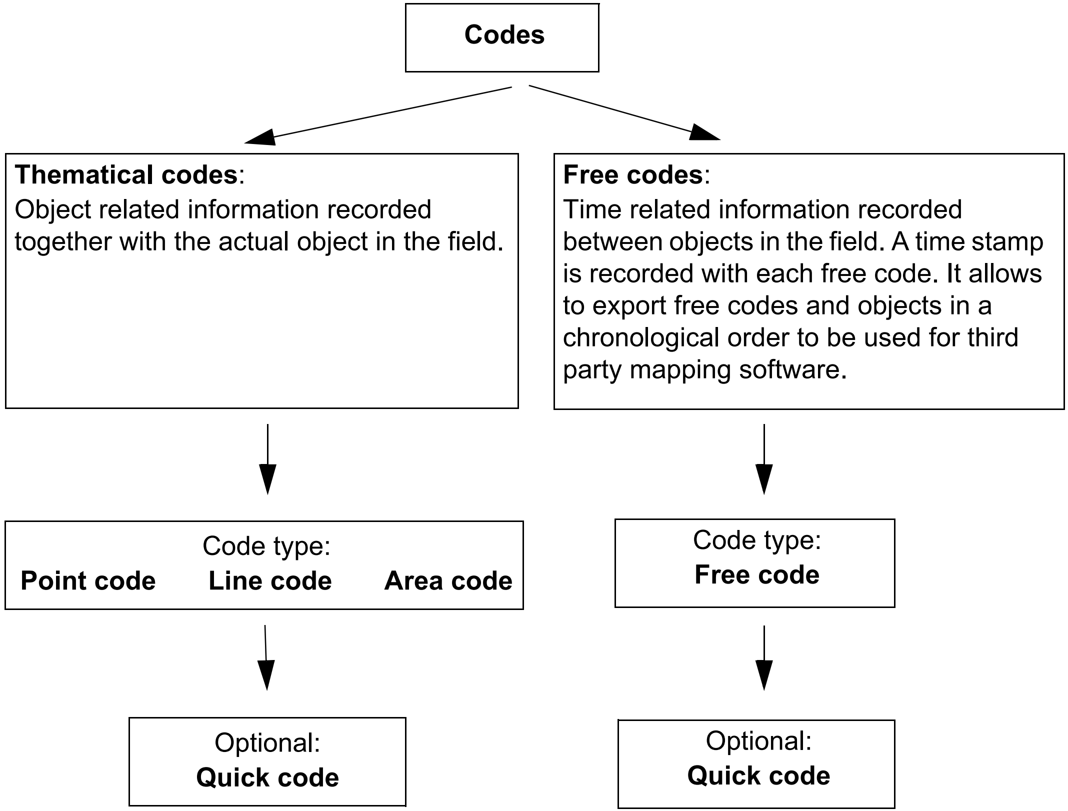
A code group allows codes belonging to the same theme to be grouped together. Individual groups can be activated or deactivated. The codes belonging to a deactivated code group cannot be selected from the choicelist for code selection.

Code

Description

A code is a description which can be stored with an object or alone.

Structure of codes



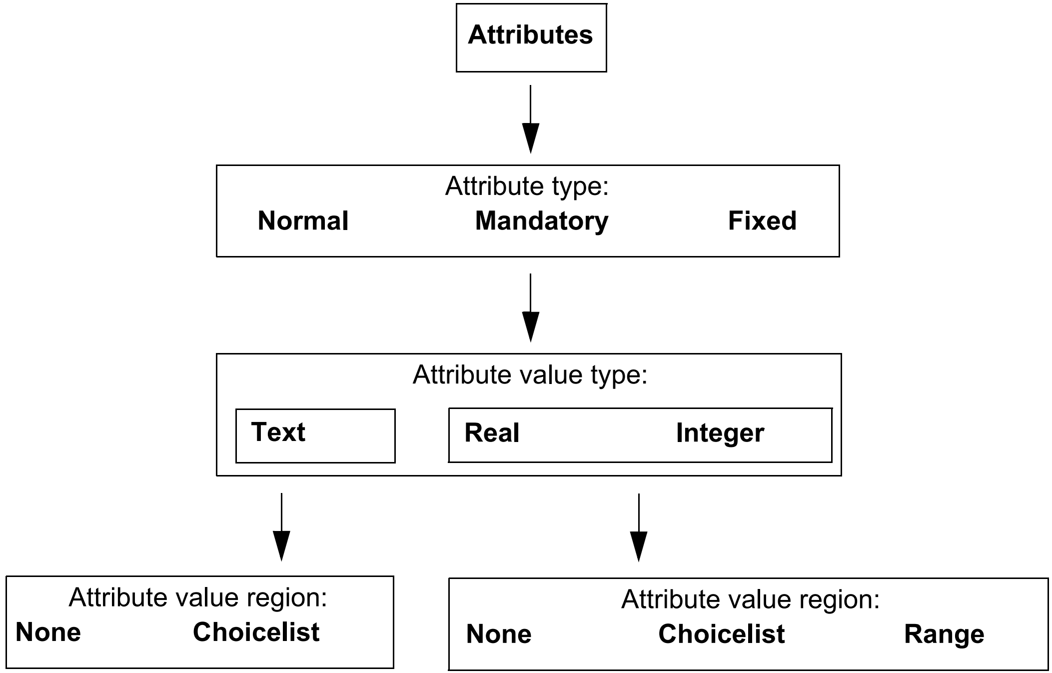
Code types

The code type defines how and for which objects a code can be used. It is possible to create a code of the same name but of different code types both on the instrument and in LGO.
Example: The code Oak can exist with code type point code and with code type line code.

Point code:	To record a code directly with a point. This is thematical point coding.
Line code:	To record a code directly with a line. This is thematical line coding.
Area code:	To record a code directly with an area. This is thematical area coding.
Free code:	To record a code based on time in between objects.
Quick code:	To start a point measurement and store the code by typing in one, two or three predefined digits.

Attribute	Description
	The use of attributes allows additional information to be stored with the code. Up to twenty attributes can be related to one code. Attributes are not compulsory.

Structure of attributes



Attribute types

The attribute type defines the input requirements for the attribute.

Normal:	An input for the attribute is optional. The attribute value can be typed in in the field. New attributes with this attribute type can be created in LGO or on the instrument.
Mandatory:	An input for the attribute is compulsory. The attribute value must be typed in the field. New attributes with this attribute type can be created in LGO.
Fixed:	The attribute value is a predefined default which is displayed but cannot be changed in the field. This attribute value is automatically attached to the code. New attributes with this attribute type can be created in LGO.

Attribute value types

The attribute value type defines which values are accepted as input.

Text:	Any input for the attribute is interpreted as text. New attributes with this attribute value type can be created in LGO or on the instrument.
Real:	An input for the attribute must be a real number, for example 1.23. New attributes with this attribute value type can be created in LGO.
Integer:	An input for the attribute must be an integer number, for example 5. New attributes with this attribute value type can be created in LGO.

Attribute value regions

The attribute value region defines if the attribute values must be selected from a predefined list.

None:	An input for the attribute must be typed in. New attributes with this attribute value region can be created in LGO or on the instrument.

Range:	An input for the attribute must fall within a predefined range. New attributes with this attribute value region can be created in LGO.
Choicelist:	An input for the attribute is selected from a predefined list. New attributes with this attribute value region can be created in LGO.

Example

Code	Attributes	Attribute value type	Attribute value region	Example for the attribute value region
Birch	Height	Real	Range	0.5-3.0
	Condition	Text	Choicelist	Good, Dead, Damaged
	Remark	Text	None	-

Codelist

Description

A codelist is a collection of codes that can be used to describe surveyed objects in the field.

Elements of a codelist

- Code group
- Code
- Attributes

Structure of a codelist

Structure	Example
Codelist	Codelist
Code group 1	Trees
Code 1.1	Birch
Attribute 1.1.1	Height
Attribute ...	Condition
Attribute 1.1.20	Remark
Code 1.2	Oak
Attribute 1.2.1	Circumference
Attribute ...	Condition
Attribute 1.2.20	...
Code ...	...
Code group 2	Infrastructure
Code 2.1	Road
Attribute 2.1.1	Material
...	...

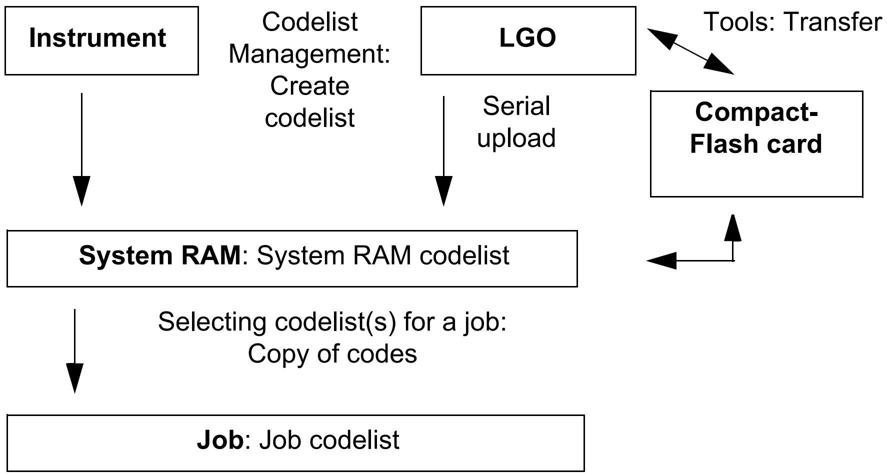
Codelist types

System RAM codelist:	A codelist stored in the System RAM of the instrument.
Job codelist:	The collection of codes contained within the currently active job.

7.2 Overview

☞ It is recommended to create a codelist in LGO. A codelist can be transferred from LGO to the System RAM of the instrument using the CompactFlash card.

Steps from creating to using a codelist



The creating, editing and managing of codelists is explained in this chapter.
In order to use a codelist on the instrument, it must be transferred from the CompactFlash card to the System RAM. Refer to "24 Tools...\Transfer Objects...".

7.3 Accessing Codelist Management

Access

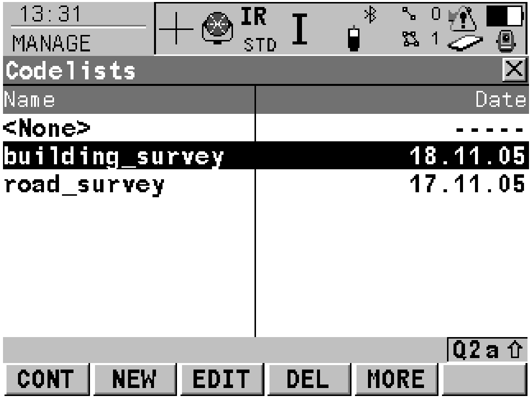
Select **Main Menu: Manage...\Codelists.**

OR

From a choicelist in some screens, for example **MANAGE New Job, Codelist** page.

MANAGE Codelists

Listed are all codelists stored in the System RAM.



CONT (F1)
To return to the screen from where this screen was accessed. If this screen was accessed from a choicelist, the codes from the highlighted codelist are copied to the active job.

NEW (F2)
To create a codelist. Refer to "7.4 Creating/Editing a Codelist".

EDIT (F3)
To edit the highlighted codelist. Refer to "7.4 Creating/Editing a Codelist".

DEL (F4)
To delete the highlighted codelist.

MORE (F5)
To display information about the creator and the date of when the codelist was created.

Next step

IF a codelist	THEN
is to be selected	highlight the desired codelist. **CONT (F1)** copies the codes of the codelist to the active job, closes the screen and returns to the screen from where **MANAGE Codelists** was accessed.
is to be created	**NEW (F2)**. Refer to "7.4 Creating/Editing a Codelist".
is to be edited	highlight the codelist and **EDIT (F3)**. Refer to "7.4 Creating/Editing a Codelist".

7.4 Creating/Editing a Codelist

Access

Refer to "7.3 Accessing Codelist Management" to access **MANAGE Codelists**.

Create/edit a codelist step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	**MANAGE Codelists** **NEW (F2)** or **EDIT (F3)** to access **MANAGE XX Codelist**.	7.3
2.	**MANAGE New Codelist** or **MANAGE Edit Codelist** **<Name:>** A unique name for the codelist. The name may be up to 16 characters long and may include spaces. Input required. **<Description:>** A detailed description of the codelist. This can be for example, work to be performed. Input optional. **<Creator:>** The person's name who is creating the new codelist. Input optional.	
☞	**CODES (F4)** accesses **MANAGE Codes** where codes can be created, edited or deleted and code groups can be accessed.	7.5.2, 7.5.3 or 7.6
3.	**STORE (F1)** stores the codelist and returns to **MANAGE Codelists**.	

7.5 Managing Codes

7.5.1 Accessing MANAGE Codes

Description

Managing codes includes
- creating new codes
- viewing codes with their related information
- editing codes.
- deleting existing codes.

Access step-by-step

Step	Description
1.	Refer to "7.3 Accessing Codelist Management" to access **MANAGE Codelists**.
2.	In **MANAGE Codelists** highlight the codelist of which codes are to be managed.
3.	**EDIT (F3)** to access **MANAGE Edit Codelist**.
4.	**CODES (F4)** to access **MANAGE Codes.** This screen is described below.

MANAGE Codes

Codes from currently active code groups are shown.

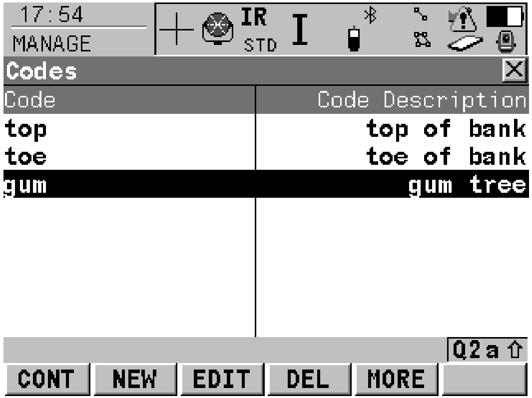
The listed code groups belong to

the selected System RAM codelist when this screen was accessed through **Main Menu: Manage...\Codelists**.

OR

to the job codelist when **MANAGE Codes** was accessed from an application program, **MANAGE New Job** or **MANAGE Edit Job**.

The indicates codes which have attributes attached.



CONT (F1)
To close the screen and return to the screen from where this screen was accessed.

NEW (F2)
To create a new code. Refer to "7.5.2 Creating a New Code".

EDIT (F3)
To edit the highlighted code. Refer to "7.5.3 Editing a Code".

DEL (F4)
To delete the highlighted code.

MORE (F5)
To display information about the code description, the quick codes if available, the code groups and the code type.

SHIFT GROUP (F4)
To view, create, delete, activate and deactivate code groups. Refer to "7.6 Managing Code Groups".

SHIFT SORT (F5)
To sort codes by code name, code description, quick code or the last use.

Next step

IF	THEN
a code is to be created	**NEW (F2).** Refer to "7.5.2 Creating a New Code".
a code is to be edited	highlight the code and **EDIT (F3)**. Refer to "7.5.3 Editing a Code".
code groups are to be accessed	**SHIFT GROUP (F4)**. Refer to "7.6 Managing Code Groups".

7.5.2 Creating a New Code

Create a new code step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to "7.5.1 Accessing MANAGE Codes" to access **MANAGE Codes**.	
2.	**NEW (F2)** to access **MANAGE New Code**.	
3.	**MANAGE New Code** **<Code:>** A unique name for the new code. The name may be up to 16 characters long and may include spaces. Input required. **<Code Desc:>** A detailed description of the code. Input optional. **<Group:>** The code group to which the code is to be assigned. All code groups from **MANAGE Code Groups** can be selected. **<Code Type:>** This field contains a choicelist, where the code type (Thematical code - Point, Line, Area or Free code - Free) can be selected. The selected option will define how the code will be used. Selecting a code type allows a code to remain unique. **<Code:>** can have the same value but with a different **<Code Type:>** within the same codelist.	
	<Linework:> Available for **<Code Type: Point>** only. This field contains a choicelist, to allow a new line or new area to be opened whenever the point code is newly selected. This functionality is also available when creating codelists with LGO Codelist Management.	

Step	Description	Refer to chapter
	• None: Select this option to disable the functionality. All other code settings on the instrument are not affected when this option is set. • Begin Line: When a point code is newly selected, a new line is opened and the point being stored is added to the line. When the same point code remains selected, a new line is not opened. The point being stored is simply added to the current line. • Begin Area: The behaviour for opening a new area is the same as the behaviour for opening a new line, as mentioned above.	
	<Line Style:> Not available for **<Code Type: Free>**. The style in which lines and areas are represented in MapView and LGO.	7.1
4.	**NEW-A (F2)** adds **<Attribute 1:>** as new input field for an attribute of attribute type normal and of value type text.	
☞	**NAME (F3)** or **VALUE (F3)** Available for attributes for which an attribute name can be typed in. To highlight **<Attribute 1:>** or the field for the attribute value. The name of **<Attribute 1:>** can be edited and the attribute value to be used as the default attribute value can be typed in.	
☞	Attributes of attribute type mandatory or fixed and of value type real or integer must be created in LGO.	
☞	Up to twenty attributes can be created.	
5.	Is another attribute to be created? • If **yes**, repeat step 4. • If **no**, continue with step 6.	

Step	Description	Refer to chapter
6.	**STORE (F1)** adds the new code and any associated attributes to the System RAM codelist and returns to the screen from where this screen was accessed.	
☞	A new code can also be created within an application program. In this case, the new code is added to the job codelist.	

7.5.3 Editing a Code

Access step-by-step

Step	Description
1.	Refer to "7.5.1 Accessing MANAGE Codes" to access **MANAGE Codes**.
2.	**EDIT (F3)** to access **MANAGE Edit Code**.
3.	All following steps are identical with the creation of a new code. Refer to "7.5.2 Creating a New Code". Follow the instructions in paragraph "Create a new code step-by-step" from step 3. onwards.
☞	Attribute names that have already been typed in cannot be edited in a job codelist.

7.6 Managing Code Groups

Access step-by-step

Step	Description
1.	Refer to "7.5.1 Accessing MANAGE Codes" to access **MANAGE Codes**.
2.	**SHIFT GROUP (F4)** to access **MANAGE Code Groups**.

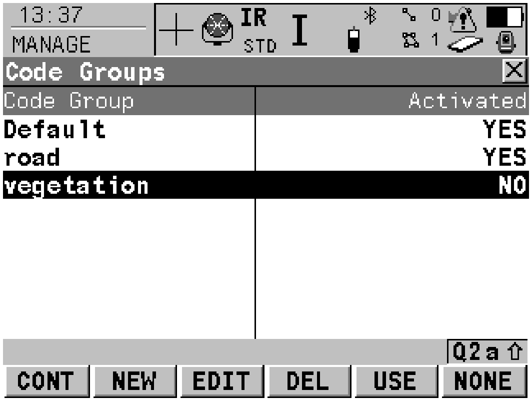
MANAGE Code Groups

The listed code groups belong to

the selected System RAM codelist when this screen was accessed through **Main Menu: Manage...\Codelists**.

OR

to the job codelist when **MANAGE Codes** was accessed from an application program, **MANAGE New Job** or **MANAGE Edit Job**.



CONT (F1)
To close the screen and return to the screen from where this screen was accessed.

NEW (F2)
To create a new code group.

EDIT (F3)
Available for System RAM codelists. To edit the highlighted code group.

DEL (F4)
Available for System RAM codelists. To delete the highlighted code group.

USE (F5)
To activate and deactivate the highlighted code group. Codes belonging to a deactivated code group are not displayed in **MANAGE Codes**.

NONE (F6) or **ALL (F6)**
To deactivate or activate all code groups.

Description of columns

Column	Description
Code Group	The name of the code group.
Activated	Use code group or not. The options are **Yes** and **No**. The codes belonging to a deactivated code group cannot be selected from the choicelist for code selection. **USE (F5)** changes between the options.

Next step

IF a code group	THEN
is to be created	**NEW (F2)**. In **MANAGE New Code Group** type in a unique name for **<Group:>**. **STORE (F1)** stores the new code group typed in and returns to **MANAGE Code Groups**.
is to be edited	highlight the code group and **EDIT (F3)**. In **MANAGE Edit Code Group** type in the changes for **<Group:>**. **STORE (F1)** stores the changes and returns to **MANAGE Code Groups**.

8 Coding

8.1 Overview

Description

A code is a description which can be stored with a point, line, area or alone.

Coding on TPS1200 is very flexible with thematical, free and quick coding being available. Thematical and free coding is possible by selecting codes from a codelist or by directly typing in codes. SmartCodes are a quick way for a code to be stored with a point to be selected and to be measured.

☞ For coding, points, lines and areas have the same behaviour. In this chapter, the word object is used as a generic term for points, lines and areas.

Coding methods

Coding method	Characteristic	Description
Thematical	Use	To store a description together with an object inside an application program or in **Main Menu: Manage...\Data**.
	Selection of the codes	• For thematical coding with codelist: On a configured display mask, codes are selected from the job codelist in a choicelist. The job codelist must contain thematical codes. • For thematical coding without codelist: On a configured display mask, codes are typed in.

Coding method	Characteristic	Description
	Recording of the codes	Together with the objects.
Free	Use	To store a description independent of an object at any time. A free code can be used to store a description related to an object or to store additional descriptions such as the job name or the temperature.
	Selection of the codes	• For free coding using a codelist: Pressing the configured hot key opens a choicelist with the free codes of the job codelist. • For free coding with direct input: Pressing the configured hot key opens a screen for alphanumeric input.
	Recording of the codes	Stored as time related information. A time stamp is stored with each free code. According to the requirements of the CAD package used, free codes can be configured to be stored before or after the object.
Quick	Use	Quick coding is the storing of an object plus a thematical or free code using a minimum number of keystrokes.

Coding method	Characteristic	Description
	Selection of the codes	Shortcuts must be assigned to codes in the job codelist. **<Quick Code: On>** must be set in **CONFIGURE Coding & Linework**. Typing the shortcut searches for the assigned code and initiates a measurement.
	Recording of the codes	• For thematical codes: Together with the objects. • For free codes: Stored as time related information before or after the points. A time stamp is stored with each free code.
		Quick codes must be created in LGO.
		Characters that can be assigned to quick codes are: • 0 to 9 • A to Z, not case sensitive • a to z, not case sensitive

Configure Coding

Refer to "16.3 Coding & Linework Settings" for information on configuring coding.

8.2 Thematical Coding

8.2.1 Thematical Coding with Codelist

☞ Thematical coding of points with a codelist is explained in this chapter. Refer to "6.4 Line/Area Management" for information on coding lines/areas.

Requirements

- The job codelist contains thematical codes.
- **<Thematc Codes: With Codelist>** in **CONFIGURE Coding & Linework**.
- A display mask with an input field for point codes must be configured.

Access

Open the choicelist for **<Code:>** in a display mask of an application program.

OR

Open the choicelist for **<Code:>/<Point Code:>** in **MANAGE New Point**, **Code** page in data management.

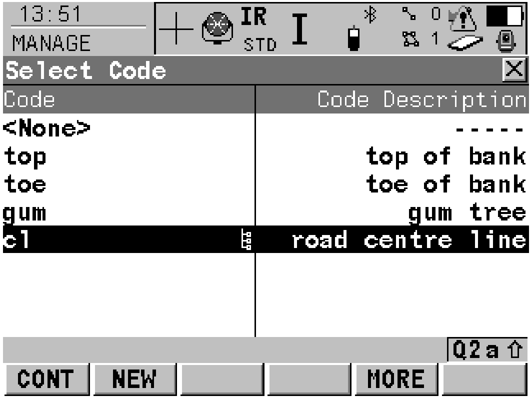
OR

Open the choicelist for **<Point Code:>** in **MANAGE Edit Point: Point ID**, **Code** page in data management.

OR

Open the choicelist for **<Auto Pt Code:>** in **SURVEY Survey: Job Name**, **Auto** page, if configured.

MANAGE
Select Code



CONT (F1)
: To return to the screen from where this screen was accessed.

NEW (F2)
: To create a new code. Refer to "7.5.2 Creating a New Code".

ATRIB (F3)
: Available unless accessed from **MANAGE New Point/Line/Area** or **MANAGE Edit Point/Line/Area**. To type in attribute values for the selected code and/or add new attributes for the selected code.

LAST (F4)
: Available if a code has been previously used in the active job. To select from a list of last used codes. The codes are sorted by time with the most recently used code at the top of the list.

MORE (F5)
: To display information about the code description, the code group, the code type and the quick code if codes with quick codes exist in the job.

SHIFT GROUP (F4)
: To view, create, delete, activate and deactivate code groups. Refer to "7.6 Managing Code Groups".

SHIFT SORT (F5)
: To sort codes by code name, code description, quick code or the last used.

Thematical coding with codelist step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to paragraph "Access" to access **XX Select Point Code**.	
2.	**MANAGE Select Point Code** All point codes from the job codelist which belong to the active code groups are available for selection. Point codes marked with have attributes attached.	7.6
3.	Highlight the desired code.	
4.	**ATRIB (F3)** to access **XX Enter Attributes**.	
5.	**XX Enter Attributes** **<Point Code:>** The name of the selected code for which attribute values are to be typed in. **<Code Desc:>** The detailed description of the selected code. If configured for the selected code, input fields for attribute values are available. Type in the attribute values. Attribute values for attributes of type • normal can be typed in. • fixed cannot be edited.	
	NEW-A (F2) to add a new attribute of type normal and of value type text.	

Step	Description	Refer to chapter
☞	**NAME (F3)** or **VALUE (F3)** Available for attributes for which an attribute name can be typed in. To highlight **<Attribute n:>** or the field for the attribute value.	
☞	Attributes of type mandatory or fixed and of value type real or integer must be created in LGO.	online help in LGO.
☞	Up to twenty attributes can be added.	
☞	**LAST (F4)** recalls the last used attribute values for the selected code.	
☞	**DEFLT (F5)** recalls the default attribute values for the selected code.	
6.	**CONT (F1)** returns to the screen from where **XX Select Point Code** was accessed.	
☞	The point code and any associated attribute values are stored when the point is stored.	
☞	If a point with the same point ID exists in the job, the codes, the attribute names and the attribute values of the new and the existing point must be identical. Should they not be identical, a screen opens where the code or attribute mismatch can be corrected.	8.6

8.2.2 Thematical Coding without Codelist

☞ Thematical coding without codelist for points is explained in this chapter. Refer to "6.4 Line/Area Management" for information on coding lines/areas.

Requirements

- **<Thematc Codes: Without Codelist>** in **CONFIGURE Coding & Linework**.
- A display mask with an input field for point codes must be configured.

Access

A thematical code is typed in the field

<Code:> in a display mask of an application program.

OR

<Code:>/<Point Code:> in **MANAGE New Point**, **Code** page in data management. The procedure is similar for lines and areas.

OR

<Point Code:> in **MANAGE Edit Point: Point ID**, **Code** page in data management. The procedure is similar for lines and areas.

OR

in the field **<Auto Pt Code:>** in **SURVEY Survey: Job Name**, **Auto** page, if configured.

Thematical coding without codelist step-by-step

Step	Description
☞	Thematical coding in the Survey application program is explained in this step-by-step instruction. A typical configuration set with a display mask for coding called **Code** is used.
1.	**SURVEY Survey: Job Name**, **Code** page

Step	Description
	<Point ID:> The identifier for the point for which codes and attribute values are to be typed in. **<Point Code:>** The name for the code. **<Attribute n:>** The attribute values for the code. Type in a code and attribute values.
	Up to eight attributes can be added. This is configured in the display mask.
2.	**ALL (F1)** to measure angles and distance. OR **PAGE (F6)** to change to another page on this screen.

8.3 Free Coding

8.3.1 Free Coding Using a Codelist

☞ In this chapter, free coding using a codelist is explained for points. Refer to "6.4 Line/Area Management" for information on coding lines/areas.

Requirements

- The job codelist contains free codes.
- A hot key is configured to access the screen **FREECODE Select Free Code** or the user defined menu is configured to display the option **Select Free Code**.

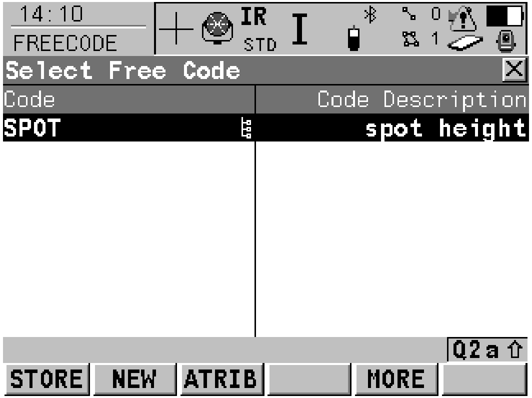
Access

Press a hot key configured to access the screen **FREECODE Select Free Code**. Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER** and select **Select Free Code** to access the screen **FREECODE Select Free Code**. Refer to "2.2 USER Key" for information on the **USER** key.

FREECODE
Select Free Code



STORE (F1)
To store the free code and any associated attribute values and to return to the screen from where this screen was accessed.

NEW (F2)
To create a new code. Refer to "7.5.2 Creating a New Code".

ATRIB (F3)
To type in attribute values and/or add new attributes for the selected free code.

LAST (F4)
Available if a free code has been previously used in the active job. To select from a list of last used free codes. The free codes are sorted by time with the most recently used code at the top of the list.

MORE (F5)
To display information about the code description, the code group and the quick code if codes with quick codes exist in the job.

SHIFT GROUP (F4)
To view, create, delete, activate and deactivate code groups. Refer to "7.6 Managing Code Groups".

SHIFT SORT (F5)
To sort codes by code name, code description, quick code or the last used.

Free coding using a codelist step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to paragraph "Access" to access **FREECODE Select Free Code**.	8.3
2.	**FREECODE Select Free Code** All free codes from the job codelist which belong to the active code groups are available for selection. Free codes marked with have attributes attached.	7.6
3.	Highlight the desired code.	
4.	**ATRIB (F3)** to access **FREECODE Enter Attributes**.	
5.	**FREECODE Enter Attributes** **<Free Code:>** The name of the selected code for which attribute values are to be typed in. **<Code Desc:>** The detailed description of the selected code. If configured for the selected code, input fields for attribute values are available. Type in the attribute values. Attribute values for attributes of type • normal can be typed in. • fixed cannot be edited.	
	NEW-A (F2) to add a new attribute of type normal and of value type text.	

Step	Description	Refer to chapter
☞	**NAME (F3)** or **VALUE (F3)** Available for attributes for which an attribute name can be typed in. To highlight **<Attribute n:>** or the field for the attribute value.	
☞	Attributes of type mandatory or fixed and of value type real or integer must be created in LGO.	online help in LGO.
☞	Up to twenty attributes can be added.	
☞	**LAST (F4)** recalls the last used attribute values for the selected code.	
☞	**DEFLT (F5)** recalls the default attribute values for the selected code.	
6.	**FREECODE Enter Attributes** **STORE (F1)** returns to the screen from where **FREECODE Select Free Code** was accessed and stores the free code, any associated attribute values and time related information.	

8.3.2 Free Coding with Direct Input

In this chapter, free coding with direct input is explained for points. Refer to "6.4 Line/Area Management" for information on coding lines/areas.

Requirements

A hot key is configured to access the screen **FREECODE Enter Free Code & Attributes** or the user defined menu is configured to display the option **Enter Free Code**.

Access

Press a hot key configured to access the screen **FREECODE Enter Free Code & Attributes**. Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER** and select **Enter Free Code** to access the screen **FREECODE Enter Free Code & Attributes**. Refer to "2.2 USER Key" for information on the **USER** key.

Free coding with direct input step-by-step

Step	Description
1.	Refer to paragraph "Access" to access **FREECODE Enter Free Code & Attributes**.
2.	**FREECODE Enter Free Code & Attributes** **<Free Code:>** The name for the free code. **<Attribute n:>** The attribute values for the free code. Type in a code and attribute values.
	As soon as a free code is typed in, a codelist is created within the job.
	Up to eight attributes can be added.

Step	Description
	LAST (F4) Available if a free code has been previously used in the active job. Accesses **FREECODE Last Used Free Codes**. To select from a list of last used free codes. The free codes are sorted by time with the most recently used code at the top of the list. In **FREECODE Last Used Free Codes** press **ATRIB (F3)** to type in attribute values.
3.	**STORE (F1)** stores the free code, any associated attribute values and time related information.

8.4 Quick Coding

Requirements

- The job codelist contains quick codes for points, lines and/or areas.
- According to the requirements of the used CAD package, set **<Rec Free Code: Before Point>** or **<Rec Free Code: After Point>** in **CONFIGURE Coding & Linework**.

Activate quick coding

The current setting for **<Quick Code:>** in **CONFIGURE Coding & Linework** determines how quick coding is activated. Quick coding can be activated at any time.

- For **<Quick Code: On>** in **CONFIGURE Coding & Linework**
  Quick coding is active and can be used.
- For **<Quick Code: Off>** in **CONFIGURE Coding & Linework**

    Press a hot key configured to switch between **<Quick Code: Off>** and **<Quick Code: On>** in **CONFIGURE Coding & Linework**. Refer to "2.1 Hot Keys" for information on hot keys.

  OR

    Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

  OR

    Tap the quick coding icon visible during Survey and other application programs where it is possible to measure a point with quick codes.

  OR

    Access **CONFIGURE Coding & Linework** and change the setting. Refer to "16.3 Coding & Linework Settings".
- For **<Quick Code: Never>** in **CONFIGURE Coding & Linework**

  Access **CONFIGURE Coding Settings** and change the setting. Refer to "16.3 Coding & Linework Settings".

Quick coding for points step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to paragraph "Activate quick coding" to activate quick coding.	
☞	A screen must be active where points can be measured. **ALL (F1)** must be visible. For example **SURVEY Survey: Job Name.**	
2.	Type in the one, two or three digits of the quick code. The current setting for **<Digits:>** in **CONFIGURE Coding & Line-work** determines by how many keystrokes quick coding is executed.	16.3
☞	**ENTER** to execute quick coding already after one or two keystrokes. Available for **<Digits: 2>** and **<Digits: 3>** in **CONFIGURE Coding & Linework**.	
☞	**ESC** clears digits from the entry.	
3.	What is the code type of the quick codes? • For point codes continue with the next row. • For free codes continue with step 5.	
☞	The point code assigned to the quick code is searched for in the job codelist and initiates measurements.	
☞	Attribute values for attributes of type • normal cannot be typed in. Depending on the setting for **<Attributes:>** in **CONFIGURE Coding & Linework**, the default or the last used attribute values are stored.	

Step	Description	Refer to chapter
	• fixed cannot be edited.	
☞	The point code and any associated attribute values are stored with the point.	
☞	If a point with the same point ID exists in the job, the codes, the attribute names and the attribute values of the new and the existing point must be identical. Should they not be identical, a screen opens where the code or attribute mismatch can be corrected.	8.6
4.	Quick coding for a point code is finished.	
5.	Quick coding for free codes continues from here.	
☞	The free code assigned to the quick code is searched for in the job codelist and initiates measurements.	
☞	Attribute values for attributes of type • normal cannot be typed in. Depending on the setting for **<Attributes:>** in **CONFIGURE Coding Settings**, the default or the last used attribute values are stored. • fixed cannot be edited.	
☞	The free code, associated attribute values and time related information are stored. The setting for **<Rec Free Code:>** in **CONFIGURE Coding & Linework** determines if the free code is stored before or after the point.	
6.	Quick coding for a free code is finished.	

Quick coding for lines/areas step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to paragraph "Activate quick coding" to activate quick coding.	
2.	Type in the one, two or three digits of the quick code. The current setting for **<Digits:>** in **CONFIGURE Coding & Linework** determines by how many keystrokes quick coding is executed.	16.3
☞	**ENTER** to execute quick coding already after one or two keystrokes. Available for **<Digits: 2>** and **<Digits: 3>** in **CONFIGURE Coding & Linework**.	
☞	**ESC** clears digits from the entry.	
☞	The line/area code assigned to the quick code is searched for in the job codelist.	
☞	A new line/area is created and immediately stored with that line/area code and attributes. For the line/area ID, the line/area ID template as defined in **CONFIGURE ID Templates** is used.	
☞	The system asks for mandatory attribute values.	
3.	Quick coding for a line/area is finished.	

8.5 SmartCodes

8.5.1 Overview

Description	SmartCodes is basically a quick way for code to be selected and point to be measured. All existing coding, linework, and point measurement functionality is retained.

8.5.2 Configuring SmartCodes

Access

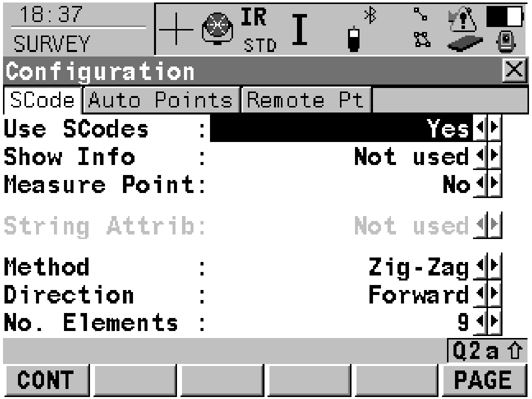
Select **Main Menu: Survey**. In **SURVEY Survey Begin** press **CONF (F2)** to access **SURVEY Configuration**.

OR

In **SURVEY Survey**: **Job Name** press **SHIFT CONF (F2)** to access **SURVEY Configuration**.

SURVEY Configuration, SCode page

The settings on this page activate the using of SmartCodes and define the method. All settings in this panel are stored within the currently active configuration set.



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

PAGE (F6)
To change to another page on this screen.

Description of fields

Field	Option	Description
<Use SCodes:>	**Yes**	Activates using of SmartCodes. ☞ All other fields on the screen are active and can be edited.
	No	Deactivates using of SmartCodes and all fields on this screen.
<Show Info:>		Information shown in line 8 of **SURVEY Survey: Job name, SCode** page.
	Not used	No display mask element is shown.
	Point ID	The identifier for the measured points. The configured point ID template is used. ☞ Refer to "47.2 Surveying Points".
	3D CQ	The current 3D coordinate quality of the measured point.
	2D CQ	The current 2D coordinate quality of the measured point.
	1D CQ	The current height coordinate quality of the measured point.
	Reflector Ht	The height of the reflector that is being used. Changing the reflector height here does not update the default reflector height as defined in the active configuration set.
	Hz	The current horizontal angle of the measured point.

Field	Option	Description
	V	The current vertical angle of the measured point.
	Horiz Dist	The current horizontal distance of the measured point.
	Slope Dist	The current slope distance of the measured point.
	Ht Diff	The current height difference between the station and the measured point.
<Measure Point:>	**Yes** or **No**	If one of the code boxes is tapped in **SURVEY Survey**: **Job name**, **SCode** page then that code is selected and the point is measured for **<Measure Point:Yes>**.
<String Attrib:>	Choicelist	Available for **<Show Codes: All Codes>**. When this field is active, surveyed points that have the same code attached are strung to one line. Refer to "16.3 Coding & Linework Settings".
<Method:>		Method by which subsequent code box is selected after a point is stored.
	Not used	**<Direction:>** and **<No. Elements:>** are invisible and the number of codes boxes shown in **SURVEY Survey: Job name, SCode** page is nine.
	Zig-Zag	Each new code block is started at the same end as where the previous code block finished.
	Same direction	Each new code block is started at the same end as where the previous code block started.

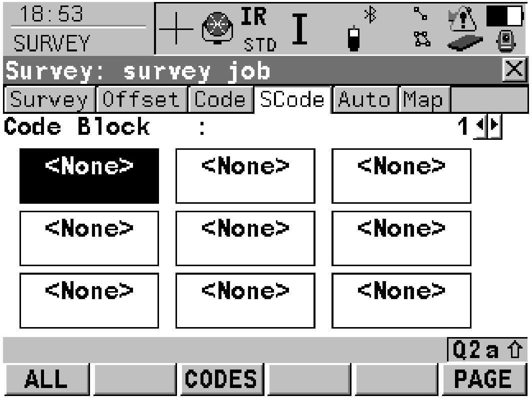
Field	Option	Description
		Refer to "50.1 Overview" for **<Method: Zig-Zag>** or **<Method: Same direction>**.
<Direction:>		The way of using the code boxes. This influences in which order the code boxes will be applied.
	Forward	The code boxes are used in the same way as defined in **SURVEY Survey: Job name, SCode** page.
	Backward	The code boxes are used in the reverse way as defined in **SURVEY Survey: Job name, SCode** page.
<No. Elements:>	**1, 2, 3, 4, 5, 6, 7, 8 or 9**	Number of code boxes shown in **SURVEY Survey: Job name, SCode** page.

8.5.3 Code Block

Requirements

- **<Use SCodes: Yes>** in **SURVEY Configuration**, **SCode** page.

SURVEY
Survey: Job Name, SCode page



ALL (F1)
To measure and store distances and angles.
CODES (F3)
To select a code from **MANAGE Select Code** panel.
PAGE (F6)
To change to another page on this screen.
SHIFT CONF (F2)
To activate/deactivate/configure SmartCodes.
SHIFT 2FACE (F4)
To take a measurement in Face I and Face II. The point stored is an average of the two measurements.

Creating a Code Block step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to paragraph "Accessing Survey" to access **SURVEY Survey Begin**.	47.1
2.	**CONT (F1)** to access **SURVEY Survey: Job Name**.	
3.	**PAGE (F6)** until the **SCode** page is visible.	

Step	Description	Refer to chapter
4.	With the focus on **<Code Block: 1>** press enter to access **SURVEY Manage Code Blocks** panel.	
5.	**NEW (F2)** to create a new code block.	
☞	Code blocks can only be created or deleted in **SURVEY Manage Code Blocks** panel.	
6.	**CONT (F1)** to return to **SURVEY Survey: Job Name, SCode** page.	

Assigning codes to a Code Block step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to paragraph "Creating a Code Block step-by-step" to access **SURVEY Survey: Job Name, SCode** page.	
2.	Move the focus on a code box.	
3.	**CODES (F4)** to select a code to be assigned to the highlighted code block.	
☞	To create a new code to be assigned refer to "Creating a New Code".	7.5.2

Copying a Code Block to a new job step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
	Code blocks are stored in the job.	
1.	Refer to paragraph "Accessing Job Management" to access **MANAGE Edit Job: Job Name, Codelist** page.	5.2
	<Codelist:> If codes had been copied from a System RAM codelist, the name of the codelist is displayed. If codes have been typed in, then the name of the active job is displayed.	
2.	**SHIFT EXPRT (F2)** copies codes and code blocks from the job to an existing or new codelist.	
	To create a new codelist refer to "Creating/Editing a Codelist".	7.4
	Copying code blocks to an existing codelist overwrites the code blocks of the existing codelist.	
3.	**STORE (F1)** to save the currently active job and return to **MANAGE Job (Device)**.	
4.	Create a new job and assign the related codelist to the job.	
	SmartCodes from the codelist are now available within the new job.	
	To create a new job refer to "Creating a New Job".	5.3

8.5.4 Using SmartCodes

Measuring points using Code Blocks step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to paragraph "Creating a Code Block step-by-step" to access **SURVEY Survey: Job Name, SCode** page.	8.5.4
2.	Move the focus on a code box.	
	When **<String Attrib:>** is active, you can type in an attribute value below the code name of the highlighted code box.	
	+ (F4) or **- (F5)** to increase or decrease the value. Applies only if the value is numeric.	
3.	**ALL (F1)** to measure and store the point with the highlighted code.	
	When **<Measure Point: Yes>** is set in the configuration settings, tapping the code box with the supplied stylus automatically measures and stores the point with the highlighted code. Selecting the code box by using the arrow keys will not measure and store the point.	

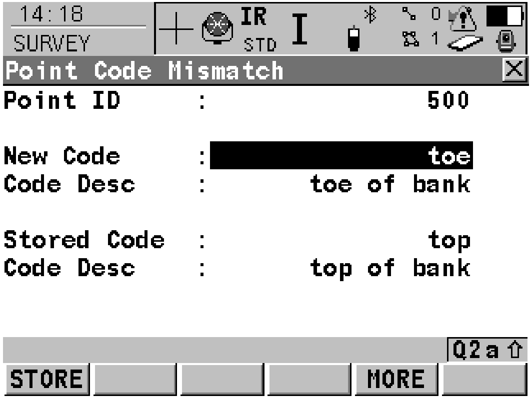
8.6 Code and Attribute Mismatch

8.6.1 Code Mismatch

Description

When storing a point with a code, it may happen that a point with the same point ID already exists in the job. If the codes of the new and the existing point do not match, a screen opens where the code can be corrected. One point cannot have different codes.

XX
Point Code Mismatch



STORE (F1)
To store the highlighted code and any associated attributes with the point being stored and to continue with the application program or data management.

MORE (F5)
To display information about the code description, the code group and any attributes associated with the highlighted code.

Description of fields

Field	Option	Description
<New Code:>	Output	The code for the point.
<Stored Code:>	Output	The code as stored for the existing point in the job.

Match codes step-by-step

Step	Description
☞	**XX Point Code Mismatch** opens automatically if the codes of the new and the existing point do not match.
1.	Highlight the code to be stored with the new point.
2.	**STORE (F1)** stores the highlighted code and any associated attributes with the point being stored and continues with the application program or data management.

8.6.2 Attribute Mismatch

Description

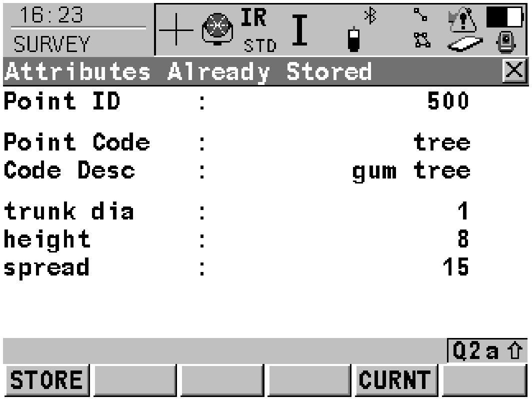
If a point with the same point ID exists in the job, the codes, the attribute names and the attribute values of the new and the existing point must be identical. Should they not be identical, a screen opens where the attribute mismatch can be corrected. One point cannot have different attributes.

The name of the screen changes with pressing **CURNT (F5)** or **STORD (F5)**:

Pressing **CURNT (F5)**: **XX Attributes Being Stored**
Pressing **STORD (F5)**: **XX Attributes Already Stored**

For simplicity, the screen shown is **XX Attributes Already Stored**.

XX Attributes Already Stored



STORE (F1)
To store the selected attributes with the new/created point and to continue with the application program or data management.

CURNT (F5) or **STORD (F5)**
To change between viewing the attribute names and values of the new/created point and those stored for the existing point in the job.

Description of fields

Field	Option	Description
<Point Code:>	Output	• For **XX Attributes Already Stored**: The code of the existing point in the job. • For **XX Attributes Being Stored**: The code of the new point.
Attributes	Output	• For **XX Attributes Already Stored**: The attributes as stored for the existing point in the job. • For **XX Attributes Being Stored**: The attributes of the new point.

Match attributes step-by-step

Step	Description
	XX Attributes Already Stored opens automatically if the attribute names and/or values of the new and the existing point do not match.
1.	**CURNT (F5)** and **STORD (F5)** to display the attribute names and values to be stored with the point.
2.	**STORE (F1)** stores the displayed attribute names and values with the point being stored and continues with the application program or data management.

9 Linework

9.1 Overview

Description

Two methods are available for the surveying of lines and areas. These two methods can be combined and are described in the following table.

Linework by	Description

Linework	• In all application programs, a display mask can be configured to show the field **<Linework:>.** This field contains a choicelist, where the Linework flags can be selected.
	• The selection of a linework flag determines:
	  • the action taken for a line/area, for example beginning a line.
	  • the linework flag to be stored with the point.
	• The Linework flags:
	  • are configured in **CONFIGURE Coding & Linework**, **Linework**.
	  • can be exported with a format file.

Coding	• Line/area codes can be selected in many application programs. • Refer to "8 Coding" for more information.

☞

- The Linework flag and coding are not linked.
- Additionally to Linework, thematical point, line and area codes can be used.
- Quick coding can be used as per normal.

9.2 Performing Linework

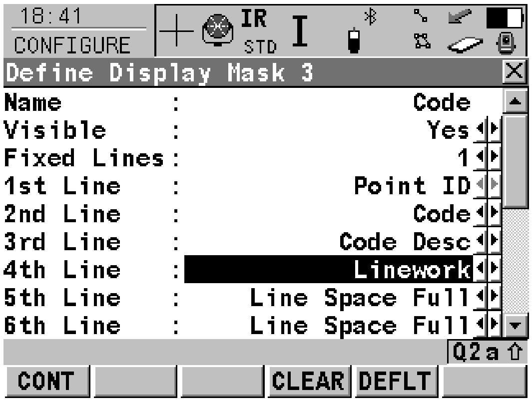
The Survey application program is used here to explain Linework.

Requirements

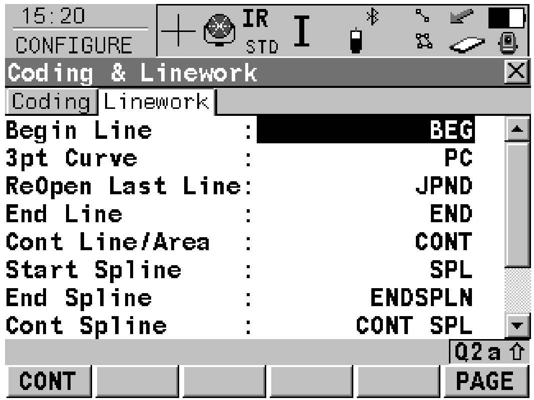
- A display mask with a choicelist for Linework must be configured.
- The Linework flags are defined in **CONFIGURE Coding & Linework Settings**, **Linework**

Preparing Linework

Step1: Placing Linework in a display mask

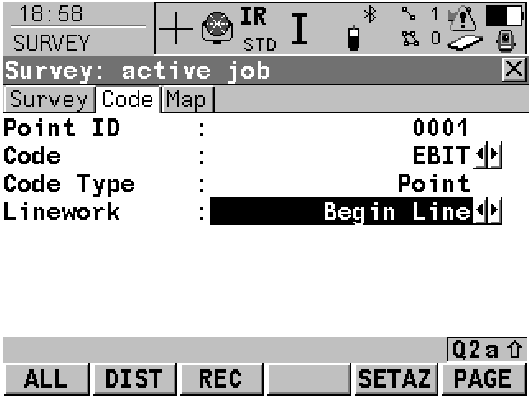


Step2: Defining the Linework flags



Performing Linework

The most important keys are explained.



ALL (F1)
To measure and store distances and angles.

STOP (F1)
Available if **<EDM Mode: Tracking>** and **DIST (F2)** was pressed. Stops the distance measurements. **(F1)** changes back to **ALL**.

DIST (F2)
To measure and display distances. Available unless **<EDM Mode: Tracking>** and/or **<Log Auto Pts: Yes>**, after the tracking or logging is started.

REC (F3)
To record data. If **<EDM Mode: Tracking>** and/or **<Log Auto Pts: Yes>**, records measured point and continues tracking.

Description of fields

Field	Option	Description
<Point ID:>	User input	The identifier for manually occupied points. The configured point ID template is used. The ID can be changed in the following ways: • To start a new sequence of point ID's type over the point ID.

Field	Option	Description
		• For an individual point ID independent of the ID template **SHIFT INDIV (F5)**. **SHIFT RUN (F5)** changes back to the next ID from the configured ID template. Refer to "16.1 ID Templates".
<Linework:>		The linework flag to be stored with the point. The options available depend on whether a line/area is currently open.
	- - - - -	No linework flag is stored.
	Begin Line	Opens a new line when the next point is stored. Any line/area which is currently open is closed and the last point belonging to that line/area is given the **End Line**/**Close Area** linework flag. The point may or may not be stored with a point code.
	3pt Curve	Stores the linework flag for a curve through the next three measured points and continues a line/area.
	ReOpen Any Line	Opens a line from a list of all lines which are currently stored in the job when the next point is stored. The last code used with the reopened line is automatically selected when the point is stored. Any line/area which is currently open is closed and the last point belonging to that line/area is given the **End Line**/**Close Area** linework flag.

Field	Option	Description
	ReOpen Last Line	Opens the last used line again. The last code used with the reopened line is automatically selected when the point is stored.
	End Line	Closes all open lines.
	Cont Line/Area	Indicates a line/area is open.
	Start Spline	Stores the linework flag for beginning a spline and continues any open line/area.
	End Spline	Closes a spline and continues any open line/area.
	Cont Spline	Indicates a line/area is open with spline line type.
	Begin Area	Opens a new area when the next point is stored. Any line/area which is currently open is closed and the last point belonging to that line/area is given the **End Line/Close Area** linework flag. The point may or may not be stored with a point code.
	ReOpen Any Area	Opens an area from a list of all lines which are currently stored in the job when the next point is stored. The last code used with the reopened area is automatically selected when the point is stored. Any line/area which is currently open is closed and the last point belonging to that line/area is given the **End Line/Close Area** linework flag.
	ReOpen Last Area	Opens the last used area again. The last code used with the reopened area is automatically selected when the point is stored.

Field	Option	Description
	Close Area	Closes all open areas.

Next step

Step	Description
1.	Go to the point to be measured.
2.	Select the appropriate Linework flag to be stored with the next point.
3.	**ALL (F1)**
4.	Repeat steps 1. to 3. until all points are measured and stored.
5.	**SHIFT QUIT (F6)** to exit the Survey application program.
6.	Use a format file to export the points including the linework flags.

Selecting a line with MapView

- Selecting a line in MapView is possible with either the softkeys or the touch screen.
- Refer to "34 MapView Interactive Display Feature" for further information.

9.3 Combining Linework and Coding

Description

- Linework and coding can be combined.
- This combination can be useful, because coding, assigning linework flags and opening/closing lines/areas can all be done with one point observation.
- Combining Linework and coding can only be configured if thematical point codes or if thematical point, line and area codes are available for selection. Thematical coding can be done with or without codelists.

Configuration options

- The configuration for the types of codes available and the configuration for coding with/without a codelist both have an influence on the following:
  - The required configuration of a display mask.
  - The behaviour of the fields configured for the display mask.
  - The behaviour of the software.
- The possible configurations and their influence are shown in this table:

Configuration in **CONFIGURE Coding & Linework**				
Show Codes	Only Pt Codes		All Codes	
Thematc Codes	With Codelist	Without Codelist	With Codelist	Without Codelist
Required fields and their appearance in display mask				
Code				
Required	✓	✓	✓	✓
Optional	-	-	-	-
Appearance	Choicelist	User input	Choicelist	User input

Code Type Required Optional Appearance	 - ✓ Output	 - ✓ Output	 - ✓ Output	 ✓ - Choicelist
Linework Required Optional Appearance	 ✓ - Choicelist	 ✓ - Choicelist	 ✓ - Choicelist	 ✓ - Choicelist

Requirements

- A display mask must be configured with:
  - a field for codes.
  - a choicelist for Linework.

- The configuration of a field for code types in a display mask is required for working with point, line and area codes without choicelist. Else the configuration of a field for code types is optional.

- Configure in **CONFIGURE Coding & Linework**, **Coding**:
  - **<Show Codes: Only Pt Codes>** or **<Show Codes: All Codes>**.
  - **<Thematc Codes: With Codelist>** or **<Thematc Codes: Without Codelist>**.
- In **CONFIGURE Coding & Linework Settings**, **Linework** defines the flags for Linework.

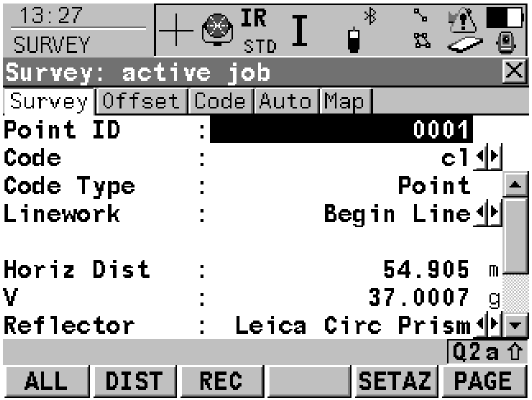
☞ The Survey application program is used here to explain the combination of Linework/Coding.

Access step-by-step

Step	Description
1.	Select **Main Menu: Survey** to access **SURVEY Survey Begin**.
2.	In **SURVEY Survey Begin** select a job.
3.	Select a configuration set.
4.	Select a reflector.
5.	**CONT (F1)** to access **SURVEY Survey: Job Name**.

Using Linework/Coding

This is what a display mask configured for Linework and coding looks like. The most important keys are explained. For the explanation of the other keys refer to "47.2 Surveying Points".



ALL (F1)
To measure and store distances and angles.

STOP (F1)
Available if **<EDM Mode: Tracking>** and **DIST (F2)** was pressed. Stops the distance measurements. **(F1)** changes back to **ALL**.

DIST (F2)
To measure and display distances. Available unless **<EDM Mode: Tracking>** and/or **<Log Auto Pts: Yes>**, after the tracking or logging is started.

REC (F3)
To record data. If **<EDM Mode: Tracking>** and/or **<Log Auto Pts: Yes>**, records measured point and continues tracking.

Using Linework/Coding for point codes step-by-step

For <Show Codes: Only Pt Codes>

Step	Field	Description for thematical coding	
		With codelist	Without codelist
1.	**<Code:>**	Select a code from the choicelist. Only point codes are available for selection. **<None>** to store a point without code or to perform Linework without coding.	Type in a code. **-----** to store a point without code or to perform Linework without coding.
2.	**<Code Type:>**	• **Point** is displayed. This field is an output field only.	
3.	**<Linework:>**	• Select a Linework flag to be stored with the point. • Select **-----** to store a point without a Linework flag or to perform coding without Linework.	
4.	-	• **ALL (F1)**	
	- - -	• The point is stored with the selected code. • The point is stored with the selected Linework flag. • The choice of flags available for **<Linework:>** is updated.	

Using Linework/Coding for all codes step-by-step

For <Show Codes: All Codes>

Step	Field	Description for thematical coding	
		With codelist	**Without codelist**
1.	**<Code:>**	Select a code from the choicelist. Point, line and area codes are available for selection. **<None>** to store a point without code or to perform Linework without coding.	Type in a code. **-----** to store a point without code or to perform Linework without coding.
2.	**<Code Type:>**	The type of the selected code. This field is an output field only.	Select the type of the entered code.
3.	**<Linework:>**	• Select a Linework flag to be stored with the point. • Select **-----** to store a point without a Linework flag or to perform coding without Linework.	
4.	-	• **ALL (F1)**	
	- - -	• For a point code being selected: • The point is stored with the selected code. • The point is stored with the selected Linework flag. • The choice of flags available for **<Linework:>** is updated.	

10 Manage...\Coordinate Systems

10.1 Overview

Using coordinate systems on TPS

Coordinate systems are used on TPS1200 instruments to combine GPS1200 data with TPS1200 data.

Description

A coordinate system

- consists of up to five elements.
- allows the conversion from WGS 1984 geodetic or cartesian coordinates to local cartesian, geodetic or grid coordinates and back.
- can be attached to jobs.
- can be defined.
- can be computed in the field.
- can be downloaded to LGO.
- can be uploaded from LGO.

☞ The geometric ppm and atmospheric ppm to reduce the raw distances measured with an EDM are completely independent from any coordinate system. An attached coordinate system is not used to reduce any measured distance on a TPS1200 instrument.

☞ Points surveyed with a TPS1200 instrument are always stored in local GRID coordinates regardless of the coordinate system being used.
GPS surveyed points are always stored as WGS 1984 geodetic coordinates regardless of the coordinate system being used.

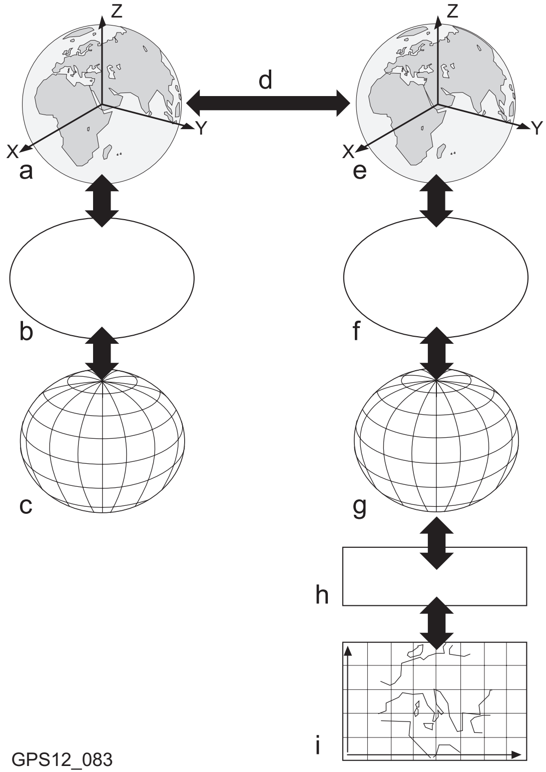
Using a different coordinate system converts the coordinates displayed on the screen, but does not convert and restore the coordinate values in the database DB-X.

☞ One coordinate system can be attached to a job at one time. This coordinate system remains attached to the job unless it is changed.

Elements of coordinate system

The five elements which define a coordinate system are:

- a transformation
- a projection
- an ellipsoid
- a geoid model
- a **C**ountry **S**pecific **C**oordinate **S**ystem model



a) WGS 1984 cartesian: X, Y, Z
b) WGS 1984 ellipsoid
c) WGS 1984 geodetic: Latitude, longitude, ellipsoidal height
d) 7 parameter transformation: dX, dY, dZ, rx, ry, rz, scale
e) Local cartesian: X, Y, Z
f) Local ellipsoid
g) Local geodetic: Latitude, longitude, ellipsoidal height
h) Local projection
i) Local grid: Easting, Northing, orthometric height

All these elements can be specified when creating a coordinate system.

Default coordinate systems	TPS1200 and GPS1200 have different default coordinate systems. They cannot be deleted. Additional default coordinate systems may be available for certain countries.
Coordinate system <None>	**<None>** is the default coordinate system on a TPS1200 instrument. It is not possible to create a coordinate system called **<None>**.
Coordinate system WGS 1984	**WGS 1984** is the global geocentric datum to which all GPS positioning information is referred to. **WGS 1984** is the default coordinate system on a GPS1200 receiver. It is not possible to create a coordinate system called **WGS 1984**.
Active coordinate system	The active coordinate system is the one attached to the job currently being used. One coordinate system is always considered as the active coordinate system.
Coordinate systems when transferring jobs between GPS and TPS	When transferring a job from TPS1200 to GPS1200, or vice-versa, the coordinate system stays attached to the job and appears like any other coordinate system on the instrument.

10.2 Terminology

Description

This chapter describes technical terms related to coordinate system management.

Transformation

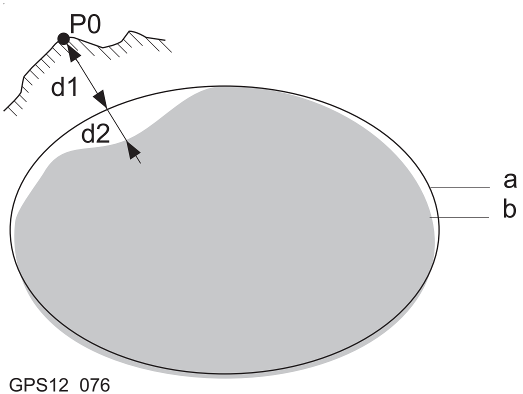
Refer to "37.1 Overview" for information on transformations.

Geoid model

Description

GPS operates on the WGS 1984 ellipsoid and all heights obtained by measuring baselines are ellipsoidal heights. Existing heights are usually orthometric heights, also called height above the geoid, height above mean sea level or leveled height. The mean sea level corresponds to a surface known as the geoid. The relation between ellipsoidal height and orthometric height is

Orthometric Height = Ellipsoidal Height - Geoid Separation N



a) WGS 1984 ellipsoid
b) Geoid

P0 Measured point
d1 Ellipsoidal height
d2 Geoid separation N, is negative when the geoid is below the ellipsoid

N value and geoid model

The geoid separation (N value) is the distance between the geoid and the reference ellipsoid. It may refer to the WGS 1984 or to the local ellipsoid. It is not a constant except over maybe small flat areas such as 5 km x 5 km. Therefore it is necessary to model the N value in order to obtain accurate orthometric heights. The modelled N values form a geoid model for an area. With a geoid model attached to a coordinate system, N values for the measured points can be determined. Ellipsoidal heights can be converted to orthometric heights and back.

Refer to the online help of LGO for more information on geoid models.

Geoid models are an approximation of the N value. In terms of accuracy, they may vary considerably and global models in particular should be used with caution. If the accuracy of the geoid model is not known it might be safer to use local control points with orthometric heights and apply a transformation to approximate the local geoid.

Geoid field file

Geoid field files may be used in the field to calculate orthometric heights out of ellipsoidal heights and vice versa.

CSCS model

Description

Country **S**pecific **C**oordinate **S**ystem models

- are tables of correction values to directly convert coordinates from WGS 1984 to local grid without the need of transformation parameters.
- take the distortions of the mapping system into account.
- are an addition to an already defined coordinate system.

Types of CSCS models

The correction values of a CSCS model can be applied at different stages in the coordinate conversion process. Depending on this stage, a CSCS model works differently. Three types of CSCS models are supported by TPS1200. Their conversion process is as explained in the following table. Any suitable geoid model can be combined with a geodetic CSCS model. Refer to the online help of LGO for more information on CSCS models.

Type	Description
Grid	1. Determination of preliminary grid coordinates by applying the specified transformation, ellipsoid and map projection. 2. Determination of the final local grid coordinates by applying a shift in Easting and Northing interpolated in the grid file of the CSCS model.
Cartesian	1. Performing the specified transformation. 2. Determination of local cartesian coordinates by applying a 3D shift interpolated in the grid file of the CSCS model. 3. Determination of the final local grid coordinates by applying the specified local ellipsoid and map projection.
Geodetic	1. Determination of local geodetic coordinates by applying a correction in latitude and longitude interpolated from the file of the CSCS model. 2. Determination of the final local grid coordinates by applying the local map projection. ☞ Using a geodetic CSCS model excludes the use of a transformation in a coordinate system.

CSCS field file

CSCS field files may be used in the field. They are extracted from the main CSCS model, which may be too big to fit on the instrument.

10.3 Accessing Coordinate System Management

Access

Select **Main Menu: Manage...\Coordinate Systems**.

OR

Press a hot key configured to access the screen **MANAGE Coordinate Systems**. Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

OR

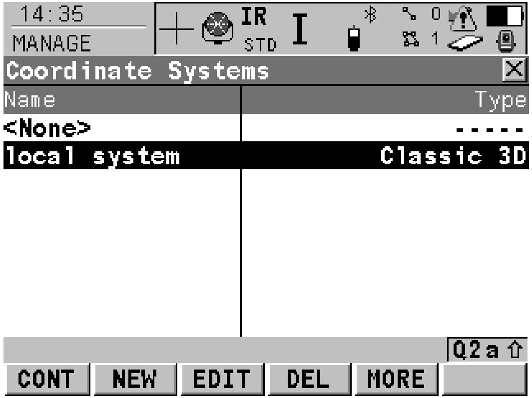
From a choicelist in some screens for example in **MANAGE New Job, Coord System** page.

OR

Press **CSYS (F6)** in some screens for example in **SURVEY Survey Begin**.

MANAGE Coordinate Systems

Listed are all coordinate systems stored in the database DB-X. Any unavailable information is shown as -----.



CONT (F1)
: To select the highlighted coordinate system and to return to the previous screen. With a CompactFlash card inserted, the selected coordinate system will be attached to the active job.

NEW (F2)
: To create a coordinate system. Refer to "10.4.1 Creating a New Coordinate System".

EDIT (F3)
: To edit the highlighted coordinate system. Refer to "10.4.2 Editing a Coordinate System".

DEL (F4)
: To delete the highlighted coordinate system.

MORE (F5)
: To display information about the type of transformation used, the type of heights computed, the number of control points used for the determination and the date of when the coordinate system was created.

SHIFT SET-D (F4)
: Available unless a default coordinate system is highlighted. To turn the highlighted coordinate system into a user defined default coordinate system stored in the instrument.

SHIFT DEFLT (F5)
: To recall the deleted default coordinate systems.

Next step

IF a coordinate system	**THEN**
is to be selected	highlight the desired coordinate system. **CONT (F1)** closes the screen and returns to the screen from where **MANAGE Coordinate Systems** was accessed.
is to be created	highlight any coordinate system and **NEW (F2)**. Refer to "10.4.1 Creating a New Coordinate System".
is to be edited	highlight the coordinate system and **EDIT (F3)**. Refer to "10.4.2 Editing a Coordinate System".

10.4 Coordinate Systems

10.4.1 Creating a New Coordinate System

☞ Coordinate systems can be defined by manual creation or determined by calculation.
In this chapter, the manual creation of coordinate systems is explained. Refer to "37 Determine Coordinate System - General" for information on the determination by calculation.

☞ Coordinate systems with a Classic 3D transformation can be defined by manual creation.

Access

Refer to "10.3 Accessing Coordinate System Management" to access **MANAGE Coordinate Systems**.

Create a coordinate system step-by-step

The following table explains the most common settings.
Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	In **MANAGE Coordinate Systems** highlight a coordinate system. A copy of this coordinate system is taken for further configurations.	
2.	**NEW (F2)** to access **MANAGE New Coordinate System**.	
3.	**MANAGE New Coordinate System** **<Name:>** A unique name for the new coordinate system. The name may be up to 16 characters long and may include spaces.	

Step	Description	Refer to chapter
	<Residuals:> Available for transformations with control points. Entered transformations do not have control points. The method by which residuals are distributed throughout the transformation area. The transformation results become more realistic and any strain is dispersed in the transformation. **<Residuals: 1/Dist>**, **<Residuals: 1/Dist^2>** and **<Residuals: 1/Dist$^{3/2}$>** distribute the residuals of the control points according to the distance between each control point and the newly transformed point. **<Residuals: Multiquadratic>** distributes the residuals using a multiquadratic interpolation approach.	
	<Transform:> The type of transformation.	10.5
	<Ellipsoid:> Available unless projection **<Type: Customised>**. The local coordinates are based on this ellipsoid.	10.6
	<Projection:> The map projection.	10.7
	<Geoid Model:> The geoid model.	10.8
	<CSCS Model:> The Country Specific Coordinate System model.	10.9
	Enter a name.	
4.	**STORE (F1)** stores the new coordinate system and returns to **MANAGE Coordinate Systems**.	

10.4.2 Editing a Coordinate System

☞ The type of transformation of the selected coordinate system determines which elements of a coordinate system can be edited. The name of the coordinate system, the method of residual distribution and the geoid model in use are always editable.

Access

Refer to "10.3 Accessing Coordinate System Management" to access **MANAGE Coordinate Systems**.

Edit a coordinate system step-by-step

The following table explains the most common settings.
Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	In **MANAGE Coordinate Systems** highlight a coordinate system to be edited.	
2.	**EDIT (F3)** to access **MANAGE Edit Coordinate System**.	
3.	**MANAGE Edit Coordinate System** The transformation type of the selected coordinate system determines the availability and the options of the subsequent fields. Most fields are identical with those for the creation of a new coordinate system. An additional field is: **<Pre Transform:>** Available for Twostep transformations. The name of a preliminary 3D transformation which is used together with the selected projection to obtain preliminary grid coordinates to be used for a final 2D transformation.	10.4.1

Step	Description	Refer to chapter
	Make the required changes.	
4.	**STORE (F1)** stores the changes and returns to **MANAGE Coordinate Systems**.	

10.5 Transformations

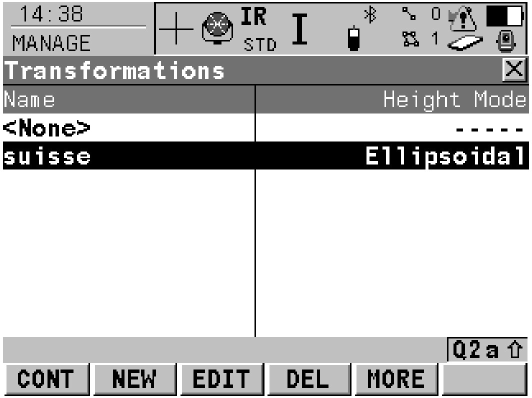
10.5.1 Accessing Transformation Management

Access step-by-step

Step	Description
1.	Refer to "10.3 Accessing Coordinate System Management" to access **MANAGE Coordinate Systems**.
2.	In **MANAGE Coordinate Systems** highlight a coordinate system to be edited.
3.	**EDIT (F3)** to access **MANAGE Edit Coordinate System**.
4.	In **MANAGE Edit Coordinate System** highlight **<Transform:>**.
5.	**ENTER** to access **MANAGE Transformations**.

MANAGE Transformations

Listed are all Classic 3D transformations stored in the database DB-X. Any unavailable information is shown as -----.



CONT (F1)
To select the highlighted transformation and to return to the previous screen.

NEW (F2)
To create a new transformation. Refer to "10.5.2 Creating a New Transformation".

EDIT (F3)
To edit the highlighted transformation. Refer to "10.5.3 Editing a Transformation".

DEL (F4)
To delete the highlighted transformation.

MORE (F5)
To display information about the type of heights computed and the number of control points used for the determination of the transformation.

SHIFT SET-D (F4)
To turn the highlighted transformation into a user defined default transformation stored in the instrument.

SHIFT DEFLT (F5)
To recall the deleted default transformations.

Next step

IF a transformation	THEN
is to be selected	highlight the desired transformation. **CONT (F1)** closes the screen and returns to the screen from where **MANAGE Transformations** was accessed.
is to be created	highlight any transformation and **NEW (F2)**. Refer to "10.5.2 Creating a New Transformation".
is to be edited	highlight the transformation and **EDIT (F3)**. Refer to "10.5.3 Editing a Transformation".

10.5.2 Creating a New Transformation

☞ Classic 3D transformations can be created.

Access

Refer to "10.5.1 Accessing Transformation Management" to access **MANAGE Transformations**.

Create a transformation step-by-step

The following table explains the most common settings.
Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	In **MANAGE Transformations** highlight a transformation. A copy of this transformation is taken for further configurations.	
2.	**NEW (F2)** to access **MANAGE New Transformation**.	
3.	**MANAGE New Transformation**, **General** page **<Name:>** A unique name for the new transformation. The name may be up to 16 characters long and may include spaces. **<Type:>** Output field. No other transformations than Classic 3D can be created. Enter a name.	37.1
4.	**PAGE (F6)** changes to the **Parameters** page.	
5.	**MANAGE New Transformation**, **Parameters** page Enter the known values of the transformation parameters.	
6.	**PAGE (F6)** changes to the **More** page.	

Step	Description	Refer to chapter
7.	**MANAGE New Transformation**, **More** page **<Height Mode:>** The type of heights to be computed. **<Transf Model:>** The transformation model to be used. For **<Transf Model: Molodensky-Bad>**, additional input fields are available. Select at least a height mode and a transformation model.	
☞	**CLEAR (F5)** Available for **<Transf Model: Molodensky-Bad>**. To set the additional input fields to 0.	
8.	**STORE (F1)** stores the new transformation and returns to **MANAGE Transformations**.	

10.5.3 Editing a Transformation

Access step-by-step

Step	Description
1.	Refer to "10.5.1 Accessing Transformation Management" to access **MANAGE Transformations**.
2.	In **MANAGE Transformations** highlight a transformation to be edited.
3.	**EDIT (F3)** to access **MANAGE Edit Transformation**.
4.	All following steps are identical with the creation of a new transformation. **<Height Mode:>** in **MANAGE Edit Transformation**, **More** page cannot be changed. Refer to "10.5.2 Creating a New Transformation". Follow the instructions in paragraph "Create a transformation step-by-step" from step 3. onwards.

10.6 Ellipsoids

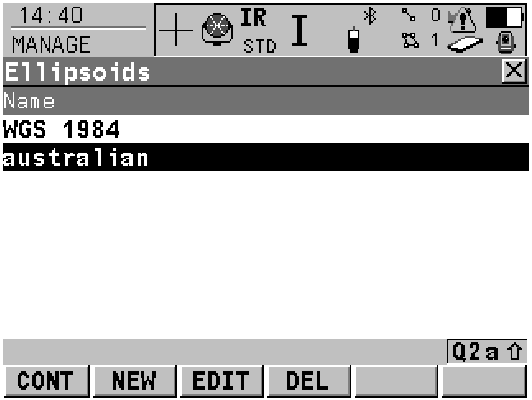
10.6.1 Accessing Ellipsoid Management

Access step-by-step

Step	Description
1.	Refer to "10.3 Accessing Coordinate System Management" to access **MANAGE Coordinate Systems**.
2.	In **MANAGE Coordinate Systems** highlight a coordinate system to be edited.
3.	**EDIT (F3)** to access **MANAGE Edit Coordinate System**.
4.	In **MANAGE Edit Coordinate System** highlight **<Ellipsoid:>**.
5.	**ENTER** to access **MANAGE Ellipsoids**.

MANAGE Ellipsoids

Listed are all ellipsoids stored in the database DB-X.



CONT (F1)
To select the highlighted ellipsoid and to return to the previous screen.

NEW (F2)
To create a new ellipsoid. Refer to "10.6.2 Creating a New Ellipsoid".

EDIT (F3)
To edit the highlighted ellipsoid. Refer to "10.6.3 Editing an Ellipsoid".

DEL (F4)
To delete the highlighted ellipsoid.

SHIFT SET-D (F4)
To turn the highlighted ellipsoid into a user defined default ellipsoid stored in the instrument.

SHIFT DEFLT (F5)
To recall the deleted default ellipsoids.

Next step

IF an ellipsoid	THEN
is to be selected	highlight the desired ellipsoid. **CONT (F1)** closes the screen and returns to the screen from where **MANAGE Ellipsoids** was accessed.
is to be created	highlight any ellipsoid and **NEW (F2)**. Refer to "10.6.2 Creating a New Ellipsoid".
is to be edited	highlight the ellipsoid and **EDIT (F3)**. Refer to "10.6.3 Editing an Ellipsoid".

10.6.2 Creating a New Ellipsoid

Access

Refer to "10.6.1 Accessing Ellipsoid Management" to access **MANAGE Ellipsoids**.

Create an ellipsoid step-by-step

The following table explains the most common settings.
Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	In **MANAGE Ellipsoids** highlight an ellipsoid. A copy of this ellipsoid is taken for further configurations.	
2.	**NEW (F2)** to access **MANAGE New Ellipsoid**.	
3.	**MANAGE New Ellipsoid** **<Name:>** A unique name for the new ellipsoid. A name is mandatory and may be up to 16 characters long and may include spaces. **<Axis a:>** The semi-major axis a. **<1/f:>** The reciprocal value of flattening f. Enter a name.	
4.	**STORE (F1)** stores the new ellipsoid and returns to **MANAGE Ellipsoids**.	

10.6.3 Editing an Ellipsoid

Access step-by-step

Step	Description
1.	Refer to "10.6.1 Accessing Ellipsoid Management" to access **MANAGE Ellipsoids**.
2.	In **MANAGE Ellipsoids** highlight an ellipsoid to be edited.
3.	**EDIT (F3)** to access **MANAGE Edit Ellipsoid**.
4.	All following steps are identical with the creation of a new ellipsoid. Refer to "10.6.2 Creating a New Ellipsoid". Follow the instructions in paragraph "Create an ellipsoid step-by-step" from step 3. onwards.

10.7 Projections

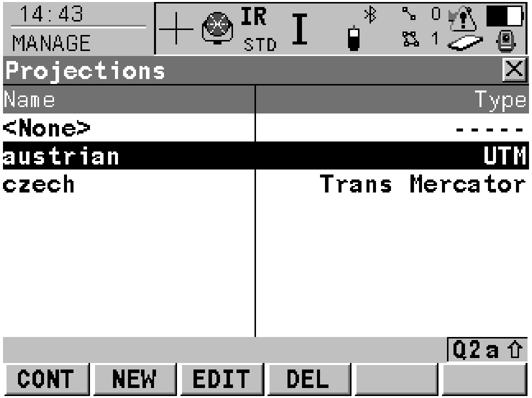
10.7.1 Accessing Projection Management

Access step-by-step

Step	Description
1.	Refer to "10.3 Accessing Coordinate System Management" to access **MANAGE Coordinate Systems**.
2.	In **MANAGE Coordinate Systems** highlight a coordinate system to be edited.
3.	**EDIT (F3)** to access **MANAGE Edit Coordinate System**.
4.	In **MANAGE Edit Coordinate System** highlight **<Projection:>**.
5.	**ENTER** to access **MANAGE Projections**.

MANAGE Projections

Listed are all projections stored in the database DB-X. Any unavailable information is shown as -----.



CONT (F1)
To select the highlighted projection and to return to the previous screen.

NEW (F2)
To create a new projection. Refer to "10.7.2 Creating a New Projection".

EDIT (F3)
To edit the highlighted projection. Refer to "10.7.3 Editing a Projection".

DEL (F4)
To delete the highlighted projection.

SHIFT SET-D (F4)
Available unless a default projection is highlighted. To turn the highlighted projection into a user defined default projection stored in the instrument.

SHIFT DEFLT (F5)
To recall the deleted default projections.

Description of columns

Column	Option	Description
Type		The projection type. Refer to standard surveying literature for details on projections.

Column	Option	Description
	Customised	Customised projection. Certain hard wired projections which cannot be defined by any of the following options.
	Trans Mercator	Transverse Mercator. Conformal projection onto a cylinder with its axis lying on the equatorial plane. The cylinder is tangential to a meridian.
	UTM	Universal Transverse Mercator. Transverse Mercator projection with fixed zone-defining constants. The central meridian is selected automatically according to the selected zone number.
	Oblq Mercator	Oblique Mercator. Oblique Mercator Conformal projection onto a cylinder. The cylinder is tangent to any circle other than the equator or a meridian.
	Mercator	Mercator. Conformal projection onto a cylinder with its axis lying on a meridian plane. The cylinder is tangent to the sphere along the equator.
	Lambert 1 Para	Lambert 1 Parallel. Conformal projection onto a cone, with its axis coinciding with the z-axis of the ellipsoid.
	Lambert 2 Para	Lambert 2 Parallel. Conformal projection onto a cone, with its axis coinciding with the z-axis of the ellipsoid. The cone is secant to the sphere.

Column	Option	Description
	Cassini-Soldn	Soldner Cassini. Projection onto a cylinder. It is neither equal area nor conformal. The scale is true along the central meridian and along lines perpendicular to central meridian.
	Polar Stereo	Polar Stereographic. Conformal azimuthal projection onto a plane. The point of projection is on the surface of the ellipsoid diametrically opposite of the origin which is the centre of the projection.
	Double Stereo	Double Stereographic. Conformal azimuthal projection onto a plane. The point of projection is on the surface of the sphere diametrically opposite of the centre of the projection.
	RSO	Rectified Skewed Orthomorphic. This is a special type of Oblique Mercator projection.

Next step

IF a projection	THEN
is to be selected	highlight the desired projection. **CONT (F1)** closes the screen and returns to the screen from where **MANAGE Projections** was accessed.
is to be created	highlight any projection and **NEW (F2)**. Refer to "10.7.2 Creating a New Projection".

IF a projection	THEN
is to be edited	highlight the projection and **EDIT (F3).** Refer to "10.7.3 Editing a Projection".

10.7.2 Creating a New Projection

Access

Refer to "10.7.1 Accessing Projection Management" to access **MANAGE Projections**.

Create a projection step-by-step

The following table explains the most common settings.
Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	In **MANAGE Projections** highlight a projection. A copy of this projection is taken for further configurations.	
2.	**NEW (F2)** to access **MANAGE New Projection**.	
3.	**MANAGE New Projection** **<Name:>** A unique name for the new projection. A name is mandatory and may be up to 16 characters long and may include spaces. **<Type:>** The projection type. The setting for **<Type:>** determines the availability of the subsequent fields for the parameters of the projection. Enter a name.	10.7.1
4.	**STORE (F1)** stores the new projection and returns to **MANAGE Projections**.	

10.7.3 Editing a Projection

Access step-by-step

Step	Description
1.	Refer to "10.7.1 Accessing Projection Management" to access **MANAGE Projections**.
2.	In **MANAGE Projections** highlight a projection to be edited.
3.	**EDIT (F3)** to access **MANAGE Edit Projection**.
4.	All following steps are identical with the creation of a new projection. **<Type:>** in **MANAGE Edit Projection** cannot be changed. Refer to "10.7.2 Creating a New Projection". Follow the instructions in paragraph "Create a projection step-by-step" from step 3. onwards.

10.8 Geoid Models

10.8.1 Overview

Use in the field

For use on the instrument in the field, geoid field files are created from the geoid model.

Geoid field file

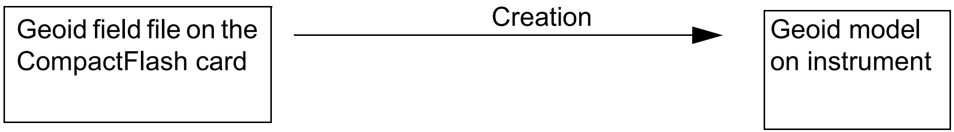
The geoid separations in a geoid field file may be used in the field to change between ellipsoidal and orthometric heights.

Creation:	In LGO with export onto a CompactFlash card or the internal memory of the instrument.
Extension:	*.gem

Create geoid models on the instrument

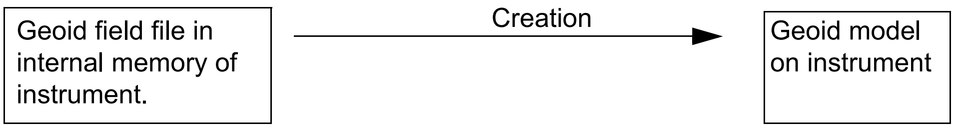
Geoid models can be created on the instrument in one of three ways:

1.



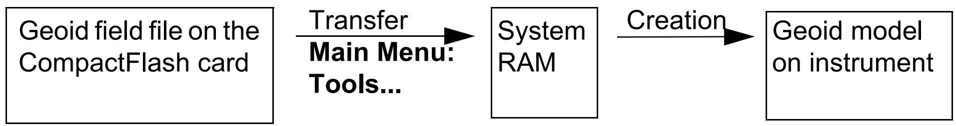
Here the geoid field file is stored on a CompactFlash card and can be used when the CompactFlash card is inserted in the instrument. It is recommended for large geoid field files. This method is explained in this chapter.

2.



Here the geoid field file is stored in the internal memory of the instrument. It is recommended for large geoid field files. This method is also explained in this chapter.

3.



Here the geoid field file is transferred to the System RAM and can be used at any time. The total size of all files is restricted to 1 MB. Refer to "24 Tools...\Transfer Objects..." for information on how to transfer geoid field files to the System RAM on the instrument.

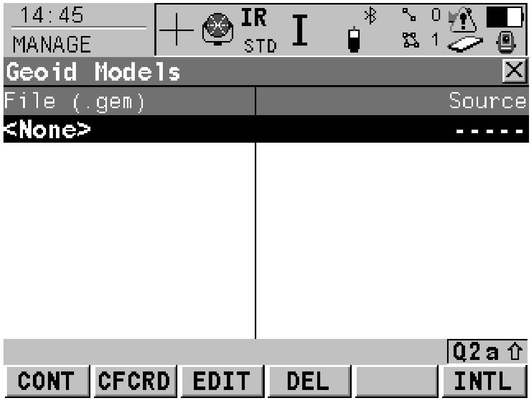
10.8.2 Accessing Geoid Model Management

Access step-by-step

Step	Description
1.	Refer to "10.3 Accessing Coordinate System Management" to access **MANAGE Coordinate Systems**.
2.	In **MANAGE Coordinate Systems** highlight a coordinate system to be edited.
3.	**EDIT (F3)** to access **MANAGE Edit Coordinate System**.
4.	In **MANAGE Edit Coordinate System** highlight **<Geoid Model:>**.
5.	**ENTER** to access **MANAGE Geoid Models**.

MANAGE Geoid Models

Listed are all geoid models stored in the database DB-X. Any unavailable information is shown as -----, for example if the geoid field file which was associated to the geoid model is not available on the CompactFlash card / internal memory.



CONT (F1)
To select the highlighted geoid model and to return to the previous screen.

CFCRD (F2)
To create a new geoid model. The \DATA\GPS\GEOID directory on the Compact-Flash card is automatically scanned for geoid field files. Refer to "10.8.3 Creating a New Geoid Model from the CompactFlash Card / Internal Memory".

EDIT (F3)
To view the highlighted geoid model. None of the fields can be edited. The geoid field file from which the geoid model was created must be stored in the System RAM or in the \DATA\GPS\GEOID directory on the CompactFlash card / internal memory.

DEL (F4)
To delete the highlighted geoid model. The geoid field file which was associated with this geoid model is then also deleted.

INTL (F6)
To create a new geoid model. The \DATA\GPS\GEOID directory of the internal memory is automatically scanned for geoid field files. Refer to "10.8.3 Creating a New Geoid Model from the CompactFlash Card / Internal Memory".

Next step

IF a geoid model	THEN
is to be selected	highlight the desired geoid model. **CONT (F1)** closes the screen and returns to the screen from where **MANAGE Geoid Models** was accessed.
is to be created	**CFCRD (F2)**. Refer to "10.8.3 Creating a New Geoid Model from the CompactFlash Card / Internal Memory".

10.8.3 Creating a New Geoid Model from the CompactFlash Card / Internal Memory

☞ Refer to "24 Tools...\Transfer Objects..." for information on how to transfer geoid field files to the System RAM on the instrument.

Requirement

At least one geoid field file with the extension *.gem is in the \DATA\GPS\GEOID directory on the CompactFlash card / internal memory. Refer to "10.2 Terminology" for information on geoid field files.

Create geoid model step-by-step

Step	Description
1.	Refer to "10.8.2 Accessing Geoid Model Management" to access **MANAGE Geoid Models**.
2.	**CFCRD (F2)** to scan the \DATA\GPS\GEOID directory on the CompactFlash card. OR **INTL (F6)** to scan the \DATA\GPS\GEOID directory of the internal memory.
3.	For each geoid field file on the CompactFlash card or in the internal memory, one geoid model is automatically created. The names given to the geoid models are those which were entered in LGO. ☞ Existing geoid models are automatically overwritten by new models with the same name.
4.	The creation of a geoid model is finished.

10.9 CSCS Models

Use in the field

For use on the instrument in the field, CSCS field files are created from the CSCS model.

CSCS field file

CSCS field files may be used in the field to directly convert coordinates from WGS 1984 to local grid without the need of transformation parameters.

Creation:	In LGO with export onto a CompactFlash card or the internal memory of the instrument.
Extension:	*.csc

☞

The creation of CSCS models on the instrument and the functionality of all screens and fields are similar to those for geoid models. Refer to "10.8 Geoid Models".

The directory on the CompactFlash card / internal memory for CSCS field files with the extension *.csc is \DATA\GPS\CSCS.

11 Manage...\Configuration Sets

11.1 Overview

Description

The instrument has numerous user configurable parameters and functions. This allows a variety of preferences to be addressed. The configuration of the parameters and functions for an individual measuring technique are combined in a configuration set.

Default configuration sets

Default configuration sets exist on the instrument. They use standard settings for the majority of application programs. Default configuration sets can be edited and deleted. It is always possible to restore the default configuration sets.

User defined configuration sets

New configuration sets can be created. The configuration set wizard assists in editing configuration sets.

Edit outside the configuration set wizard

Parameters and functions can be edited without going through the configuration set wizard. Refer to "11.4 Editing a Configuration Set" for more information.

☞

Each application program can be configured separately. Application program settings are configured in the application program but are stored as part of the configuration set. Refer to "35 Application Programs - General".

11.2 Accessing Configuration Set Management

Access

Select **Main Menu: Manage...\Configuration Sets**.

OR

Press a hot key configured to access the screen **MANAGE Configuration Sets**. Refer to "2.1 Hot Keys" for information on hot keys.

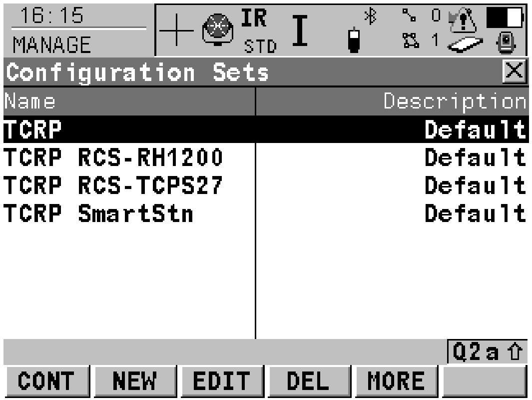
OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

OR

From a choicelist in some screens for example the begin screen of application programs.

MANAGE Configuration Sets



CONT (F1)
To select the highlighted configuration set and to return to **TPS1200 Main Menu**.

NEW (F2)
To create a new configuration set. Refer to "11.3 Creating a New Configuration Set".

EDIT (F3)
To edit a configuration set. Accesses the first screen of the sequential configuration set wizard for the highlighted configuration set. Default configuration sets can be edited. Refer to "11.4 Editing a Configuration Set".

DEL (F4)
To delete the highlighted configuration set.

MORE (F5)
To display information about the description, the creator and the creation date of the configuration set.

SHIFT SET-D (F4)
Available unless a default configuration set is highlighted. To turn the highlighted configuration sets into a user defined default configuration set stored in the instrument.

SHIFT DEFLT (F5)
To recall previously deleted default configuration sets and to reset default configuration sets to the default settings. User defined configuration sets are not affected.

Next step

IF a configuration set	THEN
is to be selected	select the desired configuration set. **CONT (F1)** to close the screen and to return to the screen from where **MANAGE Configuration Sets** was accessed.
is to be created	highlight any configuration set and **NEW (F2)**. Refer to "11.3 Creating a New Configuration Set".
is to be edited	highlight the configuration set and **EDIT (F3)**. Refer to "11.4 Editing a Configuration Set".

11.3 Creating a New Configuration Set

Access

Refer to "11.2 Accessing Configuration Set Management" to access **MANAGE Configuration Sets**.

Configuration step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	In **MANAGE Configuration Sets** highlight a configuration set. A copy of this configuration set is taken for further configurations. Example: Select **DEFAULT** for the creation of a new configuration set.	11.2
2.	**NEW (F2)** to access **MANAGE New Configuration Set**. A copy of the highlighted configuration set is created.	
3.	**MANAGE New Configuration Set** **<Name:>** A unique name for the new configuration set. **<Description:>** A detailed description of the configuration set, since the name of a configuration set is usually an abbreviation. Input optional. **<Creator:>** The person’s name who creates the new configuration set. Input optional. Enter a name.	
4.	**STORE (F1)** stores the new configuration set with the entered name. Starts the sequential configuration set wizard.	

Step	Description	Refer to chapter
5.	**CONFIGURE Wizard Mode** **<Wizard Mode: Reduced>**	18.1
	LIST (F6) accesses **CONFIGURE Quick Access**. Lists all screens within the configuration set. Allows to access these individual screens and to change settings.	
6.	**CONT (F1)** to access **CONFIGURE Coding Settings**.	
7.	**CONFIGURE Coding Settings**	16.3
8.	**CONT (F1)** to access **CONFIGURE TPS Correction**.	
9.	**CONFIGURE TPS Corrections** Configure atmospheric ppm, geometric ppm and refraction.	17.4
10.	**CONT (F1)** to access **CONFIGURE EDM & ATR Settings**.	
11.	**CONFIGURE EDM & ATR Settings**	17.1
12.	**CONT (F1)** to access **CONFIGURE Offsets**.	
13.	**CONFIGURE Offsets**	16.4
14.	**CONT (F1)** to access **MANAGE Configuration Sets**.	
15.	**MANAGE Configuration Sets** The adapted configuration set is highlighted.	
16.	**CONT (F1)** closes the screen and returns to **TPS1200 Main Menu**. The highlighted configuration set is then the active configuration set.	

11.4 Editing a Configuration Set

Description

There are two possibilities to edit a configuration set.

Using the **configuration set wizard** to be lead through the steps.

OR

Outside of the **configuration set wizard**. Each screen can be accessed separately without being guided through the steps.

Access step-by-step with using configuration set wizard

Step	Description
1.	Refer to "11.2 Accessing Configuration Set Management" to access **MANAGE Configuration Sets**.
2.	In **MANAGE Configuration Sets** highlight a configuration set to be edited.
3.	**EDIT (F3)** to access **CONFIGURE Wizard Mode**. This starts the sequential configuration set wizard.
4.	All following steps are identical with the creation of a new configuration set. Refer to "11.3 Creating a New Configuration Set". Follow the instructions in paragraph "Configuration step-by-step" from step 5. onwards.

Access without using the configuration set wizard

The currently active configuration set can be edited. Choose one of the following options and access the required screens to edit the configuration set.

Select **Main Menu: Config...**. Refer to "4 Main Menu".

OR

From inside an application program press **USER** and then **CONF (F2)**.

OR

In **CONFIGURE Wizard Mode**, press **LIST (F6).** Refer to "11.3 Creating a New Configuration Set".

12 Manage...\Reflectors

12.1 Overview

Description

- Each reflector type has an additive constant.
- Leica Geosystems reflectors are predefined as default and can be selected.
- Additional reflectors can be defined.

Default reflectors

Following default reflectors are always available on the instrument:

Product Name	Name in list	Type	Additive Constant
GRZ4, GRZ122	Leica 360° Prism	Prism	+23.1 mm
GPR1, GPR111, GPR112, GPR121, GPH1P	Leica Circ Prism	Prism	0.0 mm
HDS Black & White Target	Leica HDS Target	Tape	+34.4 mm
GMP111-0	Leica Mini 0	Prism	0.0 mm
GRZ101	Leica Mini 360°	Prism	+30.0 mm
GMP101, GMP102, GMP104, GMP111	Leica Mini Prism	Prism	+17.5 mm
Reflector Tapes, CPR105	Leica ReflTape	Tape	+34.4 mm
-	Reflectorless	RL	+34.4 mm

Active reflector

One reflector is always the active reflector.

12.2 Accessing Reflector Management

Access

Select **Main Menu: Manage...\Reflectors.**

OR

Press a hot key configured to access the screen **MANAGE Reflectors**. Refer to "2.1 Hot Keys" for information on hot keys.

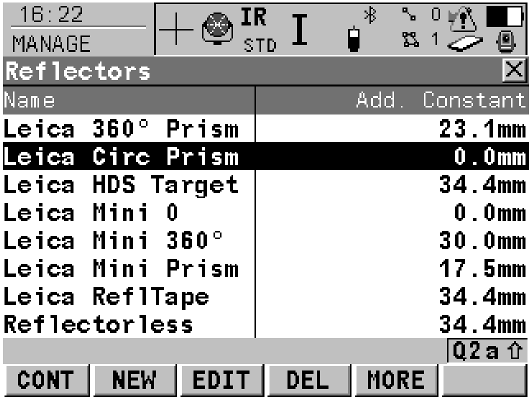
OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

OR

From a choicelist in some screens for example the **SURVEY Survey Begin** screen.

MANAGE Reflectors



CONT (F1)
To select the highlighted reflector and to return to the previous screen.

NEW (F2)
To define a new reflector. Refer to "12.3 Creating a New Reflector".

EDIT (F3)
To edit the highlighted reflector, except for default reflectors. Refer to "12.4 Editing a Reflector".

DEL (F4)
To delete the highlighted reflector, except for default reflectors.

MORE (F5)
To display information about the additive constant, the reflector type and the creator of the reflector.

Next step

IF a reflector	THEN
is to be selected	highlight the desired reflector. **CONT (F1)** closes the screen and returns to the screen from where **MANAGE Reflectors** was accessed.
is to be created	highlight any reflector and **NEW (F2)** creates a new reflector. Refer to "12.3 Creating a New Reflector".
is to be edited	highlight the desired reflector. **EDIT (F3)** Refer to "12.4 Editing a Reflector".

12.3 Creating a New Reflector

Access

Refer to "12.2 Accessing Reflector Management" to access **MANAGE Reflectors**.

Create new reflector step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description
1.	In **MANAGE Reflectors** press
2.	**NEW (F2)** The **<Type:>** of the new reflector is taken from the previously highlighted reflector except for RL reflectors.
3.	**MANAGE New Reflector** **<Name:>** A significant name for the new reflector. **<Type:>** The type of reflector to be defined can be **<Type: Prism>, <Type: Tape>** or **<Type: Undefined>**. **<Add. Constant:>** The additive constant is always in [mm]. ☞ An additive constant of 0.0 mm has been defined for the Leica Geosystems standard reflectors GPR1, GPR111, etc. All entered or selected additive constant values are differences to this 0.0 mm based Leica Geosystems TPS prism system.

Step	Description
	The additive constants of non Leica Geosystems prisms are often given in the true zero prism system. Use the following formula to convert the additive constant to the Leica Geosystems TPS prism system. This Leica constant needs to be entered into the Leica instrument. Formula: True zero constant - 34.4 mm = Leica constant. It is highly recommended to check the additive constant for non Leica Geosystems prisms on a baseline by means of an appropriate procedure. **<Creator:>** A name of the creator or other comments can be entered.
4.	**STORE (F1)** stores the new reflector and returns to **MANAGE Reflectors**.

12.4 Editing a Reflector

Access

Refer to "12.2 Accessing Reflector Management" to access **MANAGE Reflectors**.

Edit reflector step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	In **MANAGE Reflectors** highlight a reflector to be edited.	
2.	**EDIT (F3)** to access **MANAGE Edit Reflector**.	
3.	**MANAGE Edit Reflector** The fields are identical with those for the creation of a new reflector. All fields can be edited except fields of Leica default reflectors. Make the required changes.	12.3
4.	**STORE (F1)** stores the changes and returns to **MANAGE Reflectors**.	

13 Convert...\Export Data from Job

13.1 Overview

Description

This screen lists all the exporters loaded.

Data can be exported
- to a file on the CompactFlash card.
- to a file on the internal memory if fitted.
- via RS232 to an external device. Refer to "20 Config...\Interfaces... - Editing The Interface" for information on how to configure the interface.

Export format

Format	Characteristic	Description
Custom ASCII	Export variables	Refer to the online help of LGO.
	Format definition	Composed individually as format file using LGO. Refer to the online help of LGO for information on creating format files.
	Units	Defined within the format file.
	Coordinate conversion	All coordinate types are supported.
	Height	All height types are supported. If the desired height cannot be computed, the default value for the missing variable is output.

Format	Characteristic	Description
	Specialities:	
	Points in file outside of CSCS model	The default value for missing variable is output.
	Points in file outside of geoid model	The default value for missing variable is output, also if a geoid separation is available.
DXF	Coordinate conversion	All points are converted to local grid position using the coordinate system.
	Height	Orthometric height and ellipsoidal height are supported.
	Specialities:	
	Points in file outside of CSCS model	Points in LocalGrid position without CSCS transformation are exported.
	Points in file outside of geoid model	The ellipsoidal height is exported.

13.2 Accessing the Data Export Functionality

Access

Select **Main Menu: Convert...\Export Data from Job**.

OR

Press a hot key configured to access the screen **EXPORT Export Data from Job**.

Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

Next step

IF exporting to	THEN
custom ASCII format	Refer to "13.3 Exporting Data from a Job to a Custom ASCII Format".
another device	Refer to "13.4 Exporting Data from a Job to another Device".
DXF format	Refer to "13.5 Exporting Data in DXF Format".

13.3 Exporting Data from a Job to a Custom ASCII Format

Description

The settings on this screen define the data that is converted and exported and what format is used.
Data is exported from the selected job. Currently active view, filter and sort settings are applied. The points that are exported are those that are visible in **MANAGE Data**: **Job Name**.

Requirement

At least one format file was created using LGO and has been transferred to the System RAM.

Access

Refer to "13.2 Accessing the Data Export Functionality" to access **EXPORT Export ASCII from Job**.

Export data step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	**EXPORT Export ASCII from Job** **<Export To: CF Card>** or **<Export To: Internal Memory>** **<Directory:>** Available for **<Export To: CF Card>**. The data can be exported to the \Data, the \GSI or the root directory. Data must be stored to the \GSI directory in order to read it in a TPS1100. For **<Export To: Internal Memory>**, the data is always exported to the \Data directory. **<Job:>** All jobs from **Main Menu: Manage...\Jobs** can be selected. When in this choicelist press **CFCRD (F6)** or **INTL (F6)** to select a job from a different memory device.	5

Step	Description	Refer to chapter
	<Coord System:> The coordinate system currently attached to the selected **<Job:>**. **<Format File:>** The format files currently available in the System RAM. **<File Name:>** The name of the file to which the data should be exported. The name is automatically suggested based on the job name to be exported and an extension. The default extension to be used can be configured in the **EXPORT Define ASCII Export** panel using **CONF (F2)**. Select the job to be exported and enter an individual file name or accept the suggested name.	
2.	Highlight **<Format File:>** and **ENTER**.	
3.	**EXPORT Format Files** All format files available in the System RAM are listed. Select the format file to be used.	
	DEL (F4) deletes the highlighted format file from the System RAM.	
4.	**CONT (F1)** selects the highlighted format file and leads back to **EXPORT Export ASCII from Job**.	
5.	**FILT (F4)** to set the sort and filter settings for export. Accesses **EXPORT Sorts & Filters**.	
6.	**EXPORT Sorts & Filters, Points** page **<Sort:>** The order in which points, lines and areas are exported.	6.6

Step	Description	Refer to chapter
	<Filter:> Defines which points are exported.	
☞	**PAGE (F6)** changes to the **Lines** or **Areas** page. The setting for **<Filter:>** on these pages defines which lines or areas are exported.	
7.	**CONT (F1)** accepts the changes and returns to **EXPORT Export ASCII from Job**.	
☞	**CSYS (F6)** accesses **EXPORT Coordinate Systems.** To update the coordinate system in which the coordinates are exported.	10.3
8.	**CONT (F1)** exports the data.	
9.	Information message: Are more data to be exported? • If **yes**, continue with step 10. • If **no**, continue with step 11.	
10.	**YES (F4).** Repeat steps 1. to 9.	
11.	**NO (F6)** returns to the **TPS1200 Main Menu**.	

13.4 Exporting Data from a Job to another Device

General

Data can be transferred to an external device via RS232.

Access

Refer to "13.2 Accessing the Data Export Functionality" to access **EXPORT Export ASCII from Job**.

Export data step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	**EXPORT Export ASCII from Job** **<Export To: RS232>**	13.1
	IFACE (F5) accesses **CONFIGURE Export Job Interface.** Choose the port and device to which the data should be exported.	
2.	**FILT (F4)** to set the sort and filter settings for the export. Accesses **EXPORT Sorts & Filters**.	
3.	**EXPORT Sorts & Filters, Points** page **<Sort:>** The order in which points, lines and areas are exported. **<Filter:>** Defines which points are exported.	6.6
	PAGE (F6) changes to the **Lines** and **Areas** page. The setting for **<Filter:>** on these pages defines which lines or areas are exported.	
4.	**CONT (F1)** accepts the changes and returns to **EXPORT Export ASCII from Job**.	

Step	Description	Refer to chapter
	CSYS (F6) accesses **EXPORT Coordinate Systems.** To update the coordinate system in which the coordinates are exported.	10.3
5.	**CONT (F1)** exports the data.	
6.	Information message: Are more data to be exported? • If **yes**, continue with step 7. • If **no**, continue with step 8.	
7.	**YES (F4)**. Repeat the steps 1. to 6.	
8.	**NO (F6)** returns to the **TPS1200 Main Menu**.	

13.5 Exporting Data in DXF Format

General

Data can be exported to a DXF file in the \DATA directory of the CompactFlash card or the internal memory, if fitted.

Access

Refer to "13.2 Accessing the Data Export Functionality" to access **EXPORT Export DXF from Job**.

Export data step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description
1.	**EXPORT Export DXF from Job** **<Job:>** All jobs from **Main Menu: Manage...\Jobs** can be selected. When in this choicelist press **CFCRD (F6)** or **INTL (F6)** to select a job from a different memory device. **<Coord System:>** The coordinate system currently attached to the selected **<Job:>**. **<File name:>** The name of the file to which the data should be exported. The name is automatically suggested based on the job name to be exported and the extension dxf. Select the job to be exported and enter an individual file name or accept the suggested name.
	CONF (F2) accesses **Configuration**, **Export** page. **<Points:>** Defines if points are exported. **<Lines:>** Defines if lines are exported.

Step	Description
	<Areas:> Defines if areas are exported. **<Filter:>** Defines which points are exported. **PAGE (F6)** changes to the **DXF** page. **<Lines & Areas:>** Defines if lines and areas are exported as Line or Polyline entities. **<LGO Symbols:>** Defines if a block is created for each point with the same icons used in LGO. **<Symbol Size:>** Defines the size used for creation of the LGO symbols. **<Dimensions:>** Defines the dimension of the DXF file. **<DXF Layer:>** Defines the DXF Layer as **<Default>**, **<Code Group>** or **<Code>**. **PAGE (F6)** changes to the **Labels** page. The settings on this page define which labels with information (Point ID, Coords, Height and Pt Code) for each point are exported. For each label the DXF layer name and the color can be defined. Additionally the decimals can be defined for the Coords and Height label.
2.	**CONT (F1)** accepts the changes and returns to **EXPORT Export DXF from Job.**
3.	**CONT (F1)** exports the data.
	Message: **Do not remove CF Card!**
4.	Information message: Are more data to be exported? If **yes**, continue with step 5. If **no**, continue with step 6.
5.	**YES (F6)**. Repeat steps 1. to 4.

Step	Description
6.	**NO (F4)** returns to the **TPS1200 Main Menu**.

14 Convert...\Import Data to Job

14.1 Overview

Description

This screen lists all the importers loaded. The data to import must be stored on the CompactFlash card.

Data can be imported to a job
- on the CompactFlash card.
- on the internal memory, if fitted.

Import formats

Format	Characteristic	Description
ASCII	Import variables	Point ID, grid coordinates, thematical codes. No free codes, no attributes.
	Format definition	Free format. Use and order of variables and delimiter can be defined during import.
	Units	As currently configured on the instrument.
	Height	Orthometric or ellipsoidal.
	Specialities	
	Local heights but no coordinates in file	Points are imported without coordinates but with local height and code if available.
	Coordinates but no heights in file	Points are imported without height but with coordinates and code if available.

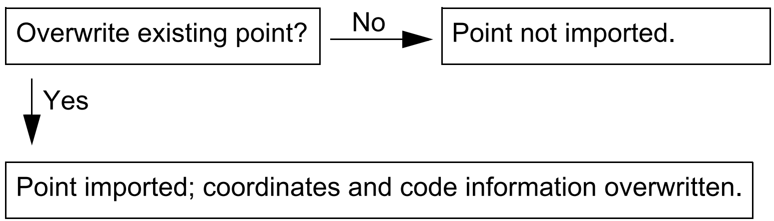
Format	Characteristic	Description
	Neither coordinates nor heights in file	No import.
	No point ID's in file	No import.
GSI8 **GSI16**	Import variables	Point ID WI 11, local coordinates WI 81, WI 82, WI 83, thematical codes WI 71. No free codes, no attributes. Refer to "20.1 GSI Output" for information on GSI Format.
	Format definition	Fixed format. Easting and Northing can be switched during import.
	Units	As defined in the GSI file.
	Heights	Orthometric or ellipsoidal.
	Specialities	
	Local heights but no coordinates in file	Points are imported without coordinates but with local height and code if available.
	Coordinates but no heights in file	Points are imported without height but with coordinates and code if available.
	Neither coordinates nor heights in file	No import.
	No point ID's in file	No import.
DXF	Import variables	Block, point, line, arc, polyline. Local coordinates. No free codes, no attributes.
	Format definition	Fixed format (X/Y/Z).

Format	Characteristic	Description
	Units	Not predefined.
	Heights	Z value imported as orthometric.
	Specialities	
	Neither coordinates nor heights in file	No import

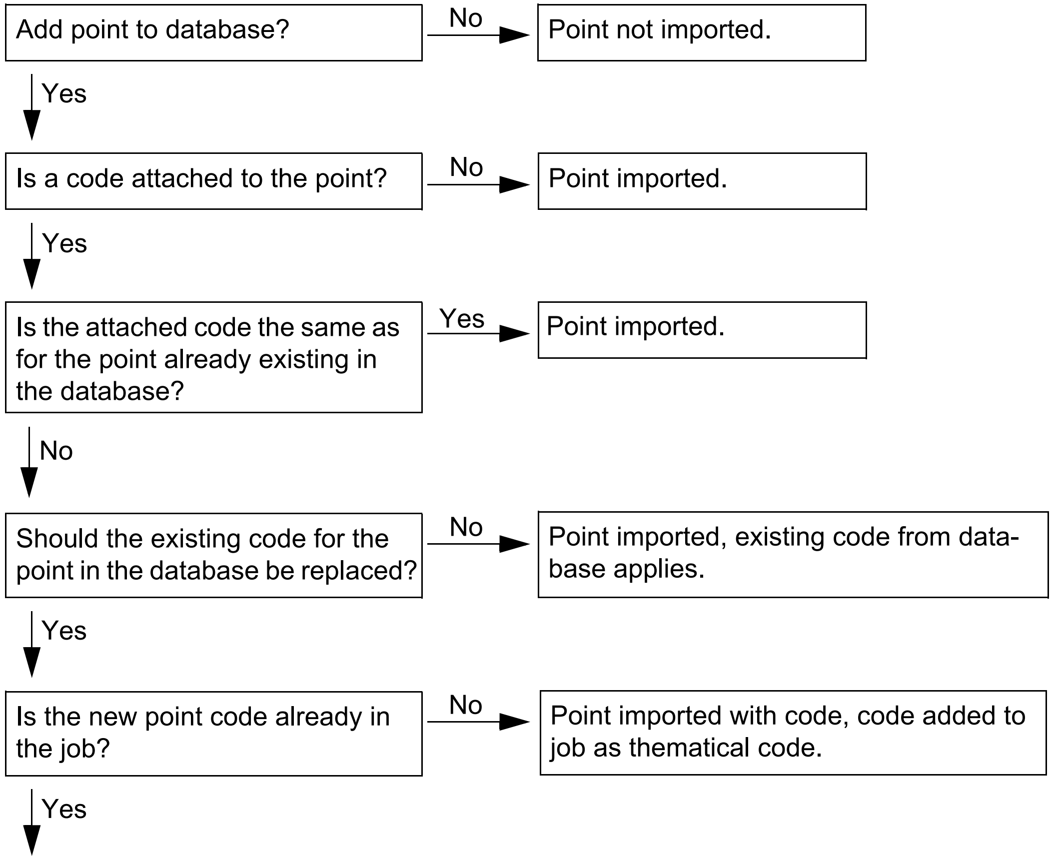
Checks

Points are always imported with the class **CTRL** and a coordinate quality of **-----**.
Refer to "6.3.1 Terminology".
While importing points to a job, checks are performed against point ID, class and coding of points already existing in the job.

Case 1: Point already exists in database with class CTRL



Case 2: Point already exists in database with a class other than CTRL



Point imported with code.

14.2 Accessing the Data Import Functionality

Access

Select **Main Menu: Convert...\Import Data to Job**.

OR

Press a hot key configured to access the screen **IMPORT Import Data to Job**. Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

Next step

IF importing data in	THEN
ASCII format	Refer to "14.3 Importing Data in ASCII Format".
GSI format	Refer to "14.4 Importing Data in GSI Format".
DXF format	Refer to "14.5 Importing Data in DXF Format".

14.3 Importing Data in ASCII Format

Requirements

At least one ASCII file with any file extension is stored in the \DATA directory of the CompactFlash card.

Access

Refer to "14.2 Accessing the Data Import Functionality" to access **IMPORT Import ASCII/GSI Data to Job**.

Import data step-by-step

Step	Description
1.	**IMPORT Import ASCII/GSI Data to Job** **<Import: ASCII Data>** **<From File**:> All files in the \DATA directory on the CompactFlash card can be selected. **<To Job:>** Choosing a job as destination for import makes this job the active job. All jobs from **Main Menu: Manage...\Jobs** can be selected. **<Header:>** This option allows up to ten header lines which may exist in an ASCII file to be skipped. Select the number of header lines.
2.	**CONF (F2)** defines the format of the data to be imported.
3.	**IMPORT Define ASCII Import** **<Delimiter:>** The separator between the import variables. **<Multi Spaces:>** Available for **<Delimiter: Space>**. **<Multi Spaces: No>** for space delimited data having one space between the variables. **<Multi Spaces: Yes>** for space delimited data having multi spaces between the variables.

Step	Description
	<No. Lines/Pt:> Available for **<Delimiter: Line Feed>**. The number of lines used to describe each point. Select the delimiter and the positions of the particular variables.
	DEFLT (F5) recalls the default ASCII import settings.
4.	**CONT (F1)** leads back to **IMPORT Import ASCII/GSI Data to Job**
5.	**SHIFT HTS (F2)** to access **IMPORT Define Ht Type & Easting Import**.
6.	**IMPORT Define Ht Type & Easting Import** **<Import as:>** The height type for the imported data. **<Easting:>** The Easting can be imported as written in the ASCII file or it can be multiplied by -1. This is required by some coordinate systems.
7.	**CONT (F1)** leads back to **IMPORT Import ASCII/GSI Data to Job**
8.	**CONT (F1)** imports the data.
	Points with a height > 20000 m are not imported.
9.	Information message: Are more data to be imported? • If **yes**, continue with step 10. • If **no**, continue with step 11.
10.	**YES (F6)**. Repeat steps 1. to 9.
11.	**NO (F4)** returns to the **TPS1200 Main Menu**.

14.4 Importing Data in GSI Format

Requirements

At least one ASCII file in GSI format with the file extension *.gsi is stored in the GSI directory of the CompactFlash card.

Access

Refer to "14.2 Accessing the Data Import Functionality" to access **IMPORT Import ASCII/GSI Data to Job**.

Import data step-by-step

Step	Description
1.	**IMPORT Import ASCII/GSI Data to Job** **<Import: GSI Data>** **<From File:>** All files with extension *.gsi in the \GSI directory on the Compact-Flash card can be selected. **<To Job:>** Choosing a job as destination for import makes this job the active job. All jobs from **Main Menu: Manage...\Jobs** can be selected.
	CONF (F2) accesses **IMPORT Define GSI Import**. For **<Switch WI81/WI82: Yes>** all WI 81 data, normally Easting, is imported as Northing and all WI 82 data, normally Northing, is imported as Easting. This coordinate switch is necessary for “left handed” coordinate systems.
2.	**SHIFT HTS (F2)** to access **IMPORT Define Ht Type & Easting Import**.
3.	**IMPORT Define Ht Type & Easting Import** **<Import as:>** The height type for the imported data. **<Easting:>** The Easting can be imported as written in the *.gsi file or it can be multiplied by -1. This is required by some coordinate systems.

Step	Description
4.	**CONT (F1)** leads back to **IMPORT Import ASCII/GSI Data to Job**
5.	**CONT (F1)** imports the data.
☞	Points with a height > 20000 m are not imported.
6.	Information message: Are more data to be imported? • If **yes**, continue with step 7. • If **no**, continue with step 8.
7.	**YES (F6)**. Repeat steps 1. to 6.
8.	**NO (F4)** returns to the **TPS1200 Main Menu**.

14.5 Importing Data in DXF Format

Requirements

At least one file in DXF format with the file extension *.dxf has to be stored in the \DATA directory of the CompactFlash card.

Access

Refer to "14.2 Accessing the Data Import Functionality" to access **DXF IMPORT Import DXF Data to Job**.

Import data step-by-step

Step	Description
1.	DXF IMPORT Import DXF Data to Job **<From File:>** All files with extension *.dxf in the \DATA directory on the CompactFlash card can be selected. **<To Job:>** Choosing a job as destination for import makes this job the active job. All jobs from **Main Menu: Manage...\Jobs** can be selected.
☞	**CONF (F2)** accesses **Configuration**. **<Block Prefix:>** Optional prefix to imported blocks. **<Point Prefix:>** Optional prefix to imported points. **<Line Prefix:>** Optional prefix to imported lines. **<File Units:>** Choosing the unit for the DXF data to be imported. **<Create Vertex Points:>** Option if points will be created at vertices of the imported line/arc/polyline elements. **<Convrt White Elements:>** Option if white colored elements will be converted to black colored elements.

Step	Description
	<Exclude Height:> Height value inside the DXF file are considered invalid and will not be converted.
2.	**CONT (F1)** leads back to **DXF IMPORT Import DXF Data to Job**
3.	**CONT (F1)** imports the data.
	Message: **Do not remove CF Card!**
4.	Information message: Are more data to be imported? If **yes**, continue with step 5. If **no**, continue with step 6.
5.	**YES (F6).** Repeat steps 1. to 4.
6.	**NO (F4)** returns to the **TPS1200 Main Menu**.

15 Convert...\Copy Points Between Jobs

Description

This chapter explains the process of copying points from one job to another.

☞

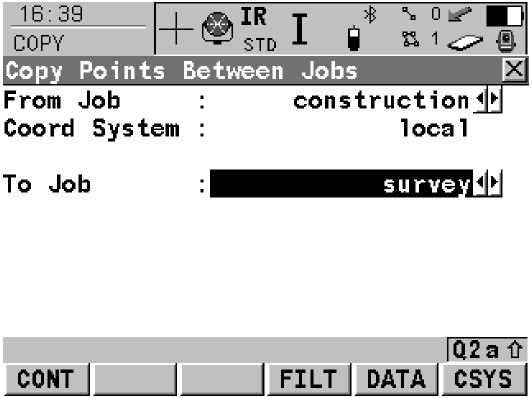
Important features:

- Points are copied as defined by the point filter settings.
- Points selected for copying may be viewed in a points listing. The point sort settings define the order of the points in the listing. The point filter settings define the points to be viewed in the listing.
- Only points are copied - observation data is not copied.
- When points are copied from one job to another:
  - their point codes and attached attributes are also copied.
  - their **Class** is retained.
  - their **Sub Class** is retained.
  - their **Source** is changed to **Copied Point**.
  - their **Point C**oordinate **Q**uality is retained.
  - their **Instrument Flag** is retained.
  - their **Date and Time Stamp** is retained.

Access

Select **Main Menu: Convert...\Copy Points Between Jobs**.

COPY
Copy Points Between Jobs



CONT (F1)
To copy a selection of points.

FILT (F4)
To define the point sort and/or point filter settings of points from the job **<From Job:>**.

DATA (F5)
To view, edit and delete points, lines and areas stored with the job. Points, lines and areas are shown on separate pages. Selected sort and filter settings apply. Refer to "6.3 Point Management".

CSYS (F6)
To select a different coordinate system.

Description of fields

Field	Option	Description
<From Job:>	Choicelist	Describes where the points are to be copied from. All jobs may be selected from **Main Menu: Manage...\Jobs**.
<Coord System:>	Output	The coordinate system which is currently attached to the job **<From Job:>**.
<To Job:>	Choicelist	Describes where the points are to be copied to. All jobs may be selected from **Main Menu: Manage...\Jobs**.

16 Config...\Survey Settings...

16.1 ID Templates

16.1.1 Overview of Templates

Description

- ID templates are predefined templates for point, line or area numbers. ID templates save having to type in the ID for each object. They are useful when many points are collected.
- ID templates that are selected to be used suggest ID's for **Point ID**, **Line ID** and **Area ID** whenever points, lines and areas are to be surveyed.

Description of the default ID templates

Default ID Template	Description
0001	• Suggested as ID for measured points in default configuration sets. • This ID is automatically incremented.
Area0001	• Suggested as ID for areas in default configuration sets. • This ID is automatically incremented.
Auto0001	• Suggested as ID for auto points in default configuration sets. These points are automatically recorded at a specific rate. • This ID is automatically incremented.
Aux0001	• Suggested as ID for auxiliary points in default configuration sets. These points are used when measuring a hidden point. • This ID is automatically incremented.
Line0001	• Suggested as ID for lines in default configuration sets. • This ID is automatically incremented.

Default ID Template	Description
No Template Used	• The last point ID during a survey will be displayed. This ID is automatically incremented if it contains numerical characters. If this ID is overwritten, the auto increment starts from the new ID. The automatic incrementation can be turned off when editing this ID template. Refer to "16.1.4 Editing an ID Template".
Time & Date	• The current local time and date is the ID.
Use Code&String	• Allows the line/area ID assigned to a line/area object to be based on the code related to the line/area. • If line/area codes are being used then the line/area code is used as part of the line/area ID. • If point codes are being used then the point code is used as part of the line/area ID. • If attributes/strings are not being used then the numerical part of the line/area ID is automatically incremented.

Availability of the default ID templates

Default ID Template	Availability:			
	Survey Points	**Auto Points**	**Lines**	**Areas**
0001	✓	✓	✓	✓
Area0001	✓	✓	✓	✓
Auto0001	✓	✓	✓	✓
Aux0001	✓	✓	✓	✓
Line0001	✓	✓	✓	✓

Default ID Template	Availability:			
	Survey Points	Auto Points	Lines	Areas
No Template Used	✓		✓	✓
Time & Date	✓	✓	✓	✓
Use Code&String			✓	✓

Selecting the default ID templates

- A default ID template can be selected:
  - manually, by selecting it in the ID Template Library under **Config \Survey Settings \ID Templates**. The ID template becomes active as soon as it is highlighted on the screen and when **CONT (F1)** is pressed. The currently active configuration set is automatically updated, to include the selected ID template. To ensure that all default ID templates appear in the ID Template LIbrary, press **SHIFT DEFLT (F5)**.
- indirectly, by selecting a configuration set which includes the ID template.

16.1.2 Accessing ID Template Configuration

Access

Select **Main Menu: Config...\Survey Settings...\ID Templates**.

OR

Press a hot key configured to access the screen **CONFIGURE ID Templates**. Refer to "2.1 Hot Keys" for information on hot keys.

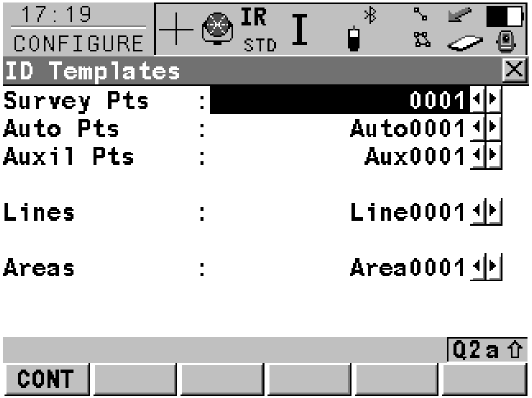
OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

OR

Within the configuration set wizard. Refer to "11.2 Accessing Configuration Set Management".

CONFIGURE ID Templates



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

Description of fields

Field	Option	Description
<Survey Pts:>	Choicelist	Sets the ID templates for measured points.
<Auto Pts:>	Choicelist	Sets the ID templates for auto points. These points are automatically recorded at a specific rate.
<Auxil Pts:>	Choicelist	Sets the ID templates for auxiliary points. These points are used when trying to find a stake-out point.
<Lines:>	Choicelist	Sets the ID templates for lines.
<Areas:>	Choicelist	Sets the ID templates for areas.

Next step

IF an ID template	THEN
is to be selected	select the desired ID template. **CONT (F1)** to close the screen and to return to the screen from where **CONFIGURE ID Templates** was accessed.
is to be created	Refer to "16.1.3 Creating a New ID Template".
is to be edited	Refer to "16.1.4 Editing an ID Template".
is to be deleted	Refer to "16.1.5 Deleting an ID Template".

16.1.3 Creating a New ID Template

Create ID template step-by-step

Step	Description
1.	Refer to "16.1.2 Accessing ID Template Configuration" to access **CONFIGURE ID Templates**.
2.	In **CONFIGURE ID Templates** highlight any field.
3.	**ENTER** to access **CONFIGURE ID Template Library**.
4.	Highlight an ID template. A copy of this ID template is taken for further configurations.
5.	**NEW (F2)** to access **CONFIGURE New ID Template**.
6.	**CONFIGURE New ID Template** **<ID:>** The name of the ID template and the format of the ID object. Any characters including spaces are allowed. Leading spaces are not accepted. **<Increment:>** ID's are incremented numerical or alphanumerical. **<Increment By:>** The amount by which the point ID is incremented. **<Cursor Posn:>** The character position at which the cursor is placed when **ENTER** is pressed in **<Point ID:>** when surveying points. **<Cursor Posn: Last Character>** means that the cursor is placed immediately to the right of the last character. Adapt the settings according to the requirements.
7.	**CONT (F1)** stores the new ID template into the ID template library and returns to **CONFIGURE ID Template Library**.
8.	**CONT (F1)** returns to **CONFIGURE ID Templates**.

Step	Description
9.	**CONT (F1)** returns to the screen from where **CONFIGURE ID Templates** was accessed.

Examples for incrementation

For <Increment: Numeric only>

The rightmost numeric part is incremented within the point ID.

<ID:>	<Increment By:>	Next point ID	Notes
Point994	5	Point999 Point1004 ...	-
994point	5	999point 1004point ...	-
123point123	-10	123point113	Right hand side numbers are incremented. Negative increments allowed.
Point11	-6	Point5 Point-1 Point-7 Point-13 ...	-
Abcdefghijklmn94	5	Abcdefghijklmno99 Point ID increment fail	Incrementation fails if next increment will result in more than 16 characters.

<ID:>	<Increment By:>	Next point ID	Notes
Abcdefghijklmno9	-5	Abcdefghijklmnop4 Point ID increment fail	Negative incrementing fails if next increment requires negative sign and will result in more than 16 characters.

For <Increment: Alphanumeric>

The rightmost character within the point ID is incremented regardless of whether that character is numeric or alphanumeric.

Template	Increment value	Next point ID's	Notes
Point994	5	Point999 Point99E Point99J ...	-
994point	5	994poiny Point ID increment fail	Lower case alpha characters increment until z is reached. Then a new point ID must be entered.
Abcdef	-5	Abcdea AbcdeV … AbcdeB Point ID increment fail	Lower case alpha characters decrement from lower to upper case until A is reached. Then a new point ID must be entered.

Template	Increment value	Next point ID's	Notes
ABCDEB	5	ABCDEB ABCDEG ... Abcdez Point ID increment fail	Upper case alpha characters increment from upper to lower case until z is reached. Then a new point ID must be entered.

16.1.4 Editing an ID Template

Edit ID template step-by-step

Step	Description
1.	Refer to "16.1.2 Accessing ID Template Configuration" to access **CONFIGURE ID Templates**.
2.	In **CONFIGURE ID Templates** highlight any field.
3.	**ENTER** to access **CONFIGURE ID Template Library**.
4.	**CONFIGURE ID Template Library** Highlight the ID template to be edited. The ID template **Time & Date** cannot be edited. **EDIT (F3)**.
5.	**CONFIGURE Edit ID Template** The type of ID template selected for editing determines the availability of the fields on this screen. • Available for the default ID template **No Template Used**: **<ID:>** The name of the ID template cannot be changed since it is a default ID template. The other fields on this screen are the same as in **CONFIGURE New ID Template**. Refer to "16.1.3 Creating a New ID Template". • Available for a user defined ID template: All fields on this screen are the same as in **CONFIGURE New ID Template**. Refer to "16.1.3 Creating a New ID Template". Adapt the settings according to the requirements.
6.	**CONT (F1)** stores the changes and returns to **CONFIGURE ID Template Library**.

Step	Description
7.	**CONT (F1)** returns to **CONFIGURE ID Templates**.
8.	**CONT (F1)** returns to the screen from where **CONFIGURE ID Templates** was accessed.

16.1.5 Deleting an ID Template

Delete ID template step-by-step

Step	Description
1.	Refer to "16.1.2 Accessing ID Template Configuration" to access **CONFIGURE ID Templates**.
2.	In **CONFIGURE ID Templates** highlight any field.
3.	**ENTER** to access **CONFIGURE ID Template Library**.
4.	**CONFIGURE ID Template Library** Highlight the ID template to be deleted. **DEL (F4)**.
☞	It does not matter if the ID template is being used in a configuration set. The ID template will be rebuilt when that configuration set becomes active.
5.	**YES (F4)** returns to the **CONFIGURE ID Template Library**.
6.	**CONT (F1)** returns to **CONFIGURE ID Templates**.
7.	**CONT (F1)** returns to the screen from where **CONFIGURE ID Templates** was accessed.

16.1.6 Working Example

Description

Application:
- Pick up points with many different point ID's.
- Most point ID's require an incrementing number behind a text.

Working technique: Application program Survey.

Goal:
- The first point ID's for survey points are Bolt 001, Bolt 002, ...
- A different point ID can be entered during the survey.
- The following point ID's will be based on the entered point ID.
- An individual point ID can be typed in for one point.

Requirement

Application program Survey is selected. Refer to "47 Survey - General" for more information on Survey.

Configuration of ID template step-by-step

Step	Description
1.	Refer to "16.1.3 Creating a New ID Template". Follow step 1. to 4.
2.	**CONFIGURE New ID Template** **<ID: Bolt 001>** **<Increment: Numeric only>** **<Increment By: 1>** **<Cursor Posn: 1>**
3.	**CONT (F1)** closes the screen and returns to **CONFIGURE ID Template Library**.
4.	**CONT (F1)** returns to **CONFIGURE ID Templates**.

Step	Description
5.	**CONFIGURE ID Templates** **<Survey Pts: Bolt 001>**
6.	**CONT (F1)** returns to the screen from where **CONFIGURE ID Templates** was accessed.

Field procedure step-by-step

Step	Description
1.	Refer to "47.2 Surveying Points" to access **SURVEY Survey: Job Name**.
2.	**SURVEY Survey: Job Name** **<Point ID: Bolt 001>** is shown automatically.
3.	**ALL (F1). <Point ID: Bolt 002>** is shown automatically.
4.	Repeat step 3. until all points with the ID Bolt XXX are surveyed.
5.	**SURVEY Survey: Job Name** The next point ID's are RoadXXXX, starting with Road0723. Type Road0723 **<Point ID: Road0723>**.
6.	**ALL (F1) <Point ID: Road0724>** is shown automatically.
7.	Repeat step 6. until all points with the ID RoadXXXX are surveyed.
8.	**SURVEY Survey: Job Name** The next required point ID is BM98. It is valid for one point. **SHIFT INDIV (F5)**
9.	**SURVEY Survey: Job Name** Type BM98 **<Indiv Pt ID: BM98>**.

Step	Description
10.	**ALL (F1).** The system changes back to the point ID's RoadXXXX.

16.2 Display Settings

Description

Display settings define the parameters shown on a page on the **SURVEY** screen.

Four display masks are definable.

Mask 1:	Always shown on the **SURVEY** screen.
Mask 2:	Can be shown or hidden on the **SURVEY** screen.
Mask 3:	Can be shown or hidden on the **SURVEY** screen.
Mask 4:	Never shown on the **SURVEY** screen. Reserved for application programs.

The settings on this screen define the layout of the four display masks.

Access

Select **Main Menu: Config...\Survey Settings...\Display Settings.**

OR

Press a hot key configured to access the screen **CONFIGURE Display Settings**. Refer to "2.1 Hot Keys" for information on hot keys.

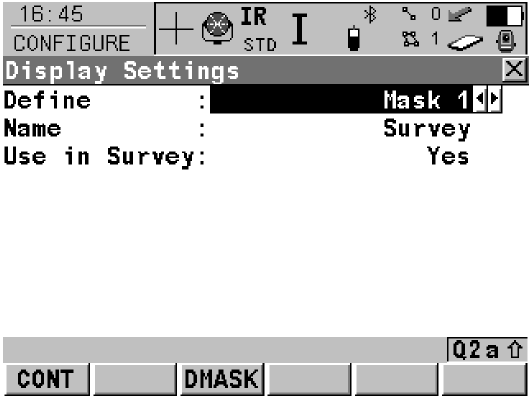
OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

OR

Within the configuration set wizard. Refer to "11.2 Accessing Configuration Set Management".

CONFIGURE
Display Settings



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

DMASK (F3)
To configure the selected display mask. Refer to paragraph "CONFIGURE Define Display Mask n".

Description of fields

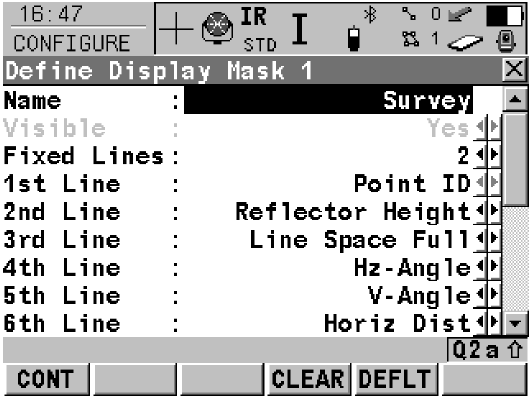
Field	Option	Description
<Define:>	**Mask 1, 2, 3** or **4**	Selected display mask.
<Use in Survey:>	Output	Indicates if the display mask is shown or hidden as a page in **SURVEY**.

Next step

IF a display mask	THEN
is not to be edited	**CONT (F1)** closes the screen and returns to the screen from where **CONFIGURE Display Settings** was accessed.

IF a display mask	THEN
is to be edited	highlight the display mask and **DMASK (F3)**. Refer to paragraph "CONFIGURE Define Display Mask n".

CONFIGURE Define Display Mask n



CONT (F1)
To accept changes and to return to **CONFIGURE Display Settings**.

CLEAR (F4)
To set all fields to **<XX. Line: Line Space Full>**.

DEFLT (F5)
To recall the default settings.

Description of fields

Field	Option	Description
<Visible:>	**Yes** or **No**	Shows or hides the display mask as a page in **SURVEY**.
<Fixed Lines:>	From **0** to **5**	Defines how many lines do not scroll in the survey screen when that display mask is used.
<1st Line:>	Output	Fixed to **<1st Line: Point ID>**.

Field	Option	Description
<2nd Line:> to **<16th Line:>**		For each line one of the following options can be selected.
	Add. Constant	Output field for additive constant of currently selected reflector.
	Angle Right	Displayes the horizontal angle difference between the backsight point and the current telescope position.
	Annotation 1-4	Input field for comments to be stored with the point.
	Attrib (free) 01-20	Output field for attributes for free codes.
	Attrib 01-20	Input field for attributes for point codes.
	Automation	Unavailable for SmartStation. Select automation type.
	Avg Max #Dist	Input field for maximum number of distance measurements in the averaging EDM mode.
	Azimuth	Output field for the azimuth.
	Backsight Pt ID	Output field for point ID of backsight point if Quickset method was used in Setup application program.
	Code	Output field for free codes.
	Code (free)	Input field for free codes.
	Code Desc	Output field for the description of codes.

Field	Option	Description
	Code Desc (free)	Output field for the description of free codes.
	Code Type	Output field for the type of code, for example point code, line code or area code.
	EDM Mode	Select EDM measurement mode.
	EDM Type	Select EDM type.
	Easting	Output field for Easting coordinate of measured point.
	Height	Output field for the height coordinate of the measured point.
	Height Diff	Output field for the height difference between station and reflector.
	Horiz Dist	Output field for horizontal distance.
	Hz-Angle	Output field for the horizontal angle.
	Instrument Ht	Output field for the instrument height.
	Line Space Full	Insert full line space.
	Line Space Half	Insert half line space.
	Linework	Choicelist with option for flagging a line/area. Refer to "16.3 Coding & Linework Settings".
	No. of Dists	Output field for number of averaged distances measured with EDM mode averaging.
	Northing	Output field for Northing coordinate of measured point.

Field	Option	Description
	Offset Cross	Input field for horizontal distance offset for measured point, perpendicular to the line of sight.
	Offset Height	Input field for height offset for measured point.
	Offset Length	Input field for horizontal distance offset, in the direction of line of sight.
	Offset Mode	Select offset mode.
	PPM Atmos	Output field for atmospheric ppm value.
	PPM Geom	Output field for geometric ppm value.
	PPM Total	Output field for the total ppm value.
	Point ID	Input field for the point number.
	Reflector	Select a reflector.
	Reflector Height	Input field for reflector height.
	SD-Last Rec	Output field for the last recorded distance.
	Slope Dist	Output field for measured slope distance.
	Station East	Output field for current station Easting coordinates.
	Station Height	Output field for current station height coordinates.
	Station ID	Output field for current station ID.

Field	Option	Description
	Station North	Output field for current station Northing coordinates.
	Std Dev	Output field of standard deviation in millimeters of averaged distances.
	Time at Point	Output field for the time from when the point is occupied until point occupation is stopped. Appears in the display mask during the point occupation.
	V-Angle	Output field for vertical angle.
	V-Display	Select vertical angle display.

Next step

Step	Description
1.	**CONT (F1)** returns to **CONFIGURE Display Settings**.
2.	**CONT (F1)** returns to the screen from where **CONFIGURE Display Settings** was accessed.

16.3 Coding & Linework Settings

Description

The settings on this screen define the method of coding, for both points and lines.
Refer to "8 Coding" for a complete description of coding.

Access

Select **Main Menu: Config...\Survey Settings...\Coding & Linework Settings**.

OR

Press a hot key configured to access the screen **CONFIGURE Coding & Linework**.
Refer to "2.1 Hot Keys" for information on hot keys.

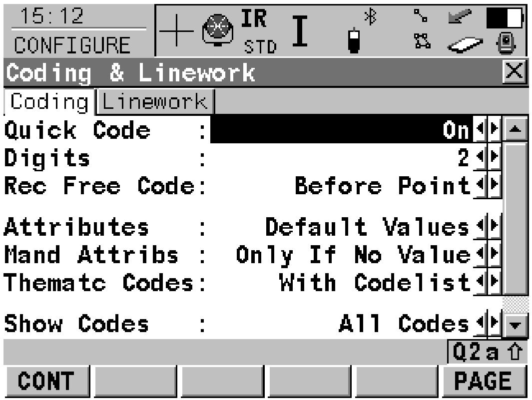
OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

OR

Within the configuration set wizard.
Refer to "11.2 Accessing Configuration Set Management".

CONFIGURE Coding & Linework, Coding page



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

PAGE (F6)
To change to another page on this screen.

Description of fields

Field	Option	Description
<Quick Code:>	**Never**	Prevents the use of quick coding completely.
	On	Allows the use of quick coding and activates it.
	Off	Allows the use of quick coding, but keeps it deactivated.
<Digits:>	**1**, **2** or **3**	Available unless **<Quick Code: Never>**. Sets the mostly used number of digits for the quick code. Quick codes with less digits can still be used. While typing a quick code during a survey, using **ENTER** after typing one or two digits of the quick code indicates the end of the input.
<Rec Free Code:>	**After Point** or **Before Point**	Determines if a free code measured with a quick code is stored before or after the point. This field is disabled when **<Quick Code: Never>**.
<Attributes:>		Determines the attribute values displayed under certain circumstances. This is applicable to both the storing and displaying of attribute values.
	Default Values	When available, the default attribute values, as stored in the job, are displayed and stored.
	Last Used	When available, the last used attribute values as stored in the job are displayed and stored.

Field	Option	Description
<Mand Attribs:>	**Always Prompt**	The screen **XX Enter Mandatory Attribute** will always appear when codes, having one or more attributes of attribute type mandatory, are being stored. Attributes of attribute type mandatory or fixed can only be created in LGO.
	Only If No Value	The screen **XX Enter Mandatory Attribute** will only appear when codes, having one or more attributes of attribute type mandatory, are being stored without an attribute value. Attributes of attribute type mandatory can only be created in LGO.
	Code Change Only	The screen **XX Enter Mandatory Attribute** will only appear when a new code with a mandatory attribute was selected.
<Thematc Codes:>		Sets the coding method.
	With Codelist	Codes stored within the job codelist can be selected to code points, lines and areas.
	Without Codelist	Codes stored within the job codelist cannot be selected to code points, lines and areas. Each code must be entered.
<Show Codes:>	**Only Pt Codes**	Only point codes will be available in the choicelist for **<Code:>**/**<Point Code:>** in a display mask of an application program.

Field	Option	Description
	All Codes	All codes of the job codelist will be available in the choicelist for **<Code:>**/**<Point Code:>** in a display mask of an application program. Selecting a line/area code opens a new line/area.
<String Attrib:>	Choicelist	Available for **<Show Codes: All Codes>**. When this field is active, surveyed points that have the same code attached are strung to one line.

Next step

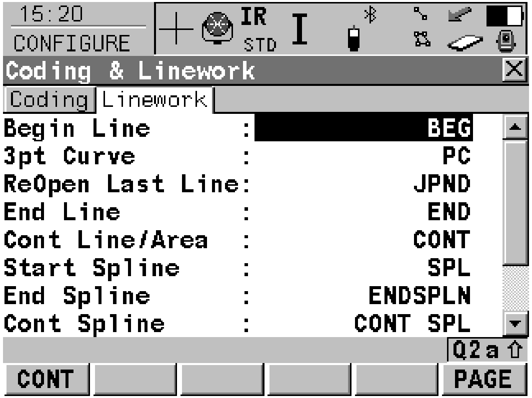
PAGE (F1) changes to the **Linework** page.

CONFIGURE Coding & Linework, Linework page

The flags for Linework are defined on this screen. A flag

- is stored as a property of a point.
- can be exported with a format file.
- is different to a code.

The flags defined on this screen are linked to the options available for **<Linework:>** in a display mask of an application program. The selection for **<Linework:>** in a display mask determines the flag stored with a point. The availability of **<Linework:>** in a display mask is configured in **CONFIGURE Define Display Mask n**. Refer to "9 Linework" for information on Linework.



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

PAGE (F6)
To change to another page on this screen.

Description of fields

Field	Option	Description
<Begin Line:>	User input	Opens a new line when the next point is stored. Any lines which are currently open are closed. The point may or may not be stored with a point code.
<3pt Curve:>	User input	Stores the linework flag for a curve through the next three measured points and continues a line/area.
<ReOpen Last Line:>	User input	Opens the last used line again.
<End Line:>	User input	Closes all open lines.
<Cont Line/Area:>	User input	Indicates a line/area is open.

Field	Option	Description
<Start Spline:>	User input	Stores the linework flag for beginning a spline and continues any open line/area.
<End Spline:>	User input	Stores the linework flag to stop a spline.
<Cont Spline:>	User input	Indicates a line/area is open with spline line type.
<Begin Area:>	User input	Opens a new area when the next point is stored. Any areas which are currently open are closed. The point may or may not be stored with a point code.
<ReOpen Last Area:>	User input	Opens the last used area again.
<Close Area:>	User input	Closes all open areas.

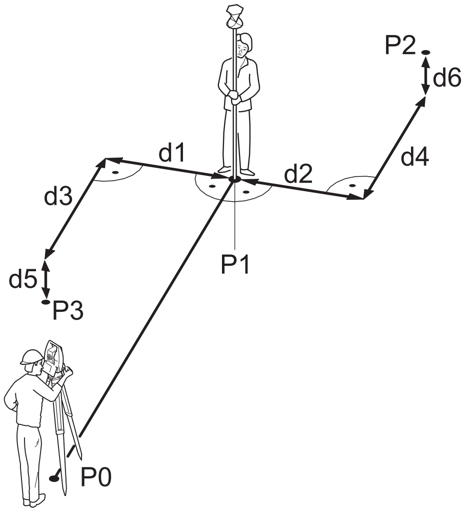
Next step

PAGE (F6) changes to the first page on this screen.

16.4 Offsets

Description

Offsets can be configured and entered. The offset values are applied to measured points. The Offset function allows offset points to be determined, for instance when the reflector cannot be set up directly on a point. Transverse, longitudinal and/or elevation offsets can be defined from the reflector position to the offset point. All of the displayed and recorded measurement data is in relation to the offset point. The values for target eccentricity is retained after storage with **<Offset Mode: Permanent>**. The values are set to zero with **<Offset Mode: Reset after REC>**.



TPS12_041

P0 Station
P1 Current position
P2 Offset point
P3 Offset point
d1 Offset cross -
d2 Offset cross +
d3 Offset length -
d4 Offset length +
d5 Offset height -
d6 Offset height +

If configured in a display mask, the offset values appear also in the display mask in Survey.

Access

Select **Main Menu: Config...\Survey Settings...\Offsets**.

OR

Press a hot key configured to access the screen **CONFIGURE Offsets**. Refer to "2.1 Hot Keys" for information on hot keys.

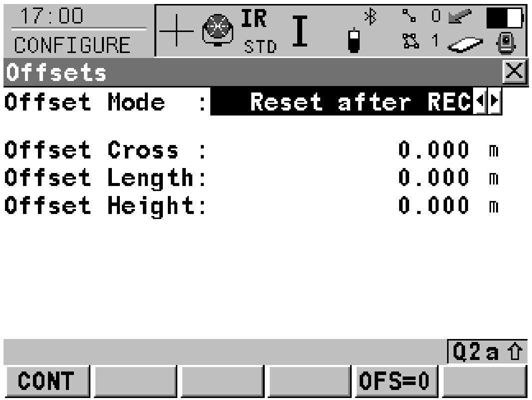
OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

OR

Within the configuration set wizard. Refer to "11.2 Accessing Configuration Set Management".

CONFIGURE Offsets



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

OFS=0 (F5)
To set all offsets to 0.000.

Description of fields

Field	Option	Description
<Offset Mode:>	**Reset after REC**	The offset values are reset to 0.000 after a point is measured with **REC (F3)** or **ALL (F1)**.
	Permanent	The offset values are applied to every measured point until reset or changed.
<Offset Cross:>	User input	Sets cross offset of target point, perpendicular to the line of sight.
<Offset Length:>	User input	Sets length offset of target point, in the direction of the line of sight.
<Offset Height:>	User input	Sets height offset of target point.

Next step

CONT (F1) returns to the screen from where **CONFIGURE Offsets** was accessed.

16.5 Target Check

Description

- It is possible to configure the instrument to monitor sequentially stored measurements and to notify the user if the coordinates lie within a defined range from each other.
- If configured, when a point is being stored the X,Y coordinates of the point being stored are compared to those of the last previously stored point. If the difference is less than the defined position tolerance then a warning is shown. It can now be decided whether to store the point or not.
- If configured, then backsight target points and resection target points which were measured during the setup procedure are also checked in this manner.

Access

Select **Main Menu: Config...\Survey Settings...\Target Check**.

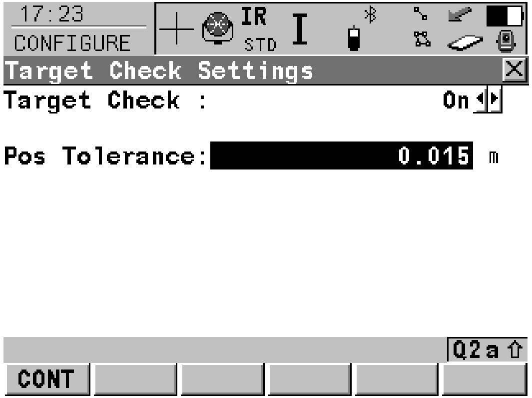
OR

Press a hot key configured to access the screen **CONFIGURE Target Check Settings**. Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

Configuring the target check



CONT (F1)
To accept the screen entries and continue.

Description of fields

Field	Option	Description
<Target Check:>	**On**	Target checking is activated.
	Off	Target checking is not activated.
<Pos Tolerance:>	User input	The position tolerance. The units are defined by **Config \General Settings \Units & Formats**.

17 Config...\Instrument Settings...

17.1 EDM & ATR Settings

Description

- The settings on this screen define the active EDM **E**lectronic **D**istance **M**easurement and ATR **A**utomatic **T**arget **R**ecognition settings.
- Refer to "32 Functions" for detailed information on EDM and ATR.

☞

- Descriptions apply in general to TPS1200 instruments.
- Available options depend on the purchased model, for example with or without ATR.

Access

Select **Main Menu: Config...\Instrument Settings...\EDM & ATR Settings**.

OR

Press a hot key configured to access the screen **CONFIGURE EDM & ATR Settings**. Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**.

Refer to "2.2 USER Key" for information on the **USER** key.

OR

Press **SHIFT USER**.

Refer to "3 Quick Settings - SHIFT USER" for information on the **SHIFT USER** key.

OR

Within the configuration set wizard.

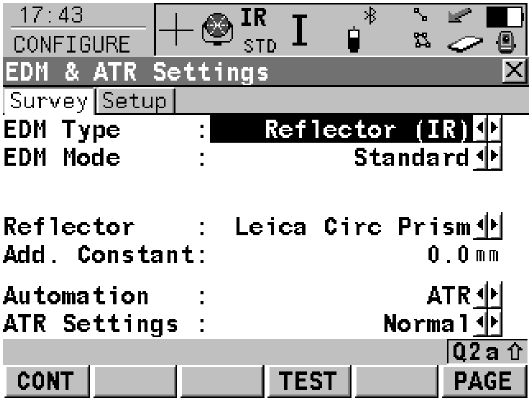
Refer to "11.2 Accessing Configuration Set Management".

CONFIGURE
EDM & ATR Settings
Survey page
Setup page

Description

- This screen has two pages - the Survey page and the Setup page.
- The Survey page and Setup page contain identical fields.
- The settings made in the Survey page are used by all applications and all measurements taken outside of the Setup application program.
- The settings made in the Setup page are only used inside the Setup application program.
- Any changes made to the EDM & ATR Settings (e.g. via Icons, Quick Set, Hotkeys) while the Setup application program is active, only affect the Setup EDM & ATR settings.
- Any changes made to the EDM & ATR Settings (e.g. via Icons, Quick Set, Hotkeys) while the Setup application program is not active, only affect the Survey EDM & ATR settings.
- When entering the Setup application program, the Setup EDM & ATR Settings are active.
- When leaving the Setup application program, the Survey EDM & ATR Settings are active.
- Both Survey and Setup EDM & ATR Settings are part of the configuration sets.

Diagram



CONT (F1)
To accept changes and return to **TPS1200 Main Menu**.

TEST (F4)
To access the **CONFIGURE EDM Test Signal/Frequency** screen.

PAGE (F6)
To change to other page on screen.

Description of fields

Field	Option	Description
<EDM Type:>	**Reflector (IR)**	All fields are set to the last used options. The IR EDM exists for all instrument types and allows to measure the distance to a prism or a tape. IR is the EDM that can be used with ATR and LOCK. For **<Automation: ATR>** or **<Automation: LOCK>** **<EDM Type: Reflector (IR)>** is automatically set. Whenever **<EDM Type: Reflector (IR)>** is selected, the last setting for **<Automation:>** which was used with reflector is set. When activated, **IR** is displayed as an icon.
	Reflctrless (RL)	**<Automation: None>** and **<Reflector: Reflector-less>** are selected. The other fields are set to the last used options. When activated, **RL** is displayed as an icon.
	Long Range (LO)	**<Automation: None>** is selected. Last used options are reset for the other fields. When activated, **LO** is displayed as an icon.
<EDM Mode:>	**Standard**	Available for all **<EDM Type:>** options. Standard single distance measurement with 1.0 s measuring time and 2 mm + 2 ppm accuracy. When activated, **STD** is displayed as an icon.

Field	Option	Description
	Fast	Available only for **<EDM Type: Reflector (IR)>**. Fast single distance measurement with 0.5 s measuring time and 5 mm + 2 ppm accuracy. When activated, **FAST** is displayed as an icon.
	Tracking	Available unless **<EDM Type: Long Range (LO)>**. Continuous distance measurement with 0.3 s measuring time and 5 mm + 2 ppm accuracy. When activated, **TRK** is displayed as an icon.
	SynchroTrack	Available only for **<EDM Type: Reflector (IR)>**. This is the measurement mode for the interpolation of angle measurements in IR LOCK Tracking mode. In difference to normal IR LOCK Tracking mode, where angle measurements are only assigned to certain distance measurements, SynchroTrack will perform a linear interpolation between the previous and following angle measurement, based upon the timestamp of the EDM measurement. Using this interpolation procedure, a higher accuracy for all dynamic applications (e.g. machine guidance) is possible. When activated, **SYNC** is displayed as an icon.

Field	Option	Description
	Average	Available for all **<EDM Type:>** options. Repeats measurements in standard measuring mode. The average distance of **<AVG Max #Dist:>** and the standard deviation for the averaged distance are calculated. When activated, **AVG** is displayed as an icon.
<AVG Max #Dist:>	User input	Available if **<EDM Mode: Average>**. Input field for the maximum number of distances to be averaged from 2 to 999 distances.
<Reflector:>	Choicelist	Reflector names as configured in **Main Menu: Manage...\Reflectors**.
<Add. Constant:>	Output	The additive constant stored with the chosen reflector.
<Automation:>	**None**	Measurements are done without ATR.
	ATR	Positioning to static prisms.
	LOCK	Unavailable for SmartStation. The instrument locks onto and follows the moving prism.
<ATR Settings:>	Choicelist	• ATR Settings.
	Normal	• Normal Mode is turned on.
	Low Vis On	• Low Visability Mode is turned on. To increase the instrument measuring ability during suboptimal weather conditions. Available only when ATR or LOCK mode is activated.

Field	Option	Description
		• This mode is automatically deactivated when the instrument is turned off.
	Low Vis Always On	• Low Visability Mode is permanently turned on.
	S-Range On	• Short Range Mode is turned on. • This mode is designed for survey work at close range from the instrument (up to 60-80 m). Under these conditions the instrument LOCK Mode is significantly stabilised. • This mode is automatically deactivated when the instrument is turned off.
	S-Range Always On	• Short Range Mode is permanently turned on.

Next step

IF EDM	THEN
is not to be tested	**CONT (F1)** closes the screen and returns to **TPS1200 Main Menu**.
is to be tested	**TEST (F4)** to test the EDM signal strength and frequency.

17.2 Search Windows

Description

- The settings on this screen define the size of search windows for prisms to be searched in. The prisms can be searched with ATR in the ATR window or with PowerSearch in the PS window.
- Refer to "32.2 Prism Search Methods" for additional information.

Access

Select **Main Menu: Config...\Instrument Settings...\Search Windows**.

OR

Press a hot key configured to access the screen **CONFIGURE Search Windows**.

Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**.

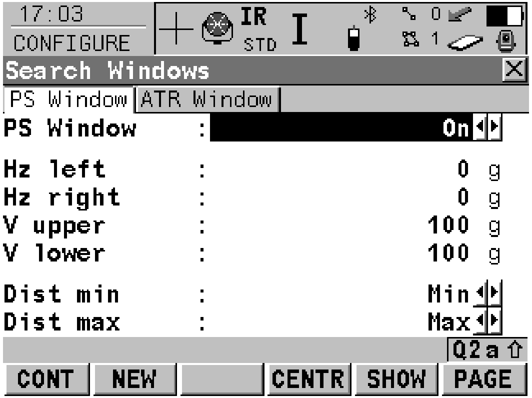
Refer to "2.2 USER Key" for information on the **USER** key.

OR

Within the configuration set wizard.

Refer to "11.2 Accessing Configuration Set Management".

CONFIGURE
Search Windows,
PS Window page



CONT (F1)
To accept changes and return to **TPS1200 Main Menu**.

NEW (F2)
To define new PowerSearch window.

CENTR (F4)
To centre the PowerSearch window to the current position of the telescope.

SHOW (F5)
To position the telescope to corners of PowerSearch window.

PAGE (F6)
To change to other page on screen.

Description of fields

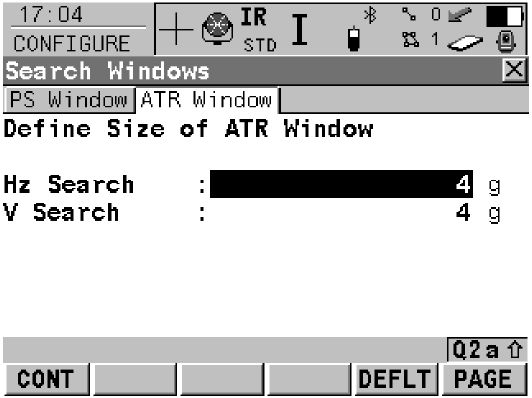
Field	Option	Description
<PS Window:>	**On**	PowerSearch searches in the defined window.
	Off	PowerSearch searches from 0° to 360° within ±20 gon from horizon.
<Hz left:> **<Hz right:>** **<V upper:>** **<V lower:>**	Output	The left, right, upper and lower boundaries of the PowerSearch window.
<Dist min:>	**Min** and from **25 m** to **175 m**	Minimum distance of the search range for the PS window to be defined.

Field	Option	Description
<Dist max:>	From **25 m** to **175 m** and **Max**	Maximum distance of the search range for the PS window to be defined.

Next step

PAGE (F6) changes to the **ATR Window** page.

CONFIGURE Search Windows, ATR Window page



CONT (F1)
To accept changes and return to **TPS1200 Main Menu**.

DEFLT (F5)
To recall the default ATR window settings.

PAGE (F6)
To change to other page on screen.

Description of fields

Field	Option	Description
<Hz Search:>	User input	Horizontal extent of window.

Field	Option	Description
<V Search:>	User input	Vertical extent of window.

Next step

CONT (F1) returns to **TPS1200 Main Menu**.

17.3 Automatic Prism Search

Description

- The settings on this screen define the behaviour of automatic prism search after the target is lost in lock mode.
- Refer to "32 Functions" for information on ATR, PowerSearch, lock and automation behaviour.

Access

Select **Main Menu: Config...\Instrument Settings...\Automatic Prism Search**.

OR

Press a hot key configured to access the screen **CONFIGURE Automatic Prism Search**.
Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**.

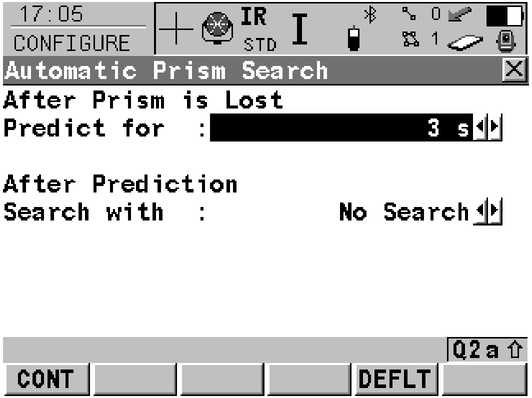
Refer to "2.2 USER Key" for information on the **USER** key.

OR

Within the configuration set wizard.

Refer to "11.2 Accessing Configuration Set Management".

CONFIGURE Automatic Prism Search



CONT (F1)
To accept changes and return to **TPS1200 Main Menu**.

DEFLT (F5)
To recall the default settings.

Description of fields

Field	Option	Description
<Predict for:>	From **1 s** to **5 s**	If the target is lost when **<Automation: LOCK>** the path of the reflector is predicted for the selected amount of seconds.
<Search with:>	**No Search**	Perform no search after prediction.
	ATR	Perform search after prediction with ATR in a dynamic ATR window.
	PowerSearch	Perform search after prediction with PowerSearch. For **<PS Window: On>** search in PS window and for **<PS Window: Off>** search in dynamic PS window.

Next step

CONT (F1) closes the screen and returns to **TPS1200 Main Menu**.

17.4 TPS Corrections

Description

- The settings on this screen define the atmospheric ppm, the geometric ppm and the refraction. The geometric ppm can also be determined by a resection calculation.
- For standard application programs the distance is corrected on account of atmospheric influences. The geometrical correction and the projection distortions are set to 0.00. Heights are reduced with the standard refraction coefficient.
- Refer to "TPS1200 User Manual" for information on calculations.

Access

Select **Main Menu: Config...\Instrument Settings...\TPS Corrections**.

OR

Press a hot key configured to access the screen **CONFIGURE TPS Corrections**.

Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**.

Refer to "2.2 USER Key" for information on the **USER** key.

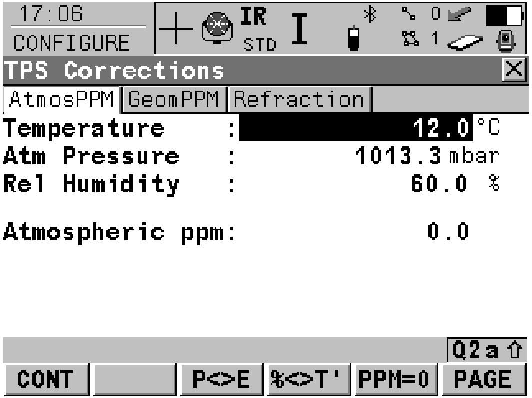
OR

Within the configuration set wizard.

Refer to "11.2 Accessing Configuration Set Management".

CONFIGURE TPS Corrections, AtmosPPM page

The atmospheric distance corrections are derived from the dry air temperature, air pressure or elevation above mean sea level MSL and relative air humidity or wet bulb temperature.



CONT (F1)
To accept changes and return to **TPS1200 Main Menu**.

P<>E (F3)
To change **<Atm Pressure:>** to **<Elev above MSL:>** and back.

%<>T ' (F4)
To change **<Rel Humidity:>** to **<Temp Wet-bulb:>** and back.

PPM=0 (F5)
To set **<Atmospheric ppm: 0.0>**.

PAGE (F6)
To change to other page on screen.

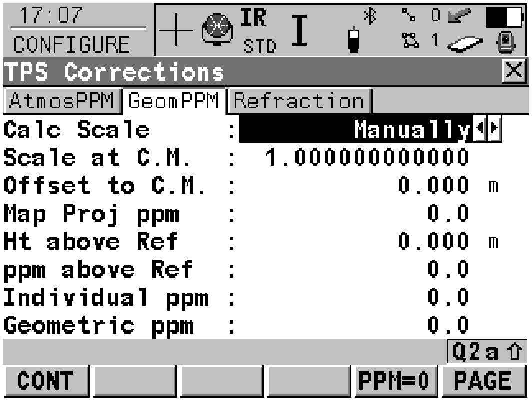
Description of fields

Field	Option	Description
<Temperature:>	User input	Sets the temperature.
<Atm Pressure:> or **<Elev above MSL:>**	User input	Sets the atmospheric pressure or the elevation above mean sea level dependent on selection.
<Rel Humidity:> or **<Temp Wet-bulb:>**	User input	Sets the relative air humidity or the wet bulb temperature dependent on selection.
<Atmospheric ppm:>	User input or Output	The atmospheric ppm is either set or calculated from the above values.

Next step
PAGE (F6) changes to the **GeomPPM** page.

CONFIGURE TPS Corrections, GeomPPM page

- The geometric distance correction (geometric ppm) is derived from the map projection distortion (map projection ppm), the height above reference datum correction (height ppm) and an individual correction (individual ppm).
- The calculation of the map projection ppm follows the formula for the Transversal Mercator Projection. The individual factors are: the scale factor of the line of projection central meridian, Gauss-Krüger = 1.0, UTM = 0.9996, etc. and the offset from the line of projection.
- The calculation of the height ppm is derived from the height of the instrument station above the reference datum. Normally this is the height above mean sea level MSL.



CONT (F1)
To accept changes and return to **TPS1200 Main Menu**.

PPM=0 (F5)
To set **<Geometric ppm: 0.0>**.
Only available when **<Calc Scale: Manually>**.

PAGE (F6)
To change to other page on screen.

Description of fields

Field	Option	Description
<Calc Scale:>	Choicelist	To manually or automatically calculate the geometric ppm value.
	Manually	The geometric ppm value is manually calculated.
	Automatically	The geometric ppm value is automatically calculated.
<Scale at C.M.:>	User input	The scale at the central meridian. Only available when **<Calc Scale: Manually>**.
<Offset to C.M.:>	User input	The offset to the central meridian. Only available when **<Calc Scale: Manually>**.
<Map Proj ppm:>	Output	The map projection ppm value. If this value cannot be calculated, then **-----** is displayed and is also ignored in the calculation of the geometric ppm value.
<Ht above Ref:>	User input	The height of the instrument station above the reference datum. Only available when **<Calc Scale: Manually>**.
<ppm above Ref:>	Output	The height ppm value calculated from **<Ht above Ref:>**. Only available when **<Calc Scale: Manually>**.

Field	Option	Description
<Height ppm:>	Output	The height ppm value calculated from the height coordinates of the current TPS station stored in the System RAM. If this value cannot be calculated, then **-----** is displayed and is also ignored in the calculation of the geometric ppm value. Only available when **<Calc Scale: Automatically>**.
<Individual ppm:>	User input	The individual ppm value. Only available when **<Calc Scale: Manually>**.
<Geometric ppm:>	Output	For **<Calc Scale: Manually>**: **Geometric ppm** = **Map Proj ppm** + **ppm above Ref** + **Individual ppm**. For **<Calc Scale: Automatically>**: **Geometric ppm** = **Map Proj ppm** + **Height ppm**.

Additional calculation method for the geometric ppm value

The geometric ppm value can also be calculated by a resection calculation. The scale factor from the resection is used for **<Individual ppm:>**. Individual ppm=(s-1)*10^6.s=1+ppm*10^{-6}. The **<Geometric ppm:>** value is calculated with the following:

- **<Scale at C.M.: 1>**,
- **<Offset to C.M.: 0>**,
- **<Map Proj ppm: 0>** and
- **<Ht above Ref: 0>**.

Automatic calculation of the geometric ppm value

When **<Calc Scale: Automatically>** is set:

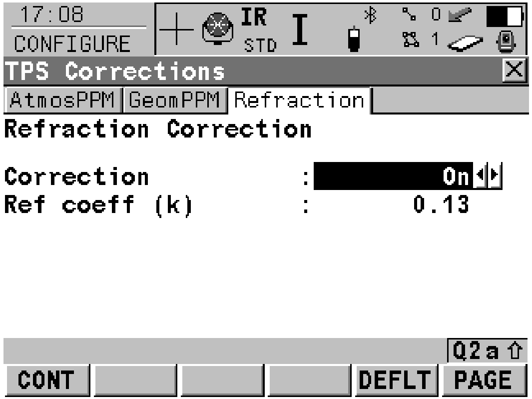
- the ppm values for **<Map Proj ppm>**, **<Height ppm>** and **<Geometric ppm>** are automatically calculated. The coordinates of the current instrument station stored in the System RAM are used, which are based on the currently active coordinate system.
- each time an application program is accessed, the geometric ppm value is automatically calculated. The coordinates of the current instrument station stored in the System RAM are used (these may have been updated), which are based on the currently active coordinate system (this may have changed). This way, the user is always working with the correct geometric ppm value.
- when either the **WGS84** or **<None>** coordinate system is chosen, then the geometric ppm value cannot be automatically calculated. A message dialog will appear, allowing the user to either manually enter the ppm values or accept ppm values of 0.

Next step

PAGE (F6) changes to the **Refraction** page.

CONFIGURE TPS Corrections, Refraction page

The refraction correction is taken into account during the calculation of the height difference. Refer to "TPS1200 User Manual" for information on refraction calculation.



CONT (F1)
To accept changes and return to **TPS1200 Main Menu**.

DEFLT (F5)
Sets **<Correction: On>** and **<Ref coeff (k): 0.13>**.

PAGE (F6)
To change to other page on screen.

Description of fields

Field	Option	Description
<Correction:>	**On** or **Off**	Refraction correction is applied to measurements.
<Ref coeff (k):>	User input	Available if **<Correction: On>**. Refraction coefficient to be used for calculation.

Next step

CONT (F1) returns to the screen from where **CONFIGURE TPS Corrections** was accessed.

17.5 Compensator

Description

The compensator and the Hz correction can be deactivated if raw data is to be displayed and recorded.

Access

Select **Main Menu: Config...\Instrument Settings...\Compensator.**

OR

Press a hot key configured to access the screen **CONFIGURE Compensator**.

Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**.

Refer to "2.2 USER Key" for information on the **USER** key.

OR

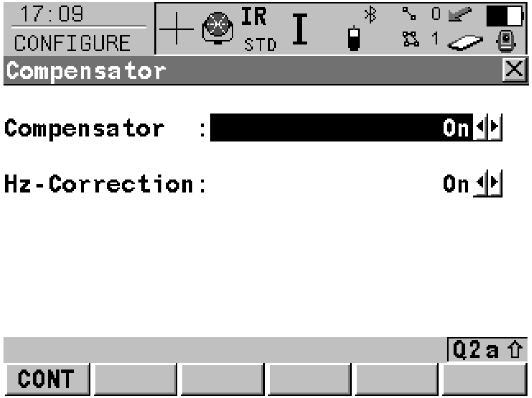
Within the configuration set wizard.

Refer to "11.2 Accessing Configuration Set Management".

OR

ICONS.

CONFIGURE Compensator



CONT (F1)
To accept changes and return to **TPS1200 Main Menu**.

Description of fields

Field	Option	Description
<Compensator:>	**On**	Vertical angles are relative to plumb line. The horizontal angle is corrected for the transversal tilt errors if **<Hz-Correction: On>**.
	Off	Vertical angles are relative to vertical/standing axis.
<Hz-Correction:>	**On**	The horizontal angles are corrected for the line of sight, tilting axis and if **<Compensator: On>** transversal tilt errors.
	Off	Horizontal angles are not corrected.

Next step

CONT (F1) returns to **TPS1200 Main Menu**.

17.6 Instrument ID

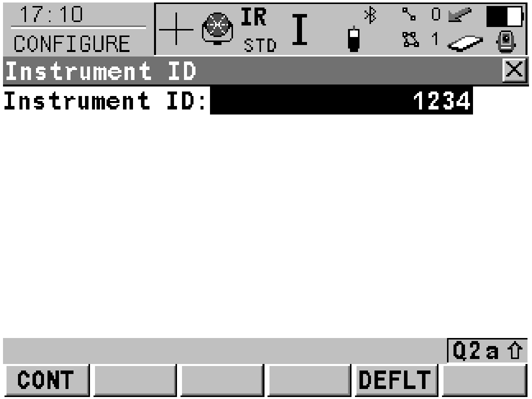
Description

- The settings on this screen define the instrument identification number. This number is used for the generation of the file names.
- Using format files, the instrument ID can be output together with data from the instrument. By doing so, it can be identified which instrument was used for certain measurements.

Access

Select **Main Menu: Config...\Instrument Settings...\Instrument ID**.

CONFIGURE Instrument ID



CONT (F1)
To accept changes and return to **TPS1200 Main Menu**.

DEFLT (F5)
To recall the default instrument ID.

Description of fields

Field	Option	Description
<Instrument ID:>	User input	Sets a four digit number as instrument identification number. By default the last four numbers of the serial number are used.

Next step

CONT (F1) returns to **TPS1200 Main Menu**.

18 Config...\General Settings...

18.1 Wizard Mode

Description

The settings on this screen define the behaviour of the configuration set wizard.

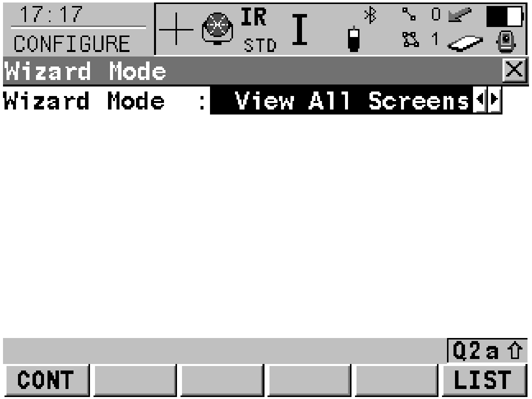
Access

Select **Main Menu: Config...\General Settings...\Wizard Mode**.

OR

Within the configuration set wizard. Refer to "11.2 Accessing Configuration Set Management".

CONFIGURE Wizard Mode



CONT (F1)

To accept changes and to return to **TPS1200 Main Menu** or to continue with the subsequent screen within the configuration set wizard.

LIST (F6)

To access **CONFIGURE Quick Access**. Lists all screens within a configuration set. Allows to access these individual screens and change settings.

Description of fields

Field	Option	Description
<Wizard Mode:>	**View All Screens**	All configuration screens are shown in the configuration set wizard. Application program configuration screens are not included. They can be configured within each application program.
	Reduced	A reduced set of screens are shown in the configuration set wizard.

Next step

CONT (F1) returns to **TPS1200 Main Menu** or continues with the subsequent screen within the configuration set wizard.

18.2 Hot Keys & User Menu

Description

The settings on this screen assign a particular function, screen or application program to each of the first and second level of hot keys and to the **USER** key. Refer to "2 Configurable Keys" for more information on hot keys and the **USER** key.

Access

Select **Main Menu: Config...\General Settings...\Hot Keys & User Menu**.

OR

Press a hot key configured to access the screen **CONFIGURE Hot Keys & User Menu**. Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

OR

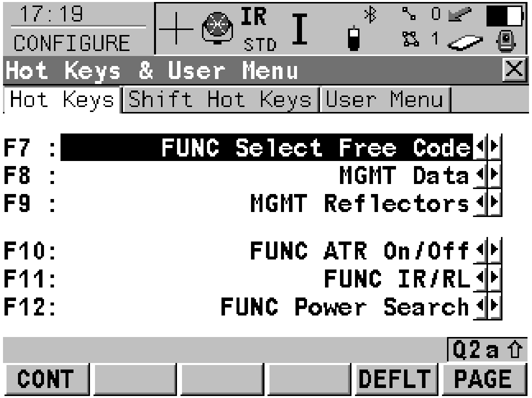
Within the configuration set wizard. Refer to "11.2 Accessing Configuration Set Management".

OR

Hold a hot key down for two seconds. This is also possible after pressing **SHIFT**.

CONFIGURE Hot Keys & User Menu, Hot Keys page

To configure the first level of hot keys.



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

PAGE (F6)
To change to another page on this screen.

Description of fields

Field	Option	Description
<F7:> to **<F12:>**	Choicelist	All functions, screens or application programs which can be assigned to the particular key.

Next step

PAGE (F6) changes to the **Shift Hot Keys** page.

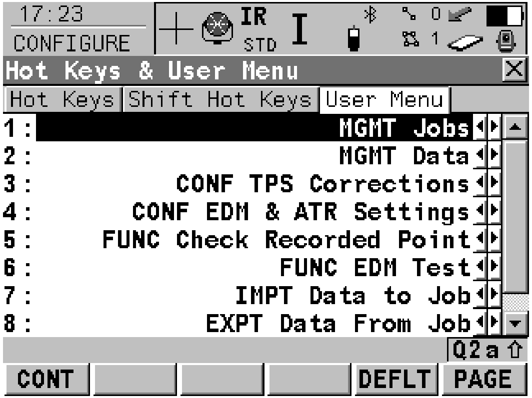
CONFIGURE
Hot Keys & User Menu, Shift Hot Keys page

To configure the second level of hot keys.
The functionality on this page is identical to the one on the **Hot Keys** page.

Field	Option	Description
<F7:> to **<F10:>**	Choicelist	All functions, screens or application programs which can be assigned to the particular key.
<F11:>	Output	The lights, display, beeps and text settings can be edited. Refer to "18.5 Lights, Display, Beeps, Text".
<F12:>	Output	The electronic level is shown. Refer to "30.7 STATUS: Level & Laser Plummet".

Next step
PAGE (F6) changes to the **User Menu** page.

CONFIGURE
Hot Keys & User Menu, User Menu page



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.
PAGE (F6)
To change to another page on this screen.

Description of fields

Field	Option	Description
<1:> to **<9:>**	Choicelist	All functions, screens or application programs which can be assigned to the individual lines in the user defined menu.

Next step

PAGE (F6) changes to the first page on this screen.

18.3 Units & Formats

Description

The settings on this screen define
- the units for all types of measurement data displayed.
- information related to some types of measurement data.
- the order in which coordinates are displayed.

Access

Select **Main Menu: Config...\General Settings...\Units & Formats**.

OR

Press a hot key configured to access the screen **CONFIGURE Units & Formats**. Refer to "2.1 Hot Keys" for information on hot keys.

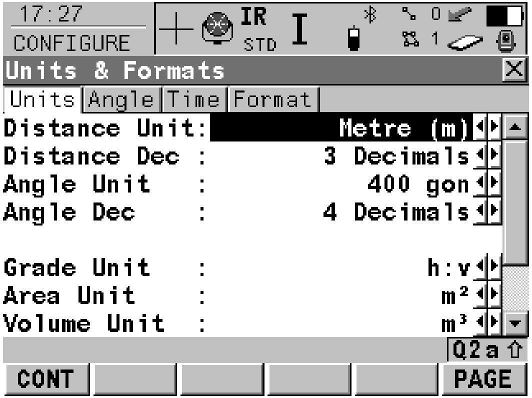
OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

OR

Within the configuration set wizard. Refer to "11.2 Accessing Configuration Set Management".

CONFIGURE
Units & Formats,
Units page



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

PAGE (F6)
To change to another page on this screen.

Description of fields

Field	Option	Description
<Distance Unit:>		The units shown for all distance and coordinate related fields.
	Metre (m)	Metres [m]
	Int Ft (fi)	International feet [fi], storage in US feet
	Int Ft/Inch (fi)	International feet [fi], inches and 1/8 inches (0' 00 0/8 fi), storage in US feet
	US Ft (ft)	US feet [ft]
	US Ft/Inch (ft)	US feet, inches and 1/8 inches (0' 00 0/8 fi) [ft]

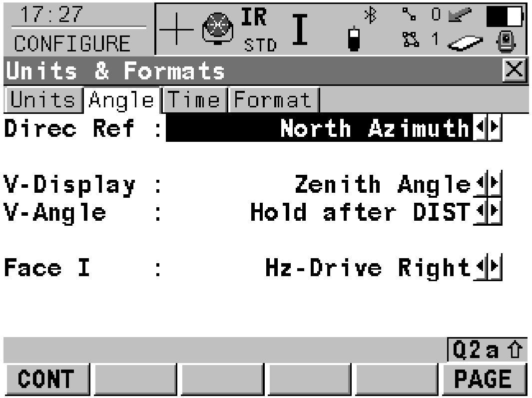
Field	Option	Description
<Distance Dec:>	From **0 Decimal** to **4 Decimals**	The number of decimal places shown for all distance and coordinate related fields. This is for data display and does not apply to data export or storage. The available options depend on the selected **<Distance Unit:>**.
<Angle Unit:>	**400 gon**, **360 ° ' "**, **360° dec** or **6400 mil**	The units shown for all angular and coordinate related fields. More angle settings can be defined on the **Angle** page.
<Angle Dec:>		The number of decimal places shown for all angular and coordinate related fields. This is for data display and does not apply to data export or storage.
	From **1 Decimal** to **3 Decimals**	Available for **<Angle Unit: 6400 mil>**.
	From **2 Decimals** to **4 Decimals**	Available for **<Angle Unit: 400 gon>** and **<Angle Unit: 360° dec>**.
	1’’, 5’’, 10’’, 60’’	Available for **<Angle Unit: 360 ° ’ ’’>**.
<Grade Unit:>		The input and output format for grades.
	h:v	Horizontal by vertical distance.
	v:h	Vertical by horizontal distance.
	% (v/h * 100)	Percentage of vertical by horizontal distance.

Field	Option	Description
	Elev Angle	Elevation angle.
<Area Unit:>	**m²**, **Int Acres (Ai)**, **US Acres (A)**, **Hectares (ha)**, **fi²** or **ft²**	The units shown for all area related fields.
<Temp Unit:>	**Celsius (°C)** or **Fahrenheit (°F)**	The units shown for all temperature related fields.
<Press Unit:>	**mbar**, **mmHg**, **Inch Hg (inHg)**, **hPa** or **psi**	The units shown for all pressure related fields. psi = pounds per square inch.

Next step

PAGE (F6) changes to the **Angle** page. Refer to paragraph "CONFIGURE Units & Formats, Angle page".

CONFIGURE Units & Formats, Angle page

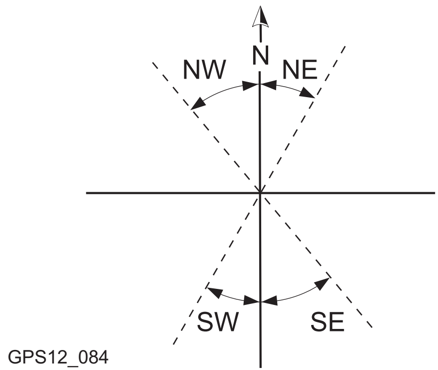


CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

PAGE (F6)
To change to another page on this screen.

Description of fields

Field	Option	Description
<Direc Ref:>	**North Azimuth**, **South Azimuth**, **North Anti-clock**, or **Bearing**	Sets the reference direction as well as the direction from where and how azimuths are computed. For **<Direc Ref: Bearing>**, the azimuth/bearing fields in other screens are called **<Bearing:>**. NE, SW, SE and NW indicate the quadrant of the bearing.

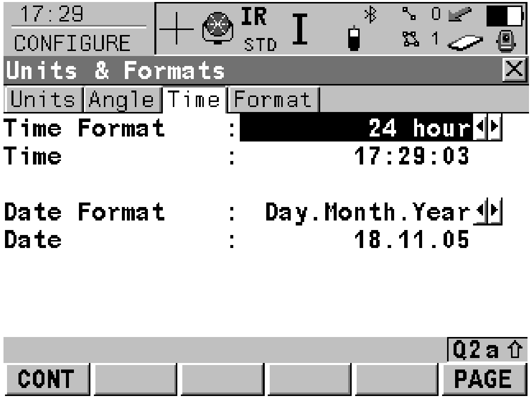
Field	Option	Description
		 For all other options, the azimuth/bearing fields in other screens are called **<Azimuth:>**.
<V-Display:>	**Zenith Angle**	V = 0 in zenith.
	Elev Angle	V = 0 horizontal elevation angle. V-angles are positive above the horizon and negative below it.
	Elev Angle %	V = 0 horizontal. V-angles are expressed in % and are positive above the horizon and negative below it.
<V-Angle:>	**Hold after DIST**	The vertical angle is fixed after a distance measurement with **DIST (F2)**, whereas the horizontal angle is continuously updated with the telescope movement.

Field	Option	Description
	Running	The vertical angle is continuously updated with the telescope movement. ☞ The active reflector height is applied in the calculation of remote point elevations. The reflector height must be set to zero to display and record the elevation of the targeted remote point.
<Face I:>	**Hz-Drive Right**	Horizontal drive on the right side.
	Hz-Drive Left	Horizontal drive on the left side.

Next step

PAGE (F6) changes to the **Time** page. Refer to paragraph "CONFIGURE Units & Formats, Time page".

CONFIGURE Units & Formats, Time page



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

PAGE (F6)
To change to another page on this screen.

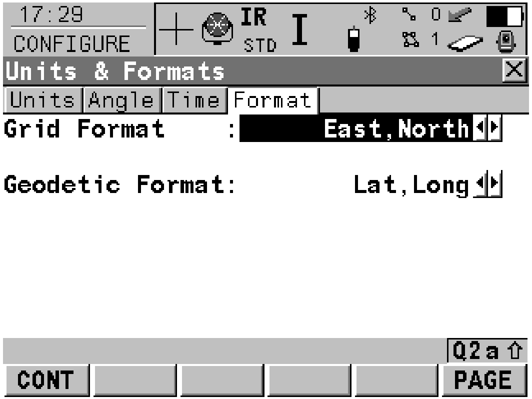
Description of fields

Field	Option	Description
<Time Format:>	**24 hour** or **12 hour (am/pm)**	How the time is shown in all time related fields.
<Date Format:>	**Day.Month.Year**, **Month/Day/Year** or **Year/Month/Day**	How the date is shown in all date related fields.

Next step

PAGE (F6) changes to the **Format** page. Refer to paragraph "CONFIGURE Units & Formats, Format page".

CONFIGURE Units & Formats, Format page



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

PAGE (F6)
To change to another page on this screen.

Description of fields

Field	Option	Description
<Grid Format:>	**East,North** or **North,East**	The order in which grid coordinates are shown in all screens. The order in display masks depends on the user settings.
<Geodetic Format:>	**Lat,Long** or **Long,Lat**	The order in which geodetic coordinates are shown in all screens. The order in display masks depends on the user settings.

Next step

PAGE (F6) changes to the first page on this screen.

18.4 Language

Description

The setting on this screen defines the language used on the instrument. Three languages can be stored on the instrument at one time - English and two others. English cannot be deleted. Refer to "25.2 System Languages".

Access

Select **Main Menu: Config...\General Settings...\Language**.

CONFIGURE Languages on Instrument

CONT (F1)
To accept changes and return to **TPS1200 Main Menu**.

DEL (F4)
To delete the highlighted language.

Description of fields

Field	Option	Description
<Language:>	Choicelist	Sets the language.

Field	Option	Description
		The selected language is used for the system software. If a language is not available for the system software, the English language is used instead. Application programs run in the language they were loaded.

Next step

CONT (F1) returns to **TPS1200 Main Menu**.

18.5 Lights, Display, Beeps, Text

Description

The settings on this screen allow the lights and screen appearance to be configured, turn the notification beeps on and off and define the behaviour of the keys.

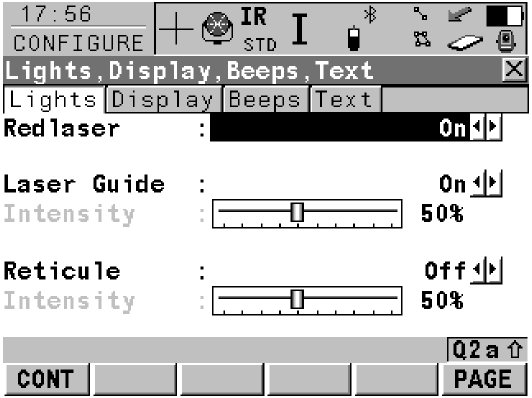
Access

Select **Main Menu: Config...\General Settings...\Lights, Display, Beeps, Text**.

OR

Press **SHIFT F11**.

CONFIGURE Lights, Display, Beeps, Text, Lights page



CONT (F1)
To accept changes and return to **TPS1200 Main Menu**.

PAGE (F6)
To change to another page on this screen.

Description of fields

Field	Option	Description
<Redlaser:>	**On** or **Off**	To turn the redlaser of RL EDM on and off.

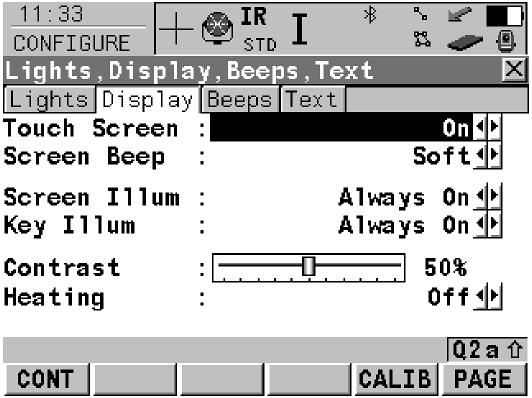
Field	Option	Description
<EGL:>	**On** or **Off**	To turn the Emitting Guide Light (EGL) on and off. This field is only available if EGL is fitted
<Laser Guide:>	**On** or **Off**	To turn the Laser Guide (GUS74) on and off. This field is only available if GUS74 is fitted
<Intensity:>	From **0 %** to **100 %**	To adjust the EGL/Laser Guide intensity using the left and right arrow keys.
<Reticule:>	**On** or **Off**	To turn the reticule illumination on and off.
<Intensity:>	From **0 %** to **100 %**	To adjust the reticule illumination intensity using the left and right arrow keys.

Next step

PAGE (F6) changes to the **Display** page.

CONFIGURE Lights, Display, Beeps, Text, Display page

This page contains the screen display settings for the TPS1200 instrument.



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

CALIB (F5)
To calibrate the touch screen.

PAGE (F6)
To change to another page on this screen.

Description of fields

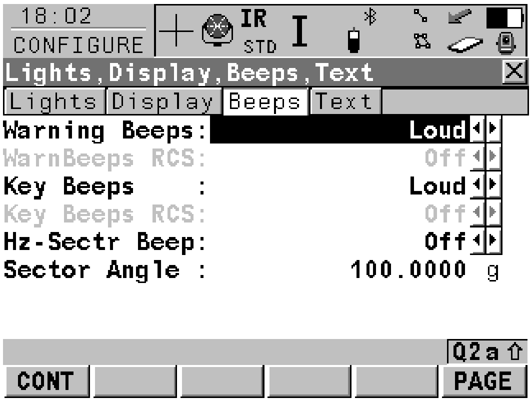
Field	Option	Description
<Touch Screen:>	**On** or **Off**	Turns touch screen on and off.
<Screen Beep:>	**Off**, **Soft** or **Loud**	Controls the beep upon touching the touch screen.
<Screen Illum:>	**Off**, **Always On**, **On for 1 min**, **On for 2 min** or **On for 5 min**	Controls the screen illumination to be on, off or on for the specified time after the last key was pressed.

Field	Option	Description
<Key Illum:>	**Off**, **Same as Screen** or **Always On**	Controls the keyboard illumination.
<Contrast:>	From **0 %** to **100 %**	Adjust the contrast level for the display with the right and left arrow key when the field is highlighted.
<Heating:>	**Automatic**	The screen heating comes on automatically at 5°C and shuts off again at 7°C.
	Off	The screen heating never comes on.

Next step

PAGE (F6) changes to the **Beeps** page.

CONFIGURE
Lights, Display, Beeps, Text,
Beeps page



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

PAGE (F6)
To change to another page on this screen.

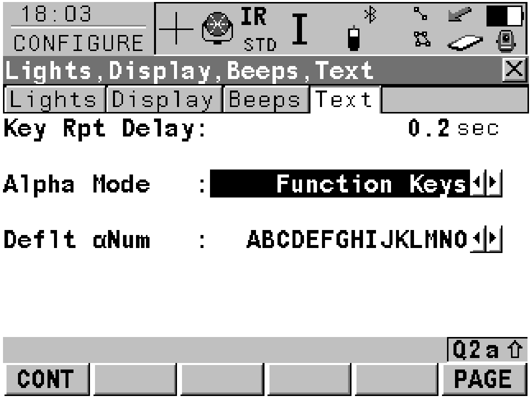
Description of fields

Field	Option	Description
<Warning Beeps:>	**Off**, **Soft** or **Loud**	Controls the beep for acoustic warning signals for the TPS1200 instrument.
<WarnBeeps RCS:>	**Off**, **Soft** or **Loud**	Controls the beep for acoustic warning signals for the RX1200 controller.
<Key Beeps:>	**Off**, **Soft** or **Loud**	Controls the beep upon key presses for the TPS1200 instrument.
<Key Beeps RCS:>	**Off**, **Soft** or **Loud**	Controls the beep upon key presses for the RX1200 controller.
<Hz-Sectr Beep:>	**On** or **Off**	Turns the Hz-sector beep on and off. The instrument beeps when within 5 gon/4°30’ of the defined sector, there is a long and consistent beep within 0.5 gon/27’ and no beep within 0.005 gon/16’’.
<Sector Angle:>	User input	Input field for sector angle for which a beep should sound.

Next step

PAGE (F6) changes to the **Text** page.

**CONFIGURE
Lights, Display, Beeps, Text,
Text page**



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

PAGE (F6)
To change to another page on this screen.

Description of fields

Field	Option	Description
<Key Rpt Delay:>	User input	Key repeat delay is the time between the initial key press and when the key starts repeating. For example in numeric mode press and hold 1. Behaviour on screen: 1 - delay - 11111111111. In alpha mode the focus stays on one field and scrolls through the available characters: S - delay - T U 7 S T U 7. Time between the initial key press and when the key starts repeating. Alphanumeric, numeric, **CE** or arrow keys in all general screens are delayed by the specified time.

Field	Option	Description
<Alpha Mode:>	**Function Keys** or **Numeric Keys**	Alphanumeric input can either be through function or numeric keys.
<Deflt αNum:>	Up to 6 choices	Available if **<Alpha Mode: Function Keys>**. Sets the set of extra characters available through **αNUM** or on **F1**-**F6** whenever an entry is made. The choices available depend on the character sets loaded on the instrument and the language configured to be used on the instrument.

Next step

PAGE (F6) changes to the next page.

18.6 Start Up & Power Down

Description

- The settings on this screen
  - define the instrument start up screen.
  - define the behaviour of the instrument and SmartAntenna when starting up and when powering down.
  - define a PIN code which needs to be entered when starting up the instrument.

Start Up

- The screen entered after turning on the instrument can be configured.

Power Down

- Once power is restored after a power loss the instrument returns to the screen in which it was operating when the power failed. After restarting, the instrument uses the same job and configuration set as before the power loss. If either the job or configuration set are not available the first in the list is used.
- Two types of power loss could be experienced:
  - Sudden power loss: Internal or external battery being removed
  - Gradual power loss: Internal or external battery running down naturally

PIN Code

- A **P**ersonal **I**dentification **N**umber protection can be activated.

Type	Description
PIN protection active	Instrument prompts for PIN code entry

Type	Description
	• after starting up. • when changing the PIN code in CONFIGURE Start Up & Power Down.
PIN code generation	By the user.
Attempts for correct PIN code	Five. After five false attempts, a **P**ersonal **U**nbloc**K**ing code must be typed in.
PUK code generation	• By Leica Geosystems. • For instruments delivered with firmware version 2.10 or higher, the PUK code comes with the instrument. • For instruments delivered with firmware versions lower than v2.10, contact a Leica representative to obtain a PUK code.

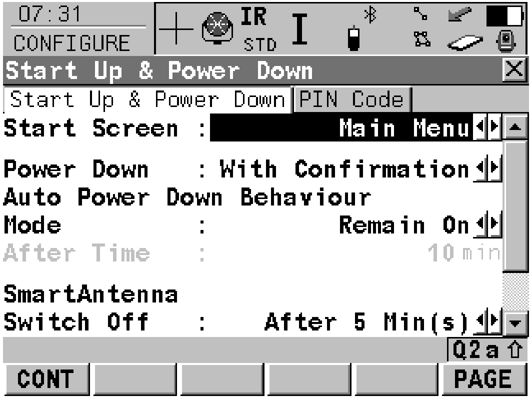
Access

Select **Main Menu: Config...\General Settings...\Start Up & Power Down**.

OR

Within the configuration set wizard. Refer to "11.2 Accessing Configuration Set Management".

CONFIGURE
Start Up & Power Down
Start Up & Power Down page



CONT (F1)
To accept changes and return to **TPS1200 Main Menu**.

Description of fields

Field	Option	Description
<Start Screen:>	Choicelist	Determines the first screen which is shown after turning on the instrument.
<Power Down:>		Sets the behaviour of the instrument shut down.
	With Confirmation	Instrument shut down must be confirmed.
	Directly	The instrument is shut down immediately without confirmation.
<Mode:>	**Turn Off**	The instrument turns off if no events have occurred after the time set in **<After Time:>**.

Field	Option	Description
	Remain On	The instrument does not power down automatically.
<After Time:>	User input	Available unless **<Mode: Remain On>** is selected. Minutes after which the instrument should turn off.
<Switch Off:>	Choicelist	This option determines when SmartAntenna is turned off. The selected time is activated whenever SmartStation leaves GPS mode. This option is directly linked to **<Switch Off:>** in **CONFIGURE Logging of Raw Obs**. Refer to "22.6 Logging of Raw Obs" for details.
<Switch On:>	**If Device Found**	Device attached to port 2 are automatically powered up.
	If ATX Found	SmartAntenna attached to port 2 is automatically powered up.

Next step
PAGE (F6) changes to the **PIN Code** page.

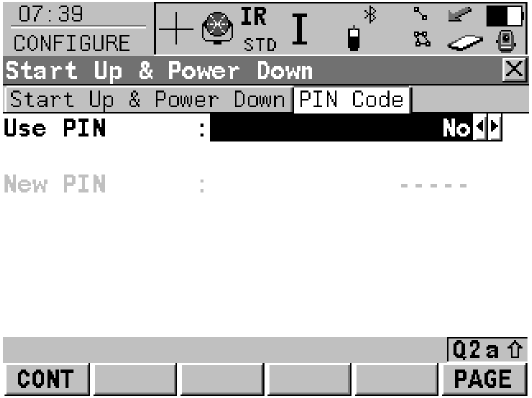
CONFIGURE Start Up & Power Down, PIN Code page

- The appearance of the screen varies with the setting for **<Use PIN:>** when this screen is accessed.

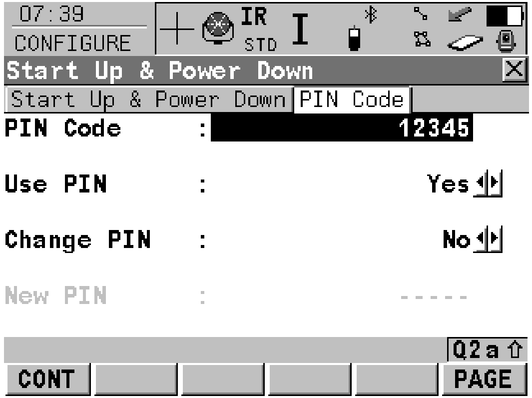
<Use PIN: No>
No PIN code has been set before.

<Use PIN: Yes>
A PIN code has been set before.

- The PIN code protection can be activated.
- Then a PIN code can be typed in.



- The PIN code must be typed in order to change settings on this page.
- Then the PIN code protection can be deactivated.
- Or the PIN code can be changed.



Description of fields

Field	Option	Description
Use PIN	**Yes** or **No**	Activates the PIN code protection. This setting is not part of the configuration set.
New PIN	User input	The PIN code must be a number with four to six digits.

Field	Option	Description
PIN Code	User input	The PIN code as previously defined on this page. The correct PIN code must be typed in within five attempts or the PUK code is required. Refer to "1 Instrument Protection with PIN".
Change PIN	**Yes** or **No**	Activates **<New PIN:>** to type in a new PIN code.

Next step

PAGE (F6) changes to the first page on this screen.

19 Interfaces, Ports, Devices

19.1 Overall Concept

Terminology

Term	Description
Interface	The procedures, codes and protocols that enable two entities to interact for an exchange of data. Each interface is given a meaningful display name which enables easy distinction between interfaces.
Port	A connection through which a separate device may communicate with the instrument.
Device	The hardware which is connected to the chosen port.

Concept

Table

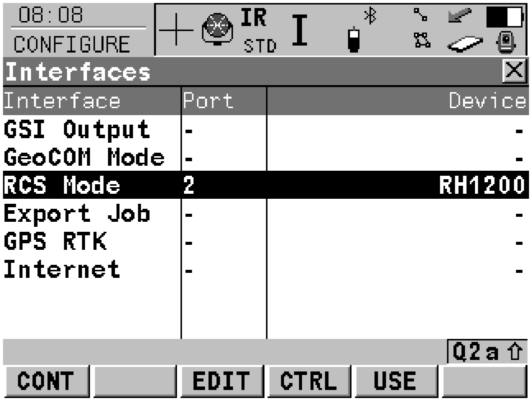
This table gives an overview of the interaction between an interface, port and device.

Concept		Example
Interface	What type of information is to be communicated between the instrument and device ?	RCS Mode
Port	Which port is being used to connect the device to the instrument ?	Port 2(Handle)

Concept		Example
Device	Which device is being connected to the port and what are its communication settings and individual parameters ?	Baud Rate: 115200 Parity: None Data Bits: 8 Stop Bit: 1 Link Number: 1, Set as: Base

Screen

This screen gives an overview of all interfaces with the currently assigned port and device.

Point	Description
1.	 • **CONFIGURE Interfaces** - **EDIT (F3)** refers to **interface parameters**.

Point	Description
	To configure the parameters related to the highlighted interface (switching on/off the interface, port selection, device selection and device communication settings). • **CONFIGURE Interfaces** - **CTRL (F4)** refers to **device parameters**. To configure additional parameters related to the highlighted device. • **CONFIGURE Interfaces - USE (F5)** enables the immediate turning on/off of an interface, without the need for editing/configuring. The last used settings are automatically recalled.
2.	One port can only connect to one device at a time.
3.	One port may be used by more than one interface at a time.

Further information

IF more information is required on	THEN
interfaces	Refer to "19.2 Interfaces"
ports	Refer to "19.3 Ports"
devices	Refer to "19.4 Devices"
EDIT (F3) interface parameters	Refer to "20 Config...\Interfaces... - Editing The Interface"
CTRL (F4) device parameters	Refer to "21 Config...\Interfaces... - Controlling The Device"

19.2 Interfaces

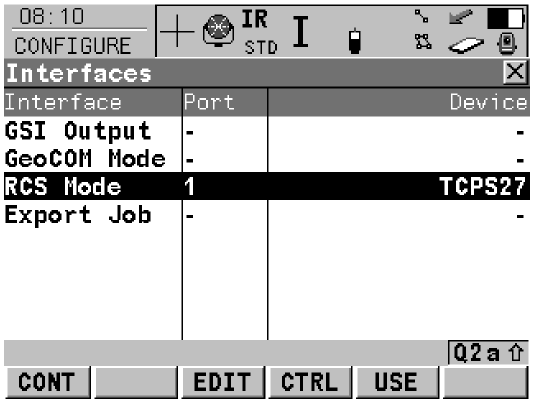
19.2.1 Overview of Interfaces

Description

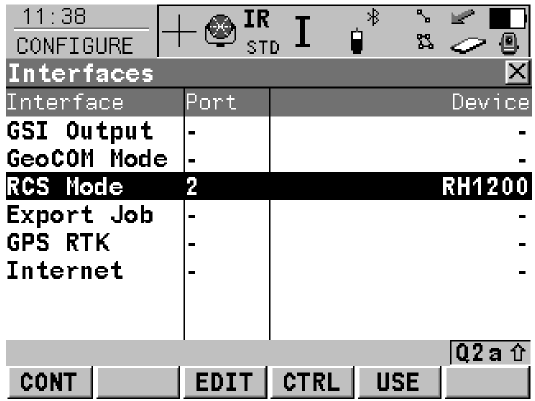
- The instrument has various interfaces configured to to be used with a port and a device. The configuration varies depending on the individual application.
- Additional interfaces are always available when the instrument is fitted with Communication side cover. Communication side cover is used by RadioHandle with RCS and by SmartAntenna Adapter with SmartStation.

Available interfaces

TPS1200
without Communication side cover



TPS1200
with Communication side cover



19.2.2 Accessing CONFIGURE Interfaces

Access

Select **Main Menu: Config...\Interfaces...**.

OR

Press a hot key configured to access the screen **CONFIGURE Interfaces**.

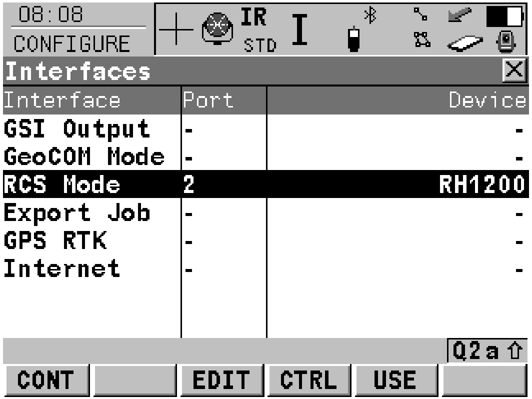
Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

CONFIGURE Interfaces

- The screen gives an overview of all interfaces with the currently assigned port and device.
- The number of interfaces, ports and devices increases when the instrument is fitted with Communication side cover.



CONT (F1)
To return to the screen from where this screen was accessed.

EDIT (F3)
To configure the parameters related to the highlighted interface.

CTRL (F4)
Available for certain devices connected to certain interfaces. To configure additional paramaters.

USE (F5)
To turn the highlighted interface on or off. If the interface is turned on then the settings which were last used with that interface are active. If the device which was last used with that interface is no longer available, the RS232 is assigned to that interface.

SHIFT CONEC (F4) and **SHIFT DISCO (F4)**
Available for a real-time interface configured to use a device of type digital cellular phone or modem. To dial the number of another station configured in the active configuration set and to hang up again.

Next step

IF	THEN
an interface is to be turned on/off, a port is to be selected or a device is to be selected	Highlight the interface and **EDIT (F3)**. Refer to "20 Config...\Interfaces... - Editing The Interface"
a device attached to an interface is to be configured	Highlight the relevant interface and **CTRL (F4)**. Refer to "21 Config...\Interfaces... - Controlling The Device"
an interface is to be turned on/off	Highlight the relevant interface and **USE (F5)**.

19.3 Ports

Description

- The instrument is always fitted with the port located at the instrument base (port 1). Additional ports are available when Communication side cover is fitted (port 2 and port 3).
- The list of available devices always depends on the selected port.

Available ports

Type

TPS1200 without Communication side cover	Port	TPS1200 with Communication side cover
5 pin LEMO-0 for power and/or communication	Port 1	5 pin LEMO-0 for power and/or communication
not applicable	Port 2 (Handle)	Hotshoe connection for RadioHandle with RCS and SmartAntenna Adapter with SmartStation
not applicable	Port 3 (BT)	Bluetooth module for communication with only Bluetooth capable devices.

Location

Port	Description
Port 1	This port is located at the base of the instrument and is always available.
Port 2 (Handle)	This port is located on top of Communication side cover.
Port 3 (BT)	This port is housed within Communication side cover.

19.4 Devices

19.4.1 Overview of Devices

Description

- A device is the hardware which is connected to the chosen port. Devices are used to transmit and receive measurement data in TPS mode and GPS real-time data in GPS mode. Devices are also used by TPS1200 to communicate with the RX1200 controller.
- Before using any device with TPS1200 it is necessary to configure the interface with which it will be used. Refer to "20 Config...\Interfaces... - Editing The Interface" for information on how to configure interfaces.
- Some devices may be used with different interfaces for different applications. For example, a radio can be used for remote control with TPS1200 but also to send GeoCOM commands from a computer to TPS1200.

Further information

IF more information is required on	THEN
digital cellular phones	Refer to "19.4.5 Device - Digital Cellular Phones".
modems	Refer to "19.4.6 Device - Modems".
radios for GPS real-time	Refer to "19.4.7 Device - Radios for GPS Real-Time".
radios for remote control	Refer to "19.4.8 Device - Radios for Remote Control".
RS232	Refer to "19.4.9 Device - RS232".
GPRS / Internet Devices	Refer to "19.4.10 Device - GPRS / Internet Devices".

19.4.2 Accessing CONFIGURE Devices / CONFIGURE GPRS Internet Devices

Description

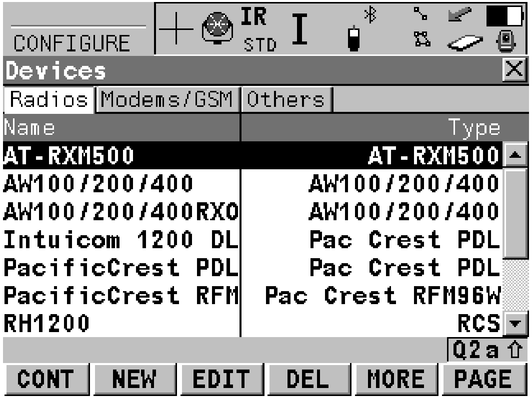
- Allows devices to be created, edited, selected and deleted.
- Refer to "21 Config...\Interfaces... - Controlling The Device" for more information.

Access step-by-step

Step	Description
1.	**Main Menu: Config...\Interfaces...**
2.	Highlight the appropriate interface based on the type of device that needs to be configured. For example, highlight **Real-Time** when a radio is to be configured.
3.	**EDIT (F3)** to access **CONFIGURE XX**.
4.	**DEVCE (F5)** to access **CONFIGURE Devices** / **CONFIGURE GPRS Internet Devices**. Refer to paragraph "CONFIGURE Devices; CONFIGURE GPRS Internet Devices".

CONFIGURE Devices; CONFIGURE GPRS Internet Devices

This screen may consist of several pages and provides different devices for selection depending on which interface the screen was accessed from. The functionality described below is always the same.



CONT (F1)

To select the highlighted device and return to the screen from where this screen was accessed.

NEW (F2)

To create a new device. Refer to "19.4.3 Creating a New Device".

EDIT (F3)

To edit the highlighted device. Refer to "19.4.4 Editing a Device".

DEL (F4)

To delete the highlighted device.

MORE (F5)

To display information about the type of device and the creator of the device.

PAGE (F6)

To change to another page on this screen.

SHIFT ALL (F4) or **SHIFT FILT (F4)**

Available for Internet and bluetooth devices. To list all devices or to hide devices which are not Internet or bluetooth capable.

SHIFT DEFLT (F5)

To recall previously deleted default devices and to reset default devices to the default settings.

Description of columns

Column	Description
Name	Names of available devices.
Type	Type of device defined when creating the device.
Creator	The creator of the device. The creator can either be **Default** if the device is a default, or **User** if the device has been created. ☞ If a **Default** device is edited by using **EDIT (F3)** then its creator is still displayed as **Default**.

Next step

IF the desired device is	THEN
present in the list	highlight the desired device. **CONT (F1)** to close the screen and to return to the screen from where **CONFIGURE Devices** / **CONFIGURE GPRS Internet Devices** was accessed.
is not present in the list	**NEW (F2)**. Refer to "19.4.3 Creating a New Device".
is present in the list but needs to be edited	highlight the desired device. **EDIT (F3)**. Refer to "19.4.4 Editing a Device".

19.4.3 Creating a New Device

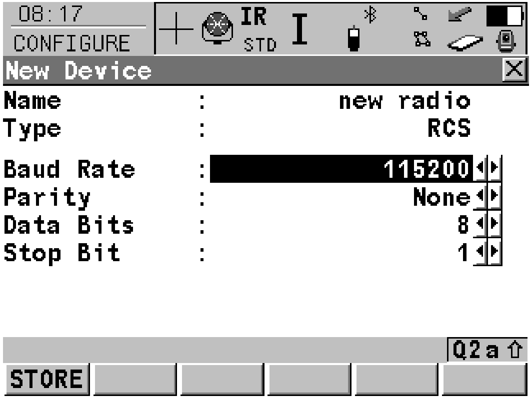
Description

Allows a new device to be configured.

Access step-by-step

Step	Description
1.	Refer to "19.4.2 Accessing CONFIGURE Devices / CONFIGURE GPRS Internet Devices" to access **CONFIGURE Devices** / **CONFIGURE GPRS Internet Devices**.
2.	Highlight a device of the same type as the device to be created, from the list.
3.	**NEW (F2)** to access **CONFIGURE New Device**.

CONFIGURE New Device



STORE (F1)
To store the new device and to return to the screen from where this screen was accessed.

ATCMD (F4)
Available for digital cellular phones and modems. To configure communication commands. Refer to paragraph "Editing a Device".

Description of fields

Field	Option	Description
<Name:>	User input	Name of new device.
<Type:>	Output	Same device type as was highlighted when **NEW (F2)** was used.
<Baud Rate:>	From **300** to **115200**	Frequency of data transfer from instrument to device in bits per second.
<GPRS/Internet:>	**Yes** or **No**	Available for digital cellular phones and modems. Defines the device as an Internet capable device and adds it to the list in **CONFIGURE GPRS Internet Devices**.
<Parity:>	**None**, **Odd** or **Even**	Error checksum at the end of a block of digital data.
<Terminator:>		To define the terminator.
	CR/LF	The terminator is a carriage return followed by a line feed.
	CR	Not available for RS232 GeoCOM and TCPS27 device. The terminator is a carriage return.
<Data Bits:>	**7** or **8**	Number of bits in a block of digital data.
<Stop Bits:>	**1** or **2**	Number of bits at the end of a block of digital data.

Field	Option	Description
<Flow Control:>	**None** or **RTS/CTS**	Available for some devices. Activates hardware handshake. When the receiver/device is ready for data, it asserts the **R**equest **T**o **S**end line indicating it is ready to receive data. This is read by the sender at the **C**lear **T**o **S**end input, indicating it is clear to send the data.

Next step

IF the device is a	THEN
radio or device other than digital cellular phone or modem	**STORE (F1)** to close the screen and to return to the screen from where **CONFIGURE Device** was accessed.
digital cellular phone or modem	**ATCMD (F4)**. Refer to paragraph "Editing a Device".

CONFIGURE GSM/Modem AT Command Lines

For **<GPRS/Internet: Yes>** in **CONFIGURE New Device**, this screen consists of two pages:

GSM/CSD page: The AT commands configure the devices for normal digital cellular phone/modem mode.

GPRS/Internet page The AT commands configure the devices for GPRS/Internet mode. Please refer to the manual of the GPRS / Internet device for information about which AT commands need to be entered or contact the supplier.

The following table lists the fields of both pages.

Description of fields

Field	Option	Description
<Init 1:>	User input	Initilisation sequence to initilise digital cellular phone/modem.
<(cont):>	User input	Allows the **<Init X:>** or the **<Connect:>** string to continue onto a new line.
<Init 2:>	User input	Initilisation sequence to initilise digital cellular phone/modem.
<Dial:>	User input	Dialing string used to dial the phone number of the real-time reference.
<Hangup:>	User input	Hangup sequence used to end the network connection.
<Escape:>	User input	Escape sequence used to switch to the command mode before using the hangup sequence.
<Connect:>	User input	Dialing string used to dial into the Internet.

When the device is used, between **<Init 1:>** and **<Init 2:>**, a check for the PIN is performed. Refer to "Appendix G AT Commands" for more information about AT commands.

Next step

STORE (F1) returns to **CONFIGURE Devices** / **CONFIGURE GPRS Internet Devices**.

19.4.4 Editing a Device

Access step-by-step

Step	Description
1.	Refer to "19.4.2 Accessing CONFIGURE Devices / CONFIGURE GPRS Internet Devices" to access **CONFIGURE Devices** / **CONFIGURE GPRS Internet Device**.
2.	Highlight the device to be edited from the list.
3.	**EDIT (F3)** to access **CONFIGURE Edit Device**.

CONFIGURE Edit Device

The availability of options may change depending on the selected device. Most fields are identical with the creation of a new device. Refer to "19.4.3 Creating a New Device" for information on the fields.

Next step

STORE (F1) to close the screen and to return to the screen from where **CONFIGURE Edit Device** was accessed.

19.4.5 Device - Digital Cellular Phones

Description

Digital cellular phones comprise of the technologies CDMA and GSM with its subgroup GPRS.

Typical uses

- To transmit real-time data.
- To receive real-time data.
- To download raw observations from a remote location.
- To steer a receiver.

Example use

Step	Description
1.	Reference and rover must both be equipped with a digital cellular phone.
2.	Ensure that the digital cellular phone at the reference is on.
3.	The rover digital cellular phone contacts the selected reference of which the phone number was pre-defined. Refer to "19.4.3 Creating a New Device".
4.	One rover can dial in to the reference digital cellular phone at a time.
5.	As soon as the reference digital cellular phone is contacted, real-time data is sent to the rover digital cellular phone that has called.
	Several digital cellular phone numbers can be pre-defined on the rover. Dialing a different number dials that particular reference station.

Requirements for using digital cellular phones

Always required:

- AT command language must be supported by the digital cellular phone. Refer to "19.4.3 Creating a New Device".
- Working area must be covered by a digital cellular phone network.
- The network operator must support data transmission.

Sometimes required:

- SIM card. This is the same SIM card as normally used in mobile phones. The SIM card must be enabled to transmit data. Contact the service provider to enable the SIM card.
- **P**ersonal **I**dentification **N**umber
- Registration

Supported digital cellular phones

Default digital cellular phones fitting into a clip-on-housing

- CDMA MultiTech MTMMC-C (US)
- CDMA MultiTech MTMMC-C (CAN)
- Siemens MC75
-

Default digital cellular phones not fitting into a clip-on-housing

These digital cellular phones must be connected with a cable. Refer to "Appendix E Cables" for information on cables.

- Siemens M20
- Siemens S25/S35i
- Siemens TC35
- Wavecom M1200 Series

These digital cellular phones can be connected via bluetooth or cable using the implemented standard device provided for the below mentioned cellular phone manufacturers.

- Motorola RAZR v3
- Motorola E1000
- Nokia 6021
- Siemens S55
- Siemens S65
- Siemens S65v

- Nokia 6230(i)
- Nokia 6310(i)
- Nokia 6630
- Nokia 6822a
- Nokia N80
- Siemens M75
- SonyEricsson K700i
- SonyEricsson K750i
- SonyEricsson K800i
- SonyEricsson P900
- SonyEricsson S700i
- SonyEricssonT610

User defined digital cellular phones

Other digital cellular phones than those listed above can be used. Their settings must be defined by creating a new digital cellular phone configuration. Refer to "19.4.3 Creating a New Device". These digital cellular phones must be connected with a cable. Refer to "Appendix E Cables" for information on cables. Please contact the local selling unit or dealer for further information.

Advantages

- Unlimited range of the data link between reference and rover.
- Free of jamming from other users.
- Cheaper in price in the initial costs of buying.

Disadvantages

Fees are charged for the time that the digital cellular phone network is being used.

Reference and rover can both be equipped with a digital cellular phone and a radio. On the reference they operate simultaneously. On the rover, use the radio when within radio range of the reference and the digital cellular phone when radio reception is not possible.

19.4.6 Device - Modems

Typical uses

- To transmit NMEA messages.
- To transmit real-time data
- To download raw observations from a remote location.

Example of use

Step	Description
1.	The reference is equipped with a modem.
2.	The rover is equipped with a digital cellular phone.
3.	Ensure that the modem is switched on.
4.	The rover digital cellular phone contacts the selected reference of which the phone number was pre-defined. Refer to "19.4.3 Creating a New Device".
5.	One rover can dial in to the reference modem at a time.
6.	As soon as the reference modem is contacted, it sends its data to the rover digital cellular phone that has called.
	Several modem numbers can be pre-defined on the rover. Dialing a different number changes the reference station.

Requirements for using modem

AT command language must be supported by the modem. Refer to "19.4.3 Creating a New Device".

Supported modems

Default modems

- AirLink CDMA
- U.S. Robotics 56K

Modems must be connected with a cable. Refer to "Appendix E Cables" for information on cables.

User defined modems

Other modems than those listed above can be used. Their settings must be defined by creating a new modem configuration. Refer to "19.4.3 Creating a New Device".

19.4.7 Device - Radios for GPS Real-Time

Typical uses

- To transmit real-time data.
- To receive real-time data.
- To download raw observations from a remote location.
- To steer a receiver.

Example of use

Step	Description
1.	Reference and rover must both be equipped with radios using the same frequency range and the same data format.
2.	The reference radio continuously sends out real-time data until the receiver is turned off, the configuration is changed or the radio is detached.
3.	The rover radio continuously receives real-time data until the receiver is turned off, the configuration is changed or the radio is detached.
4.	Several rovers can receive data from the same reference at the same time.
	Several reference radios can transmit real-time data simultaneously using different radio channels. Changing to a different radio channel on the rover changes the reference from which real-time data is received.

Supported radios

Default radios fitting into a clip-on-housing

- Intuicom 1200 Data Link
- Pacific Crest PDL, receive
- Satelline 3AS, transceive

Default radios not fitting into a clip-on-housing

These radios must be connected with a cable. Refer to "Appendix E Cables" for information on cables.

- AT-RXM500, Akasaka Tech
- Pacific Crest RFM96W
- Satelline 2ASx
- Satelline 2ASxE

User defined radios

Other radios than those listed above can be used. Their settings must be defined by creating a new radio configuration. Refer to "19.4.3 Creating a New Device". These radios must be connected with a cable. Refer to "Appendix E Cables" for information on cables.

Reference and rover can both be equipped with a radio and a digital cellular phone. On the reference they operate simultaneously. On the rover, use the radio when within radio range of the reference and the digital cellular phone when radio reception is not possible.

19.4.8 Device - Radios for Remote Control

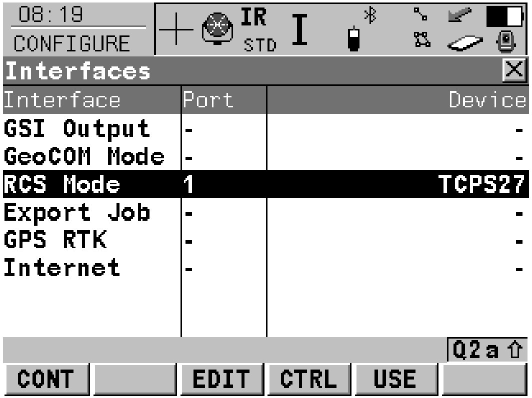
Typical uses

- To remote control the TPS1200.
- To transmit data between TPS1200 and computer.

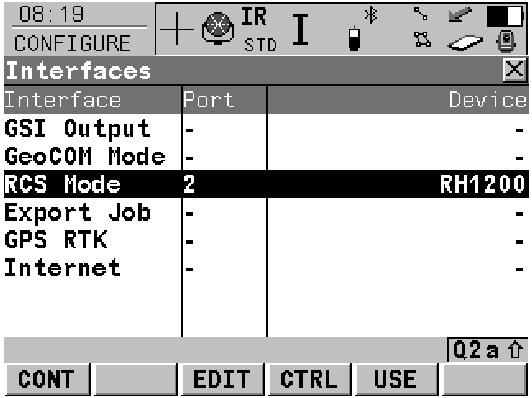
Supported radios

- The default radios used with TPS1200 for remote control are RadioHandle and TCPS27. TPS1200 has to be set to the correct communication mode to send and receive data and commands via the radio. A radio is also integrated in the RX1250T/RX1250Tc controller to allow communication. Refer to "RX1200 User Manual" for more information.
- Communication side cover must be fitted to TPS1200 when operating with RadioHandle.

TPS1200 interface settings with TCPS27



TPS1200 interface settings with RadioHandle



User defined radios

Other radios than the default radios can be used. Their settings must be defined by creating a new radio configuration. Refer to "19.4.3 Creating a New Device". These radios must be connected with a cable. Refer to "Appendix E Cables" for information on cables.

19.4.9 Device - RS232

Typical uses

- To exchange information with a device via an RS232 interface.
- RS232_GeoCOM can be used to control the instrument via GeoCOM commands from a computer.
- RS232_GSI can be used to send data from the instrument to a computer.
- Port 1 is used to connect to RS232 devices with a cable. Refer to "Appendix E Cables" for information on cables.

Example of use

Step	Description
1.	A device with an RS232 interface must be connected to the instrument.
2.	Information can be exchanged between the instrument and the device. For example measurement data can be continuously sent out from the instrument. Commands to steer the instrument are sent from an external device.
3.	A connection is maintained until the instrument is turned off, the configuration is changed or the device is detached.

Supported RS232

Default RS232 devices

- RS232
- RS232_GSI
- RS232_GeoCOM

User defined RS232

All settings can be defined.

19.4.10 Device - GPRS / Internet Devices

Description

- GPRS is a telecommunication standard for transmitting data packages using the **I**nternet **P**rotocol.
- When using GPRS technology charges are made based on the amount of transferred data and not as for normal digital cellular phones where charges are made for the connection time.

Typical uses

To access the Internet with SmartStation in order to receive real-time data from the Internet.

Example use

Step	Description
☞	This is an example use for receiving data from the Internet.
1.	SmartStation must be equipped with a GPRS / Internet device.
2.	The GPRS / Internet device accesses the Internet where SmartStation connects for example to NTRIP.
3.	SmartStation receives real-time corrections from this other computer in the Internet.

Requirements for using GPRS / Internet devices

- AT command language must be supported by the digital cellular phone. Refer to "19.4.3 Creating a New Device".
- **A**ccess **P**oint **N**ame of a server from the network provider. The APN can be thought of as the home page of a provider supporting GPRS data transfer.
- SIM card. This is the same SIM card as normally used in mobile phones. The SIM card must be enabled to transmit data. Contact the service provider to enable the SIM card.
- **P**ersonal **I**dentification **N**umber
- Registration

Supported GPRS / Internet devices

Default GPRS / Internet devices fitting into a clip-on-housing

- Siemens MC75

User defined GPRS / Internet devices

Other GPRS capable devices than those listed above can be used as long as they use AT commands. Their settings must be defined by creating a new GPRS / Internet device configuration. Refer to "19.4.3 Creating a New Device". These GPRS / Internet devices must be connected with a cable. Refer to "Appendix E Cables" for information on cables. Please contact the local selling unit or dealer for further information.

Advantages

- Unlimited range of the data link between reference and rover.
- Free of jamming from other users.
- Fees are charged for the amount of data being transferred.

20 Config...\Interfaces... - Editing The Interface

20.1 GSI Output

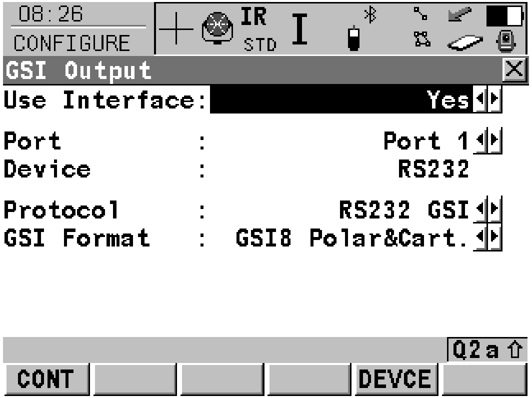
Description

Data is streamed through the serial port (RS232) and is stored to the active job. GSI data is stored when **<Use Interface: Yes>** and either **ALL (F1)** or **REC (F3)** is pressed. The format of the data depends on the option selected in **<Output Format:>**.

Access step-by-step

Step	Description
1.	Refer to "19.2.2 Accessing CONFIGURE Interfaces" to access **CONFIGURE Interfaces**
2.	**CONFIGURE Interfaces** Highlight **GSI Output**.
3.	**EDIT (F3)** to access **CONFIGURE GSI Output**.

CONFIGURE
GSI Output



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

DEVCE (F5)
To create, select, edit or delete a device.

Description of fields

Field	Option	Description
<Use Interface:>	**Yes** or **No**	Activates the interface.
<Port:>	Output	This field is available when **<Use Interface: Yes>**. Port to be used.
<Device:>	Output	This field is available when **<Use Interface: Yes>**. Device to be used.
<Protocol:>		This field is available when **<Use Interface: Yes>**. Protocol defines if the system expects a handshake or no handshake.

Field	Option	Description
	RS232 GSI	A handshake is required. A data block is sent out from the instrument and a receive confirmation (?) is expected. This handshake requires that GeoCom Mode be activated.
	None	No handshake is required.
<GSI Format:>	Output format options: **GSI8 Polar&Cart.** or **GSI16 Polar** or **GSI16 Cartesian** or **Pt,N,E,Ht,Date** or **Pt,E,N,Ht,Date** or **Pseudo NMEA GGA**	This field is available when **<Use Interface: Yes>**. The output format options are: • GSI Polar and Cartesian (8 data characters) (Point ID, Hz, V, SlopeDist, PPM, E, N, Elev.) • GSI Polar (16 data characters) (Point ID, Hz, V, SlopeDist, PPM) • GSI Cartesian (16 data characters) (E, N, Elev, Reflector Height) • Coordinate data (Northing BEFORE Easting) • Coordinate data (Easting BEFORE Northing) • based on NMEA (**N**ational **M**arine **E**lectronics **A**ssociation), which is a standard for interfacing marine electronic devices.

Next step

IF a device is	THEN
not to be created or edited	**CONT (F1)** closes the screen and returns to the screen from where **CONFIGURE GSI Output** was accessed.
to be created or edited	**DEVCE (F5)** to create or edit a device.

Output format - GSI Format

GSI data is transmitted in blocks. Every block consists of several data words, refer to the examples below. Every data word begins with a two character Word Index, the WI code, specifying the data type within this block. Each GSI-8 word has in total 16 characters, consisting of 7 information characters followed by 8 data characters and by the blank character ASCII code 32 at the end of the data word. The GSI-16 block is similar to the GSI-8 block but the block begins with * and the data word contains 16 characters for large values such as UTM coordinates, large alphanumeric codes, attributes or point ID's.

Example 1 shows a GSI-8 block sequence with the words for point ID (11), Easting coordinate (81) and Northing coordinate (82). Example 2 shows a GSI-16 block sequence with the words for point ID (11), horizontal (21) and vertical angle (22).

There are no hardcoded GSI files available

Type	GSI8 Polar&Cart	GSI16 Polar	GSI16 Cartesian
WI 11	Point ID	Point ID	Point ID
WI 21	Hz	Hz	-
WI 22	V	V	-

Type	GSI8 Polar&Cart	GSI16 Polar	GSI16 Cartesian
WI 31	SlopeDist	SlopeDist	-
WI 51	PPM Total/mm	PPM Total/mm	-
WI 81	East	-	East
WI 82	North	-	North
WI 83	Elev.	-	Elev.
WI 87	Refl. Ht	-	Refl. Ht

Example 1: GSI8

Each word has 16 characters of which 8 characters are used for the data block.

Word 1	Word 2	Word 3
110001+0000A110	81..00+00005387	82..00-00000992
110002+0000A111	81..00+00007586	82..00-00003031
110003+0000A112	81..00+00007536	82..00-00003080
110004+0000A113	81..00+00003839	82..00-00003080
110005+0000A114	81..00+00001241	82..00-00001344

Example 2: GSI16

Each word has 24 characters of which 16 characters are used for the data block.

Word 1	Word 2	Word 3
*110001+000000000PNC0055	21.002+0000000013384650	22.002+0000000005371500
*110002+000000000PNC0056	21.002+0000000012802530	22.002+0000000005255000

```
*110003+000000000PNC0057   21.002+0000000011222360  22.002+0000000005433800
*110004+000000000PNC0058   21.002+0000000010573550  22.002+0000000005817600
*110005+000000000PNC0059   21.002+0000000009983610  22.002+0000000005171400
```

GSI Word information

Pos.	Name	Description of values	Applicable for
1-2	Word Index (WI)		
3	No significance	.: No information.	WI 11, WI 21, WI 22, WI 31, WI 51, WI 81, WI 82, WI 83, WI 87
4	Automatic index information	.: No information. 0: **<Compensator: Off>** 3: **<Compensator: On>**	WI 21, WI 22
5	Input mode	.: No information. 0: Measured values transferred from instrument 1: Manual input from keyboard 2: Measured value, **<Hz-Correction: On>**. 3: Measured value, **<Hz-Correction: Off>**. 4: Result calculated from functions	WI 21, WI 22, WI 31, WI 51, WI 81, WI 82, WI 83, WI 87

Pos.	Name	Description of values	Applicable for
6	Units	.: No information. 0: **<Distance Unit: Metre (m)>**, last digit 1 / 1000 m 1: **<Distance Unit: Us ft (ft)>,** last digit 1 / 1000 ft 2: **<Angle Unit: 400 gon>** 3: **<Angle Unit: 360 ° dec>** 4: **<Angle Unit: 360 ° ” ’>**| 5: **<Angle Unit: 6400 mil>** 6: **<Distance Unit: Metre (m)>,** last digit 1 / 10000 m 7: **<Distance Unit: Us ft (ft)>,** last digit 1 / 10000 ft	WI 21, WI 22, WI 31, WI 81, WI 82, WI 83, WI 87
7	Sign	+: Positive value -: Negative value	WI 21, WI 22, WI 31, WI 51, WI 81, WI 82, WI 83, WI 87
8-15 8-23	Data	Data includes a sequence of 8 (16) numerical or alphanumerical characters. Certain data blocks are allowed to carry more than one value for example ppm/mm. This data is automatically transferred with the according sign before each single value.	WI 11, WI 21, WI 22, WI 31, WI 51, WI 81, WI 82, WI 83, WI 87
16 24	Separating character	: Blank	WI 11, WI 21, WI 22, WI 31, WI 51, WI 81, WI 82, WI 83, WI 87

Output format - Pt,N,E,Ht,Date

Format

Point ID, Northing, Easting, Elevation, Date, Time <CR/LF>

Description of fields

The format settings are defined in **CONFIGURE Units & Formats**.

Field	Description
Point ID	Text describing the point identification
Northing	The northing coordinate.
Easting	The easting coordinate.
Elevation	The height coordinate.
Date	The measurement/origination date.
Time	The measurement/origination time.
<CR/LF>	**C**arriage **R**eturn **L**ine **F**eed

Example

2004,4997.635,6010.784,393.173,09/10/2001,16:34:12.2
2005,4997.647,6010.765,393.167,09/10/2001,16:34:12.4
2006,4997.657,6010.755,393.165,09/10/2001,16:34:12.7

Output format - Pt,E,N,Ht,Date

Format

This output format is identical to the Pt,N,E,Ht,Date format except the order of the Easting and Northing variables are reversed.

Output format - Pseudo NMEA GGA

Description

This output format is based on NMEA (**N**ational **M**arine **E**lectronics **A**ssociation), which is a standard for interfacing marine electronic devices.

Format

$GPGGA,Time,Northing,N,Easting,E,1,05,1.0,Elevation,M,0.0,M,0.0,0001*99 <CR/LF>

Description of Fields

Field	Description
$GPGGA	Sentence identification (header including talker identification). A Talker ID appears at the beginning of the header of each NMEA message.
Time	UTC time of position (hhmmss.ss)
Northing	The northing coordinate (always output with 2 decimal places)
N	Fixed text (N)
Easting	The easting coordinate (always output with 2 decimal places)
E	Fixed text (E)
GPS Quality Indicator	Fixed number (1=no real time position, navigation fix)
Number of satellites	Number of satellites in use (00 to 12)
HDOP	Fixed number (1.0)
Elevation	The height coordinate (always output with 2 decimal places)
Elevation units	Elevation units (F or M). The format settings are defined in **CONFIGURE Units & Formats**, **Units** page.
Height Geoid	Fixed number (0.0)
Height units	Fixed text (M)

Field	Description
Time since last DGPS update	Fixed number (0.0)
DGPS reference station id	Fixed number (0.0001)
Checksum	Fixed number (*99)
<CR/LF>	**C**arriage **R**eturn **L**ine **F**eed

Example

$GPGGA,171933.97,7290747.02,N,3645372.06,E,1,05,1.0,1093609.54,F,0.0,M,0.0,0001*99
$GPGGA,171934.20,7290747.02,N,3645372.06,E,1,05,1.0,1093609.54,F,0.0,M,0.0,0001*99
$GPGGA,171934.45,7290747.03,N,3645372.06,E,1,05,1.0,1093609.54,F,0.0,M,0.0,0001*99

☞ Fields are always separated by a comma. A comma is never placed before the Checksum field. When information for a field is not available, the position in the data string is empty.

20.2 GeoCOM Mode

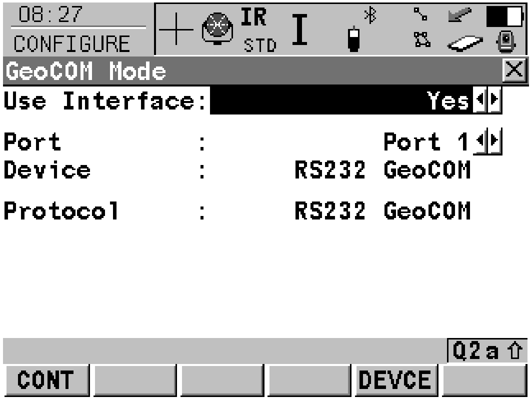
Description

The GeoCOM Mode permits communication of the TPS1200 with a 3rd party device.

Access step-by-step

Step	Description
1.	Refer to "19.2.2 Accessing CONFIGURE Interfaces" to access **CONFIGURE Interfaces**
2.	**CONFIGURE Interfaces** Highlight **GeoCOM Mode**.
3.	**EDIT (F3)** to access **CONFIGURE GeoCOM Mode**.

CONFIGURE GeoCOM Mode



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

DEVCE (F5)
To create, select, edit or delete a device.

Description of fields

Field	Option	Description
<Use Interface:>	**Yes** or **No**	Activates the interface.
<Port:>	Output	Available if **<Use Interface: Yes>**. Port to be used.
<Device:>	Output	Available if **<Use Interface: Yes>**. Device to be used.
<Protocol:>	Output	Available if **<Use Interface: Yes>**. Protocol to be used.
<Terminator:>	Output	The terminator is carriage return followed by a line feed.

Next step

IF a device is	THEN
not to be created or edited	**CONT (F1)** closes the screen and returns to the screen from where **CONFIGURE GeoCOM Mode** was accessed.
to be created or edited	**DEVCE (F5)** to create or edit a device.

20.3 RCS Mode

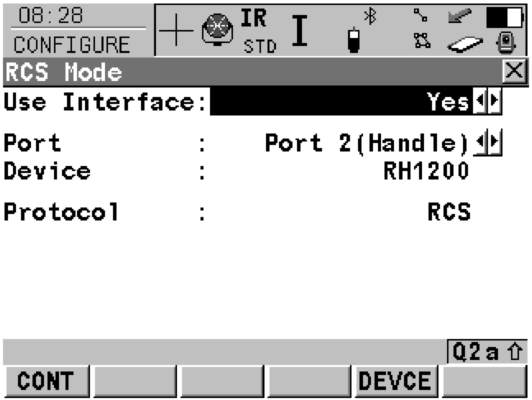
Description

- RCS stands for Remote Control Surveying.
- This enables the instrument to be remotely controlled by an RX1200 controller.

Access step-by-step

Step	Description
1.	Refer to "19.2.2 Accessing CONFIGURE Interfaces" to access **CONFIGURE Interfaces**
2.	**CONFIGURE Interfaces** Highlight **RCS Mode**.
3.	**EDIT (F3)** to access **CONFIGURE RCS Mode**.

CONFIGURE RCS Mode



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

DEVCE (F5)
To create, select, edit or delete a device.

Description of fields

Field	Option	Description
<Use Interface:>	**Yes** or **No**	Activates the interface.
<Port:>	Output	Available if **<Use Interface: Yes>**. Port to be used.
<Device:>	Output	Available if **<Use Interface: Yes>**. Device to be used.
<Protocol:>	Output	Available if **<Use Interface: Yes>**. Protocol to be used.

Next step

IF a device is	THEN
not to be created or edited	**CONT (F1)** closes the screen and returns to the screen from where **CONFIGURE RCS Mode** was accessed.
to be created or edited	**DEVCE (F5)** to create or edit a device.

20.4 Export Job

Description

- The Export Job interface allows data from a job to be exported from the instrument to an external device. Refer to "13.4 Exporting Data from a Job to another Device" for information on how to export data via RS232.
- The settings on this screen define the port and the device to which the data should be exported.

Access

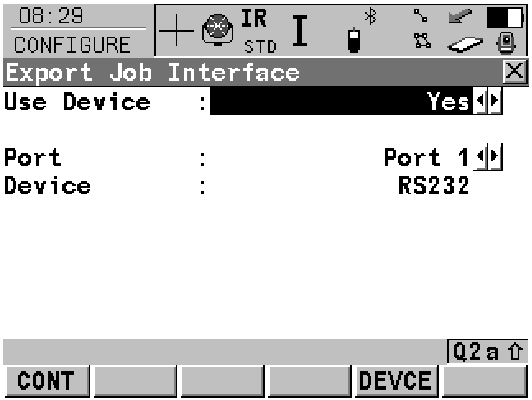
Select **Main Menu: Config...\Interfaces...**. Highlight **Export Job**. **EDIT (F3)**.

OR

Select **Main Menu: Convert...\Export Data from Job**. Set **<Export To: RS232>**. **IFACE (F5)**.

CONFIGURE Export Job Interface

The availability of the fields depend on the setting for **<Device:>**.



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

DEVCE (F5)
To create, select, edit or delete a device.

Description of fields

Field	Option	Description
<Use Device:>	**Yes** or **No**	Activates the interface.
<Port:>	Output	Available if **<Use Interface: Yes>**. Port to be used.
<Device:>	Output	The device currently assigned to the selected port within the active configuration set. The device which is selected determines the availability of the next fields.

Next step

CONT (F1) returns to the screen from where **CONFIGURE Export Job Interface** was accessed.

20.5 GPS RTK

Description

- The settings on this screen allow real-time related parameters to be configured. This includes defining if SmartStation should work as a rover and the real-time messages to be used.
- Refer to "22.1 Real-Time Mode" for detailed information.

20.6 Internet

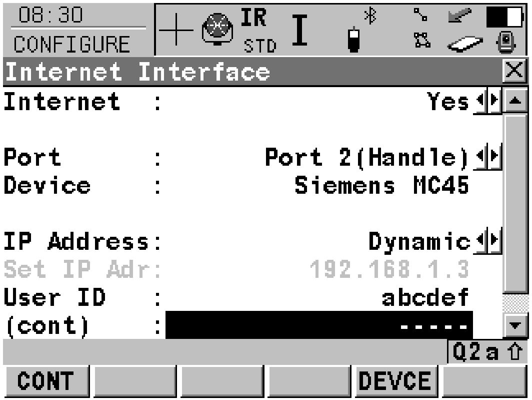
Description

- The Internet interface
  - allows accessing the Internet using SmartStation and normally a GPRS device.
  - can be used together with the Real-Time interface to receive real-time data from a NTRIPCaster via Internet communication. Refer to "33.1 Overview" for information about NTRIP.
- The settings on this screen define the port and parameters required for accessing the Internet.

Access

Select **Main Menu: Config...\Interfaces...**. Highlight **Internet**. **EDIT (F3)**.

CONFIGURE Internet Interface



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

DEVCE (F5)
To create, select, edit or delete a device. Refer to "19.4.2 Accessing CONFIGURE Devices / CONFIGURE GPRS Internet Devices".

Description of fields

Field	Option	Description
<Internet:>	**Yes** or **No**	Activates the Internet interface.
<IP Address:>		In order to get access to the Internet, an IP address is required. This IP address identifies the receiver in the Internet.
	Dynamic	The IP address to get access to the Internet is provided by the network provider dynamically. Each time SmartStation wants to access the Internet via the device a new IP address is assigned to the receiver. When using GPRS to connect to the Internet then the network provider always dynamically assigns the IP address.
	Static	The IP address to get access to the Internet is provided by the network provider permanently. Each time SmartStation wants to access the Internet via the device the same IP address identifies SmartStation. This is important if SmartStation is used as a TCP/IP server. This option should only be selected if a static IP address is available for SmartStation.
<Set IP Adr:>	User input	Available for **<IP Address: Static>**. To set the IP address.
<User ID:>	User input	Some providers ask for a user ID to allow connecting to the Internet via GPRS. Contact your provider if a user ID needs to be used.

Field	Option	Description
		It is possible to show/hide the User ID. Refer to "28 Tools...\Licence Keys" for further details.
<(cont):>	User input	Allows the **<User ID:>** string to continue onto a new line.
<Password:>	User input	Some providers ask for a password to allow connecting to the Internet via GPRS. Contact your provider if a password is required.

Next step

CONT (F1) returns to the screen from where **CONFIGURE Internet Interface** was accessed.

21 Config...\Interfaces... - Controlling The Device

21.1 Digital Cellular Phones

21.1.1 Overview

Description

For digital cellular phones, information such as
- the reference stations that can be contacted
- the phone numbers of the reference stations and
- the type of protocol to be used

can be defined.

Changing the reference station to be dialled is of interest in two cases.

Case 1: Two real-time reference stations, each equipped with a digital cellular phone, are set up at two locations belonging to different network providers.
When leaving the area of one reference, the station can be changed and the other reference can be called.

Case 2: Set up as in case 1.
Two separate fixes from each reference for each point can be obtained, providing redundancy for future least squares adjustment operations.

Technologies

CDMA	**C**ode **D**ivision **M**ultiple **A**ccess is a high speed data transmission for very effective and flexible use of available ressources such as band width. Users of a cellular phone network occupy the same frequency band. The signal is especially coded for each user.
GSM	**G**lobal **S**ystem for **M**obile Communications is a more efficient version of CDMA technology that uses smaller time slots but faster data transfer rates. It is the world’s most commonly used digital network.

Next step

IF using a digital cellular phone of technology	THEN
GSM	Refer to "21.1.2 Configuring a GSM Connection".
CDMA	Refer to "21.1.3 Configuring a CDMA Connection".

21.1.2 Configuring a GSM Connection

Configure GSM connection step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to "19.2.2 Accessing CONFIGURE Interfaces" to access **CONFIGURE Interfaces**.	
2.	In **CONFIGURE Interfaces** highlight an interface which has a digital cellular phone of GSM technology attached.	19.2.2
3.	**CTRL (F4)** to access **CONFIGURE GSM Connection**.	
4.	**CONFIGURE GSM Connection** **<GSM Type:>** The type of digital cellular phone highlighted when **CONFIGURE GSM Connection** was accessed. **<Bluetooth:>** SmartStation detects automatically if the attached device is bluetooth capable. Some GSM's ask for the identification number of the Bluetooth. The identification number of Leica's Bluetooth is 0000. **<ID Address:>** Available for **<Bluetooth: Yes>**. The ID address of the Bluetooth device to be used. Refer to the device's user manual for information about the ID address. **<Station:>** The digital cellular phone reference station to be dialled. Opening the choicelist accesses **CONFIGURE Stations to Dial** where new reference stations can be created and existing reference stations can be selected or edited.	 21.9

Step	Description	Refer to chapter
	<Number:> The number of the digital cellular phone at the selected **<Station:>** as configured in **CONFIGURE Stations to Dial**. **<Protocol:>** The configured protocol of the digital cellular phone at the selected **<Station:>** as configured in **CONFIGURE Stations to Dial**. **<Auto CONEC:>** Allows for automatic connection between the rover and the reference when a point is occupied during a survey. **<Net Data Rate:>** The network baud rate. Select **Autobauding** for an automatic search of the network baud rate. For digital cellular phones of GSM technology that do not support autobauding choose the baud rate from the choicelist. **<Connection:>** Define if the digital cellular phone uses **R**adio **L**ink **P**rotocol. Select **Non-Transparent** for digital cellular phones that use RLP. For digital cellular phones that do not use RLP select **Transparent**. Check with the network provider if the digital cellular phone uses RLP. Select the digital cellular phone reference station to be dialled.	 40
	NEAR (F2) finds the nearest reference station with a digital cellular phone of GSM technology. Available when reference stations to dial are already created in **CONFIGURE Stations to Dial**. Coordinates of these stations must be known.	21.9

Step	Description	Refer to chapter
5.	**CODES (F3)** accesses **CONFIGURE GSM Codes** to enter the **P**ersonal **I**dentification **N**umber of the SIM card. If the PIN is locked for any reason, for example the wrong PIN was entered, input the **P**ersonal **U**nbloc**K**ing code for access to the PIN.	
	SRCH (F4) available for **<Bluetooth: Yes>**, to search for all available Bluetooth devices. If more than one Bluetooth device is found a list of available devices is provided.	
	SHIFT CMND (F4) allows AT commands to be sent to the digital cellular phone.	
6.	**CONT (F1)** returns to **CONFIGURE Interfaces**.	

21.1.3 Configuring a CDMA Connection

Configure CDMA connection step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to "19.2.2 Accessing CONFIGURE Interfaces" to access **CONFIGURE Interfaces**.	
2.	In **CONFIGURE Interfaces** highlight an interface which has a digital cellular phone of CDMA technology attached.	
3.	**CTRL (F4)** to access **CONFIGURE CDMA Connection**.	
4.	**CONFIGURE CDMA Connection**	
	<CDMA Type:> The type of digital cellular phone highlighted when **CONFIGURE CDMA Connection** was accessed.	
	<Station:> The digital cellular phone reference station to be dialled. Accesses **CONFIGURE Stations to Dial** where new reference stations can be created and existing reference stations can be selected or edited.	21.9
	<Number:> The number of the digital cellular phone at the selected **<Station:>** as configured in **CONFIGURE Stations to Dial**.	
	<Auto CONEC:> Allows for automatic connection between the rover and the reference when a point is occupied during a survey.	40
	Select the digital cellular phone reference station to be dialled.	

Step	Description	Refer to chapter
☞	**NEAR (F2)** finds the nearest reference station with a digital cellular phone of CDMA technology. Available when reference stations to dial are already created in **CONFIGURE Stations to Dial**. Coordinates of these stations must be known.	21.9
5.	**CONT (F1)** returns to **CONFIGURE CDMA Connection**.	
☞	**SHIFT CMND (F4)** allows AT commands to be sent to the digital cellular phone.	Appendix G
☞	**SHIFT INFO (F2)** provides information about the CDMA device being used, such as the manufacturer, the model and the electronic serial number. For registration purposes, send the electronic serial number to the network provider in order to receive the service programming code and the mobile directory number. These numbers must be typed in in **CONFIGURE CDMA Registration**.	
6.	**SHIFT REG (F3)** to access **CONFIGURE CDMA Registration**.	
7.	**CONFIGURE CDMA Registration** The settings allow the CDMA digital cellular phone to be registered over the air. **<Prog Code:>** Type in the service program code provided by the network provider. **<My Phone No:>** Type in the mobile directory number provided by the network provider.	

Step	Description	Refer to chapter
☞	**CLEAR (F5)** deletes the input of the highlighted field.	
8.	**CONT (F1)** returns to **CONFIGURE Interfaces**.	

21.2 Modems

Description

For modems, information such as

- the reference stations that can contacted and
- the phone numbers of the reference stations can be controlled.

Changing the reference station to be dialled is of interest in two cases.

Case 1: Two real-time reference stations, each equipped with a digital cellular phone, are set up at two locations belonging to different network providers.
When leaving the area of one reference, the station can be changed and the other reference can be called.

Case 2: Set up as in case 1.
Two separate fixes from each reference for each point can be obtained, providing redundancy for future least squares adjustment operations.

Configure modem connection step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to "19.2.2 Accessing CONFIGURE Interfaces" to access **CONFIGURE Interfaces**.	
2.	In **CONFIGURE Interfaces** highlight an interface which has a modem attached.	
3.	**CTRL (F4)** to access **CONFIGURE Modem Connection**.	
4.	**CONFIGURE Modem Connection**	

Step	Description	Refer to chapter
	<Modem Type:> The type of modem highlighted when **CONFIGURE Modem Connection** was accessed. **<Station:>** The modem reference station to be dialled. Accesses **CONFIGURE Stations to Dial** where new reference stations can be created and existing reference stations can be selected or edited. **<Number:>** The number of the modem at the selected **<Station:>** as configured in **CONFIGURE Stations to Dial**. Select the modem reference station to be dialled.	 21.9
	NEAR (F2) finds the nearest reference station with a modem. Available when reference stations to dial are already created in **CONFIGURE Stations to Dial**. Coordinates of these stations must be known.	21.9
5.	**CONT (F1)** returns to **CONFIGURE Interfaces**.	

21.3 Radios for GPS Real-Time

Description

For radios the channels on which the radio broadcasts can be changed. Changing channels changes the frequency at which the radio operates. The following radios support channel changing:

- AT-RXM500
- Pacific Crest PDL
- Pacific Crest RFM96W
- Satelline 2ASx
- Satelline 2ASxE
- Satelline 3AS

Changing radio channels is of interest in three cases.

Case 1:	Two real-time reference stations are set up at two locations, each broadcasting on a different channel. If the signal from one reference station is jammed, the channel can be changed and the other reference can be used.
Case 2:	Set up as in case 1. Two separate fixes for each point can be obtained, providing redundancy for future least squares adjustment operations.
Case 3:	One real-time reference and one real-time rover are being used. If the signal is blocked due to radio interference, the channel at the reference and the rover can be changed in order to work on a different frequency.

Requirements for channel changing

Pacific Crest radios:
- Channel changing must be activated by a Pacific Crest dealer.
- A special licence might be required.

Satelline radios: The radio must be in programming mode. This can be set by a Satelline dealer.

☞ Channel changing may contravene radio broadcasting regulations in certain countries. Before operating with radios, check the regulations in force in the working area.

☞ The number of channels available and the frequency spacing between channels depends on the radio used.

☞ If channel changing is to be used, when configuring the reference real-time interface, set **<Ref Stn ID:>** in **CONFIGURE Additional Reference Options**, **General** page to a different ID for each reference site. By doing so, the rover can recognise if the incoming real-time data after channel changing is being received from a different reference station or if the original reference station is using a new frequency. In the first case, the ambiguities are recomputed.

Configure radio channel step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to "19.2.2 Accessing CONFIGURE Interfaces" to access **CONFIGURE Interfaces**.	
2.	In **CONFIGURE Interfaces** highlight an interface which has a radio attached.	
3.	**CTRL (F4)** to access **CONFIGURE Radio Channel**.	

Step	Description	Refer to chapter
4.	**CONFIGURE Radio Channel** **<Radio Type:>** The type of radio highlighted when **CONFIGURE Radio Channel** was accessed. **<Channel:>** The radio channel. The channel used must be within minimum and maximum allowed input values. The minimum and maximum allowed input values for a radio depend on the number of channels supported by the radio and the spacing between the channels. **<Actual Freq:>** Available for **<Radio Type: Satelline 3AS>**. Displays the actual frequency of the radio. Type in the radio channel.	
	SCAN (F5) provides information such as the station ID, latency and the data format of incoming signals from reference stations broadcasting on the same radio channel. This information can be used to select appropriate reference stations to dial.	21.8
5.	**CONT (F1)** returns to **CONFIGURE Interfaces** screen.	

21.4 Radios for Remote Control

Description

For radios the channels on which the radio broadcasts can be changed. Changing channels changes the frequency at which the radio operates. This may be necessary to enable multiple pairs of radios to work simultaneously in the same area without interferring with each other. The following radios for remote control support channel changing:

- RadioHandle
- TCPS27

Configure TCPS27/RH1200 connection step-by-step

Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Access **CONFIGURE Interfaces**.	19.2.2
2.	Highlight the interface **RCS Mode** with either RadioHandle or TCPS27 attached as the device.	
3.	**CTRL (F4)** to access **CONFIGURE TCPS27 / RH1200**.	
4.	**CONFIGURE TCPS27 / RH1200**. **<Radio Type:>** The type of protocol, which is fixed as **RCS**. **<Link Number:>** The assigned channel number (from 0 to 15). The link number for the RX1200 controller and the radio must be the same. The communication settings for the RX1200 controller and the radio must also be same. **<Set as:>** The option **Remote** or **Base** are available. **Remote** sets the radio into remote mode.	

Step	Description	Refer to chapter
	Base sets the radio into base mode. ☞ The radio modules inside the RX1200 controller and the radio must be set to opposite settings. It is recommended to set the RX1200 controller to **Remote** and the radio to **Base**.	

21.5 RS232

Description

RS232 is a standard serial communication method that is able to transfer data without the need for predefined time slots. RS232 can be used, with a Bluetooth housing, to provide a wireless connection to another Bluetooth enabled device, for example, a computer.

Configure RS232 connection step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to "19.2.2 Accessing CONFIGURE Interfaces" to access **CONFIGURE Interfaces**.	
2.	In **CONFIGURE Interfaces** highlight an interface which has an RS232 device attached.	
3.	**CTRL (F4)** to access **CONFIGURE RS232 Connection**.	
4.	**CONFIGURE RS232 Connection** **<Type:>** The type of device highlighted when **CONFIGURE RS232 Connection** was accessed. **<Bluetooth:>** SmartStation detects automatically if the attached device is bluetooth capable. Some devices ask for the identification number of the Bluetooth. The identification number of Leica's Bluetooth is 0000. **<ID Address:>** Available for **<Bluetooth: Yes>**. The ID address of the Bluetooth device to be used. Refer to the device's user manual for information about the ID address.	

Step	Description	Refer to chapter
☞	**SRCH (F4)** available for **<Bluetooth: Yes>**, to search for all available Bluetooth devices. If more than one Bluetooth device is found a list of available devices is provided.	
☞	**SCAN (F5)** provides information such as the station ID, latency and the data format of incoming signals from reference stations. This information can be used to select appropriate reference stations to dial.	21.8
5.	**CONT (F1)** returns to **CONFIGURE Interfaces**.	

21.6 GPRS / Internet Devices

Description

GPRS / Internet devices can be used to access the Internet from SmartStation.

Configure Internet connection step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to "19.2.2 Accessing CONFIGURE Interfaces" to access **CONFIGURE Interfaces**.	
2.	In **CONFIGURE Interfaces** highlight the **Internet** interface which has a GPRS / Internet device attached.	
3.	**CTRL (F4)** to access **CONFIGURE GPRS/Internet Connection**.	
4.	**CONFIGURE GPRS/Internet Connection** **<Device:>** The type of GPRS / Internet device highlighted when **CONFIGURE GPRS/Internet Connection** was accessed. **<Bluetooth:>** SmartStation detects automatically if the attached device is bluetooth capable. Some devices ask for the identification number of the Bluetooth. **<ID Address:>** Available for **<Bluetooth: Yes>**. The ID address of the Bluetooth device to be used. Refer to the device's user manual for information about the ID address.	

Step	Description	Refer to chapter
	<APN:> Available for some GPRS / Internet devices. The **A**ccess **P**oint **N**ame of a server from the network provider, which allows access to data services. Contact your provider to get the correct APN. Mandatory for using GPRS.	
	CODES (F3) Available for digital cellular phones of GSM technology. Accesses **CONFIGURE GSM Codes** to enter the **P**ersonal **I**dentification **N**umber of the SIM card. If the PIN is locked for any reason, for example the wrong PIN was entered, input the **P**ersonal **U**nbloc**K**ing code for access to the PIN.	
	SRCH (F4) Available for **<Bluetooth: Yes>**, to search for all available Bluetooth devices. If more than one Bluetooth device is found a list of available devices is provided.	
	SHIFT CMND (F4) allows AT commands to be sent to the GPRS / Internet device.	Appendix G
5.	**CONT (F1)** returns to **CONFIGURE Interfaces**.	

21.7 Internet

☞ The Internet connection is available for SmartStation.

Description

The Internet connection allows SmartStation to be connected to the Internet to receive real-time data. A GPRS / Internet device must be attached.

Requirements

For Internet

- **<Internet: Yes>** in **CONFIGURE Internet Interface**.
- **<Port: NETx>** assigned to an interface in **CONFIGURE Interfaces**.

Configure port NET step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to "19.2.2 Accessing CONFIGURE Interfaces" to access **CONFIGURE Interfaces**.	
2.	**CONFIGURE Interfaces** Highlight an interface which has an Internet device attached.	19
3.	**CTRL (F4)** to access **CONFIGURE Set NET Port**.	
4.	**CONFIGURE Set NET Port**, **General** page **<Name:>** The name of the port NET that was attached to the interface that was highlighted when this page was accessed.	

Step	Description	Refer to chapter
	<User:> How SmartStation will operate in the Internet. **<User: Client>** must be selected when using NTRIP as Internet application. Inside the Internet NTRIPClients and NTRIPServers are considered as clients. **<User: Server>** must be selected when SmartStation is the server.	33.1
	<Server:> The server to be accessed in the Internet. Opening the choicelist accesses **CONFIGURE Server to Connect** where new servers can be created and existing servers can be selected or edited.	21.10
	<IP Address:> The IP address of the selected **<Server:>** as configured in **CONFIGURE Server to Connect**. For **<User: Server>**: Output of the IP address associated with the NET port as configured in **CONFIGURE Set NET Parameter**	
	<TCP/IP Port:> The TCP/IP port number of the selected **<Server:>** as configured in **CONFIGURE Server to Connect**.	
	<Auto CONEC:> Available for **<User: Client>**. For **<R-Time Mode: Rover>** in **CONFIGURE Real-Time Mode** Allows for automatic connection between SmartStation and the Internet when a point is occupied during a survey. Ending the point occupation also ends the Internet connection.	
5.	**PAGE (F6)** to access **CONFIGURE Set NET Port**, **Ranges** page	
6.	**CONFIGURE Set NET Port**, **Ranges** page	

Step	Description	Refer to chapter
	For **<User: Server>** in **CONFIGURE Set NET Port**, **General** page, the fields are input fields. The fields **<Range X From:>** and **<Range X To:>** can be used to prevent a user with an IP address outside the defined ranges from accessing the receiver. Enter the IP address ranges.	
☞	**CLEAR (F5)** returns the fields back to their default values.	
7.	**CONT (F1)** returns to the screen from where **CONFIGURE Set NET Port** was accessed.	

21.8 Scanning Reference Stations

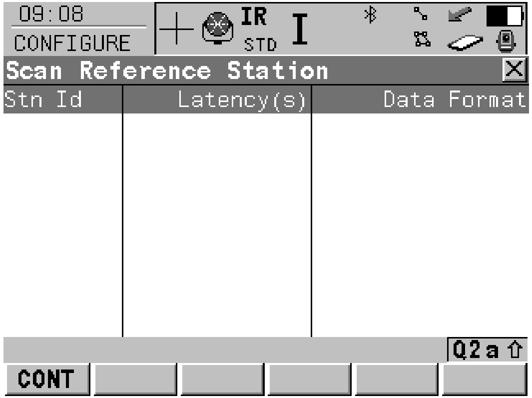
Description

CONFIGURE Scan Reference Station provides information about the reference stations, with specific types of devices attached, for example a radio, from which real-time corrections are being received. This can also be useful for finding out if anyone else in the area is using a particular radio channel.

Access step-by-step

Step	Description	Refer to chapter
1.	Refer to "19.2.2 Accessing CONFIGURE Interfaces" to access **CONFIGURE Interfaces**.	
2.	In **CONFIGURE Interfaces** highlight an interface which has an appropriate device attached.	19.2.2
3.	**CTRL (F4)** to access **CONFIGURE RS232 Connection** or **CONFIGURE Radio Channel**.	
4.	**SCAN (F5)** to access **CONFIGURE Scan Reference Station**.	

CONFIGURE
Scan Reference Station



CONT (F1)
To select the highlighted reference station and to continue with the subsequent screen.

CH- (F2) and **CH+(F3)**
Available for scanning reference stations with radios attached. To switch the radio to one channel lower/higher than the current channel. The reference stations displayed change to those broadcasting on the new channel.

Description of columns

Column	Description
Stn ID	Station ID of available reference stations from which a signal is being received. For radios, the reference station radios transmitting on the same channel will be listed.
Latency (s)	Time delay, in seconds and configured on the reference, from when the reference collects the data to when the data is transmitted.
Data Format	Format of the data from the reference station.

21.9 Configuring the Stations to Dial

21.9.1 Overview

Description

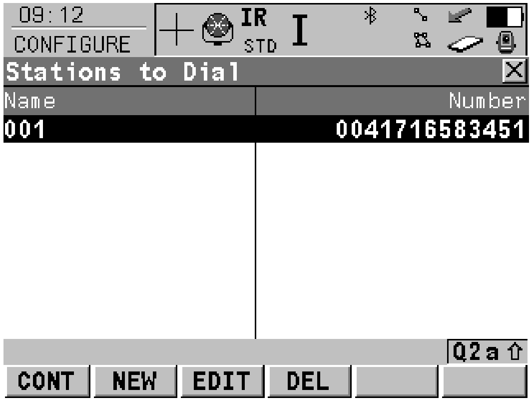
CONFIGURE Stations to Dial allows new stations to be created, provides a list of reference stations that can be dialled and allows existing stations to be edited.
For digital cellular phones of any technology and for modems, the phone numbers of the device at the reference station must be known. For a reference station to be dialled, a name, the phone number and, if available, the coordinates can be configured.
The configuration is possible for rover and reference digital cellular phones and modems.

21.9.2 Accessing CONFIGURE Stations to Dial

Access step-by-step

Step	Description	Refer to chapter
1.	Refer to "19.2.2 Accessing CONFIGURE Interfaces" to access **CONFIGURE Interfaces**.	
2.	In **CONFIGURE Interfaces** highlight an interface which has a digital cellular phone of any technology or modem attached.	19.2.2
3.	**CTRL (F4)** to access **CONFIGURE XX Connection**.	
4.	Open the choicelist for **<Station:>** to access **CONFIGURE Stations to Dial**.	

CONFIGURE Stations to Dial



CONT (F1)
To select the highlighted station and to return to the screen from where this screen was accessed.

NEW (F2)
To create a new station. Refer to "21.9.3 Creating a New Station to Dial".

EDIT (F3)
To edit a station. Refer to "21.9.4 Editing a Station to Dial".

DEL (F4)
To delete the highlighted station.

Description of columns

Column	Description
Name	Name of all available reference stations.
Number	Phone number of the station to dial.

21.9.3 Creating a New Station to Dial

Create new station to dial step-by-step

Step	Description
1.	Refer to "21.9.2 Accessing CONFIGURE Stations to Dial" to access **CONFIGURE Stations to Dial**.
2.	**NEW (F2)** to access **CONFIGURE New Station to Dial**.
3.	**CONFIGURE New Station to Dial** **<Name:>** A unique name for the new reference station to be dialled. The name may be up to 16 characters long and may include spaces. Input optional. **<Number:>** The number of the reference station to dial. If the survey is to be undertaken across country borders it is necessary to input the phone number using standard international dialing codes. For example, +41123456789. Otherwise it can be input as a standard digital cellular phone number. **<Protocol:>** Available for digital cellular phones of GSM technology. The configured protocol of the digital cellular phone of GSM technology. **<Protocol: Analog>** For conventional phone networks. **<Protocol: ISDN v.110>** For GSM networks. Type in the number to be dialled.
4.	Are the approximate coordinates of the reference station to be typed in? • If **yes**, continue with step 5. • If **no**, continue with step 6.
5.	**CONFIGURE New Stations to Dial** **<Enter Coords: Yes>** Type in the coordinates of the reference station.
☞	**COORD (F2)** views other coordinate types.

Step	Description
	SHIFT ELL H or **SHIFT ORTH (F2)** Available for local coordinates. Changes between the ellipsoidal and the orthometric height.
6.	**STORE (F1)** returns to the screen from where **CONFIGURE New Points to Dial** was accessed.

21.9.4 Editing a Station to Dial

Access step-by-step

Step	Description
1.	Refer to "21.9 Configuring the Stations to Dial" to access **CONFIGURE Stations to Dial**.
2.	**EDIT (F3)** to access **CONFIGURE Edit Station to Dial**.
3.	All following steps are identical with the creation of a new station to dial. Refer to "21.9.3 Creating a New Station to Dial". Follow the instructions from step 3. onwards.

21.10 Configuring the Server to Connect

21.10.1 Overview

Description

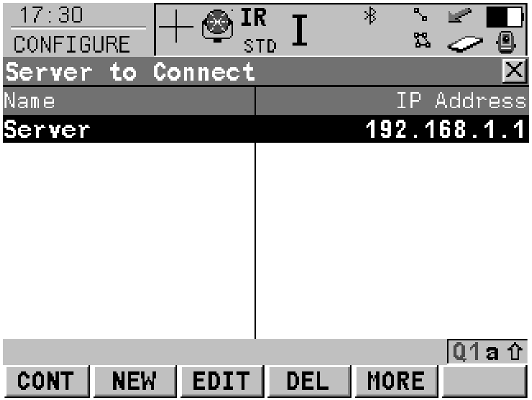
CONFIGURE Server to Connect allows new servers to be created, provides a list of servers that can be accessed in the Internet and allows existing servers to be edited.
For servers to be accessed in the Internet, the IP address and the TCP/IP port must be known. For a server to be accessed, a name can be configured.

21.10.2 Accessing CONFIGURE Server to Connect

Access step-by-step

Step	Description	Refer to chapter
1.	Refer to "19.2.2 Accessing CONFIGURE Interfaces" to access **CONFIGURE Interfaces**.	
2.	In **CONFIGURE Interfaces** highlight an interface which has an Internet/Ethernet interface attached.	19
3.	**CTRL (F4)** to access **CONFIGURE XX Connection**.	
4.	Open the choicelist for **<Server:>** to access **CONFIGURE Server to Connect**.	

CONFIGURE Server to Connect



CONT (F1)
To select the highlighted server and to return to the screen from where this screen was accessed.

NEW (F2)
To create a new server. Refer to "21.10.3 Creating a New Server".

EDIT (F3)
To edit a server. Refer to "21.10.4 Editing a Server to Connect".

DEL (F4)
To delete the highlighted server.
MORE (F5)
To change between the IP Address and the TCP/IP Port of the server.

Description of columns

Column	Description
Name	Name of all available servers.
IP Address	IP addresses of all available servers.
TCP/IP Port	TCP/IP Port numbers of all available servers.

21.10.3 Creating a New Server

Create new server to be accessed step-by-step

Step	Description
1.	Refer to "21.10.2 Accessing CONFIGURE Server to Connect" to access **CONFIGURE Server to Connect**.
2.	**NEW (F2)** to access **CONFIGURE New Server**.
3.	**CONFIGURE New Server** **<Name:>** A unique name for the new server to be accessed. The name may be up to 16 characters long and may include spaces. **<IP Address:>** Type in the IP address of the server to be accessed in the Internet. **<TCP/IP Port:>** The port of the Internet server through which the data is provided. Each server has several ports for various services..
4.	**STORE (F1)** returns to the screen from where **CONFIGURE New Points to Dial** was accessed.

21.10.4 Editing a Server to Connect

Access step-by-step

Step	Description
1.	Refer to "21.10 Configuring the Server to Connect" to access **CONFIGURE Server to Connect**.
2.	**EDIT (F3)** to access **CONFIGURE Edit Server**.
3.	All following steps are identical with the creation of a new server. Refer to "21.10.3 Creating a New Server". Follow the instructions from step 3. onwards.

22 Config...\SmartStation...

22.1 Real-Time Mode

22.1.1 Configuration of Real-Time

Description

The settings on this screen allow GPS real-time related parameters to be configured. This includes defining whether SmartStation should operate as a rover (static, as on a tripod) and the type of GPS real-time messages to be used.

Access

Select **Main Menu: Config...\SmartStation...\Real-Time Mode**.

OR

Select **Main Menu: Config...\Interfaces...**. Highlight **GPS RTK**. **EDIT (F3)**.

OR

Press a hot key configured to access the screen **CONFIGURE Real-Time Mode**.
Refer to "2.1 Hot Keys" for information on hot keys.

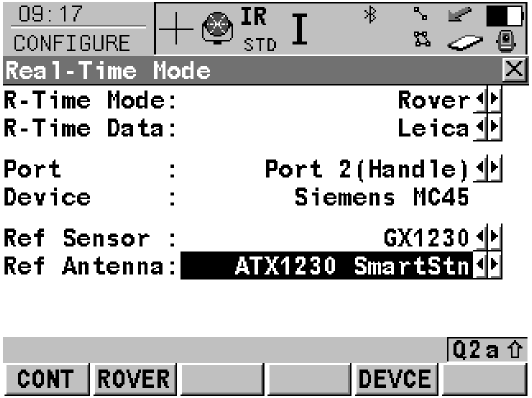
OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

OR

Within the configuration set wizard.
Refer to "11.2 Accessing Configuration Set Management".

CONFIGURE
Real-Time Mode



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

ROVER (F2)
To configure additional settings relevant to rover operations. Refer to paragraph "CONFIGURE Additional Rover Options, General page".

DEVCE (F5)
To create, select, edit or delete a device.

Description of fields

Field	Option	Description
<R-Time Mode:>	**None**	SmartStation is not to be used as a GPS real-time rover.
	Rover	Activates a rover GPS real-time interface.
<R-Time Data:>	**Leica**	The proprietary Leica GPS real-time data format. This is recommended when working exclusively with Leica receivers.
	CMR **CMR+**	CMR and CMR+ are compacted formats used to receive data from third party receivers.

Field	Option	Description
	RTCM v3	Message according to RTCM version 3. A new standard format for transmission of **G**lobal **N**avigation **S**atellite **S**ystem correction information. Higher efficiency than RTCM v2.x. Supports GPS real-time services with significantly reduced bandwidth. Message types for real-time GNSS operation: • 1001: L1-only GPS real-time observables • 1002: Extended L1-only GPS real-time observables • 1003: L1 & L2 GPS real-time observables • 1004: Extended L1 & L2 GPS real-time observables • 1005: Stationary GPS real-time reference station **A**ntenna **R**eference **P**oint • 1006: Stationary GPS real-time reference station ARP with antenna height • 1007: Antenna descriptor • 1008: Antenna descriptor and serial number • 1009: L1-only GLONASS real-time observables • 1010: Extended L1-only GLONASS real-time observables

Field	Option	Description
		• 1011: L1 & L2 GLONASS real-time observables • 1012: Extended L1 & L2 GLONASS real-time observables • 1013: System parameters Pseudorange and phase range values for L1 and L2. Depending on the type of receiver, the data for L1-only or for L1 and L2 are sent out. Accuracy at the rover: • For L1-only: 0.25 - 1 m rms. • For L1 and L2: 1 - 5 cm rms after a successful ambiguity resolution.
	RTCM 1,2 v2	Message according to RTCM version 2.x. Differential and delta differential GPS corrections. Message 3 is also generated. Use for DGPS applications. Accuracy at the rover: 0.25 - 1 m rms.
	RTCM 9,2 v2	Message according to RTCM version 2.x. GPS partial correction set and delta differential GPS corrections. Message 3 is also generated. Use for DGPS applications with a slow data link in the presence of interference. Accuracy at the rover: 0.25 - 1 m rms.

Field	Option	Description
	RTCM 18,19 v2)	Message according to RTCM version 2.x. Uncorrected carrier phase and pseudorange. Message 3 is also generated. Use for GPS real-time operations where the ambiguities will be resolved at the rover. Accuracy at the rover: 1 - 5 cm rms after a successful ambiguity resolution.
	RTCM 20,21 v2	Message according to RTCM version 2.x. GPS real-time carrier phase corrections and high-accuracy pseudorange corrections. Message 3 is also generated. Use for GPS real-time operations. Accuracy at the rover: 1 - 5 cm rms after a successful ambiguity resolution.
<Port:>		Port to which the device is attached.
	Port 1	5 pin LEMO-0 for communication and/or power. This port is located at the base of the instrument.
	Port 2(Handle)	Hotshoe connection for RadioHandle with RCS and SmartAntenna Adapter with SmartStation. This port is located on top of Communication side cover.
	Port 3(BT)	Bluetooth module for communication with only Bluetooth capable devices. This port is housed within Communication side cover.

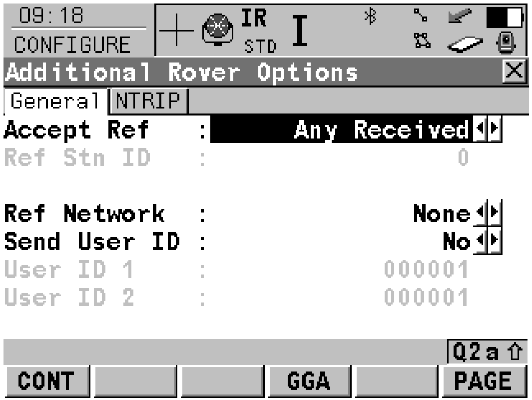
Field	Option	Description
	NETx	Available for an activated Internet interface. If these ports are not assigned to a specific interface, then these ports are additional remote ports.
<Ref Sensor:>	Choicelist	The receiver type used at the reference. If the GPS real-time data format does not contain the information of the receiver type certain corrections based on the information of the receiver type are applied in order to provide correct results. The GPS real-time data formats **Leica**, **CMR** and **CMR+** contain this information. This is mainly important when a System300 receiver is used as reference.
<Ref Antenna:>	Choicelist	The antenna used at the reference. If the GPS real-time data format does not contain the information of the antenna certain corrections based on the information of the antenna are applied in order to provide correct results. The GPS real-time data formats **Leica**, **RTCM v2.3**, **CMR** and **CMR+** contain this information. If the reference data is corrected by absolute antenna calibration values and a Leica standard antenna is being used on the rover, select **ADVNULLANTENNA** as reference antenna.

Next step

IF additional rover options	THEN
are not to be configured	**CONT (F1)** closes the screen and returns to the screen from where **CONFIGURE Real-Time Mode** was accessed.
are to be configured	**ROVER (F2)**. Refer to paragraph "CONFIGURE Additional Rover Options, General page".

CONFIGURE Additional Rover Options, General page

The available fields depend on the selected **<R-Time Data:>** in **CONFIGURE Real-Time Mode**.



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

GGA (F4)
To activate the sending of a GGA message for reference network applications.
Refer to "22.1.2 Configuration of GGA Message Sending for Ref Network Applications".

GETID (F5)

Available for **<Accept Ref: User Defined>**. To display and select the station ID of the available reference stations, the latency of the message and the data format. When using radios, the radio channel can be switched and the stations received on the new frequency are displayed.

1st (F6)

Available for **<Accept Ref: First Received>**. To force the system to try to establish a new connection with a different reference station.

PAGE (F6)

To change to another page on this screen.

Description of fields

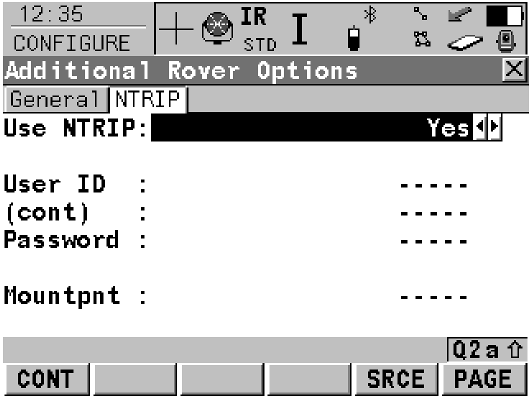
Field	Option	Description
<Accept Ref:>		The reference station of which GPS real-time data is to be accepted.
	User Defined	Incoming GPS real-time data is accepted from the reference station defined in **<Ref Stn ID:>**.
	First Received	Incoming GPS real-time data from the first recognised reference station is accepted.
	Any Received	Incoming GPS real-time data from any reference station is accepted.

Field	Option	Description
<Ref Stn ID:>	User input	Available for **<Accept Ref: User Defined>**. The special ID of the reference station from which GPS real-time data is to be received. The allowed minimum and maximum values vary.
	From **0** to **31**	For **<R-Time Data: Leica>** and **<R-Time Data: CMR/CMR+>**.
	From **0** to **1023**	For **<RTCM Version: 1.x>** and **<RTCM Version: 2.x>**.
	From **0** to **4095**	For **<R-Time Data: RTCM v3>**.
<Ref Network:>	**None**, **VRS** or **FKP**	Defines the type of reference network to be used.
<Send User ID:>	**Yes** or **No**	Activates the sending of a Leica proprietary NMEA message defining the user.
<User ID 1:> and **<User ID 2:>**	User input	Available for **<Send User ID: Yes>**. The specific user ID's to be sent as part of the Leica proprietary NMEA message. By default the serial number of the instrument is displayed.
<RTCM Version:>	**1.x**, **2.1**, **2.2** or **2.3**	Available for **<R-Time Data: RTCM XX v2>** in **CONFIGURE Real-Time Mode**. The same version must be used at the reference and the rover.
<Bits / Byte:>	**6** or **8**	Defines the number of bits/byte in the RTCM message being received.

CONFIGURE Additional Rover Options, NTRIP page

Next step

PAGE (F6) changes to the **NTRIP** page.



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

SRCE (F5)
To download the NTRIP source table if **<Mountpnt:>** is unknown. To do this, the GPRS Internet interface must already be configured. Refer to "33.2.3 Using the NTRIP Service with SmartStation".

PAGE (F6)
To change to another page on this screen.

Description of fields

Field	Option	Description
<Use NTRIP:>	**Yes** or **No**	Activates NTRIP.
<User ID:>	User input	A user ID is required to receive data from the NTRIP-Caster. Contact the NTRIP administrator for information.

Field	Option	Description
<(cont):>	User input	Allows the **<User ID:>** string to continue onto a new line.
<Password:>	User input	A password is required to receive data from the NTRIPCaster. Contact the NTRIP administrator for information.
<Mountpnt:>	User input	The NTRIPSource from where GPS real-time data is required. **SRCE (F5)** to download the NTRIPSource table if **<Mountpnt:>** is unknown.

Next step

Step	Description
1.	**CONT (F1)** returns to **CONFIGURE Real-Time Mode**.
2.	**CONT (F1)** returns to **TPS1200 Main Menu**.

22.1.2 Configuration of GGA Message Sending for Ref Network Applications

Description

- Most reference networks require an approximate position of the rover. For reference network applications, a rover dials into the reference network and submits its approximate position in form of a NMEA GGA message.
- By default, the receiver sends GGA messages with updated current positions automatically when a reference network is selected.
- Surveying regulations in some countries require that one certain position can be selected. This position is then sent to the reference network as GGA message through the real-time interface every five seconds.
- Refer to "F.3 GGA - Global Positioning System Fix Data" for information on GGA message format.

Access step-by-step

Step	Description
1.	Refer to "22.1.1 Configuration of Real-Time" to access **CONFIGURE Real-Time Mode**.
2.	Press **ROVER (F2)** to access **CONFIGURE Additional Rover Options**.
3.	Press **GGA (F5)** to access **CONFIGURE Send GGA NMEA**.

OR

Press a hot key configured to access the screen **CONFIGURE Send GGA NMEA**.

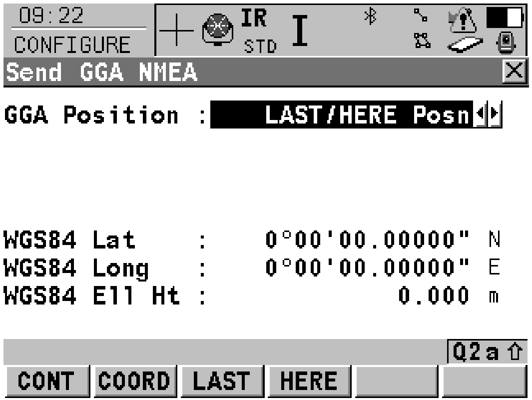
Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**.

Refer to "2.2 USER Key" for information on the **USER** key.

CONFIGURE
Send GGA NMEA



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

COORD (F2)
Available for **<GGA Position: From Job>** and **<GGA Position: LAST/HERE Posn>**. To view other coordinate types. Local coordinates are available when a local coordinate system is active.

LAST (F3)
Available for **<GGA Position: LAST/HERE Posn>**. To use the same coordinates in the GGA message as when the receiver was last used in a reference network application. This is possible when position coordinates from a previous reference network application are still stored in the System RAM.

HERE (F4)
Available for **<GGA Position: LAST/HERE Posn>**. To use the coordinates of the current navigation position in the GGA message.

SHIFT ELL H (F2) and **SHIFT ORTH (F2)**
To change between the ellipsoidal and the orthometric height. Available for local coordinates.

Description of fields

Field	Option	Description
<GGA Position:>	**Automatic**	The current rover position is sent to the reference network. The position is updated and sent every five seconds.
	From Job	A point from the active job can be selected in **<Point ID:>**. The position of this point is sent to the reference network every five seconds.
	LAST/HERE Posn	The position last used in a reference network application or the current navigation position can be selected using **LAST (F3)** or **HERE (F4)**. The selected position is sent every five seconds.
	None	No GGA message is sent to the reference network.
<Point ID:>	Choicelist	Available for **<GGA Position: From Job>**. The coordinates of this point are sent out as position in the GGA message. Opening the choicelist opens **MANAGE Data: Job Name**. Refer to "6.2 Accessing Data Management".

Next step

Step	Description
1.	**CONT (F1)** returns to **CONFIGURE Additional Rover Options**.

Step	Description
2.	**CONT (F1)** returns to **CONFIGURE Real-Time Mode**.
3.	**CONT (F1)** returns to the screen from where **CONFIGURE Real-Time Mode** was accessed.

22.2 Point Occupation Settings

Description

The settings on this screen define the way in which points are occupied and recorded.

Access

Select **Main Menu: Config...\SmartStation...\Point Occupation Settings**.

OR

Press a hot key configured to access the screen **CONFIGURE Point Occupation Settings**. Refer to "2.1 Hot Keys" for information on hot keys.

OR

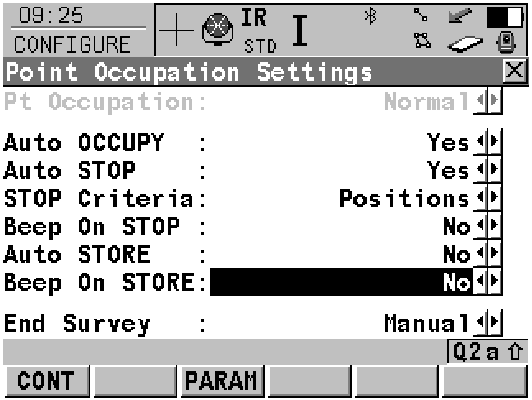
Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

OR

Within the configuration set wizard.

Refer to "11.2 Accessing Configuration Set Management".

CONFIGURE Point Occupation Settings



CONT (F1)

To accept changes and return to the screen from where this screen was accessed.

PARAM (F3)

To configure the time interval after which a point occupation can be stopped automatically.

Description of fields

Field	Option	Description
<Pt Occupation:>	**Normal**	The way in which coordinates for a point are recorded. This field is fixed to **<Pt Occupation: Normal>**.
<Auto OCCUPY:>	**No**	Starts point occupation when pressing **OCUPY (F1)**.
	Yes	Starts point occupation automatically when entering **SETUP New Station Point**.
	Timed	Starts point occupation automatically at a certain time. The start time is specified in **SETUP New Station Point**.
<Auto STOP:>	**Yes** or **No**	Stops the measurements automatically when the parameter defined for **<STOP Criteria:>** reaches 100 %.
<STOP Criteria:>		Available for **<Auto STOP: Yes>**. Defines the method used for **<Auto STOP:>**. The setting determines the computation of the duration of the point occupation. Parameters for the selected method are defined with **PARAM (F3)**.
	Accuracy or **Positions**	Available for **<R-Time Mode: Rover>**.

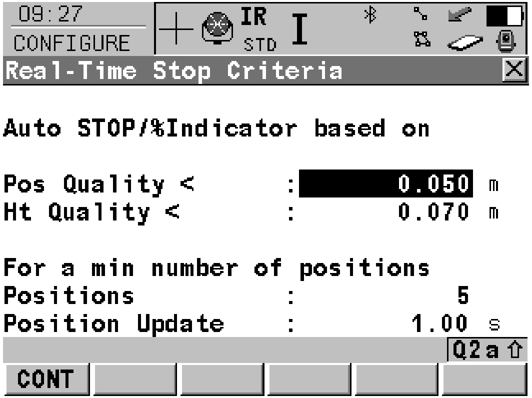
Field	Option	Description
	Time, **Observa-tions** or **No. of Satel-lites**	Available for **<R-Time Mode: None>**.
<% Indicator:>		Available for **<Auto STOP: No>**. This is an indicator when to stop the point occupation. Parameters for the selected method are defined with **PARAM (F3)**.
	None or **Positions**	Available for **<R-Time Mode: Rover>**.
	None, **Time**, **Observa-tions** or **No. of Satel-lites**	Available for **<R-Time Mode: None>**.
<Beep On STOP:>	**Yes** or **No**	Activates that a beep is made when the point occupation is ended by **<Auto STOP:>**.
<Auto STORE:>	**Yes** or **No**	Stores points automatically after stopping the point occupation.
<Beep On STORE:>	**Yes** or **No**	Activates that a beep is made when the point is stored by **<Auto STORE:>**.

Field	Option	Description
<End Survey:>		Defines the instrument behaviour once a point is stored.
	Manual	Exits **GPS SURVEY** when pressing **ESC**.
	Automatically	Exits **GPS SURVEY** automatically when pressing **STORE (F1)** and returns to main menu.

Next step

IF parameters for **<Auto STOP:>**	AND	THEN
are not to be config-ured	-	**CONT (F1)** closes the screen and returns to the screen from where **CONFIGURE Point Occupation Settings** was accessed.
are to be configured	**<R-Time Mode: None>**	**PARAM (F3)** changes to **CONFIGURE Post-Process Stop Criteria**.
are to be configured	**<R-Time Mode: Rover>**	**PARAM (F3)** changes to **CONFIGURE Real-Time Stop Criteria**. Refer to paragraph "CONFIGURE Real-Time Stop Criteria".

CONFIGURE
Real-Time Stop Criteria



CONT (F1)
To accept changes and to return to **CONFIGURE Point Occupation Settings**.

Description of fields

The parameters shown on this screen depend on the setting for **<STOP Criteria:>** in **CONFIGURE Point Occupation Settings**.

Field	Option	Description
<Pos Quality <:> and **<Ht Quality <:>**	User input	Sets the maximum position and height qualities for each point occupation. Calculating the qualities starts when **OCUPY (F1)** is pressed. SmartStation stops measuring when the position and height qualities are both less than the configured values.
<Positions:>	User input	Point is occupied for a minimum number of positions even when the **<Pos Quality <:>** and **<Ht Quality <:>** is already less than the specified maximum.

Field	Option	Description
<Position Update:>	User input	Sets the number the positions which must be observed before SmartStation stops measuring. Counting the number of positions starts when **OCUPY (F1)** is pressed.

Next step

Step	Description
1.	**CONT (F1)** returns to **CONFIGURE Point Occupation Settings**.
2.	**CONT (F1)** returns to **TPS1200 Main Menu**.

22.3 Satellite Settings

Description

The settings on this screen define which satellite system, satellites and satellite signals will be used by SmartStation.

Access

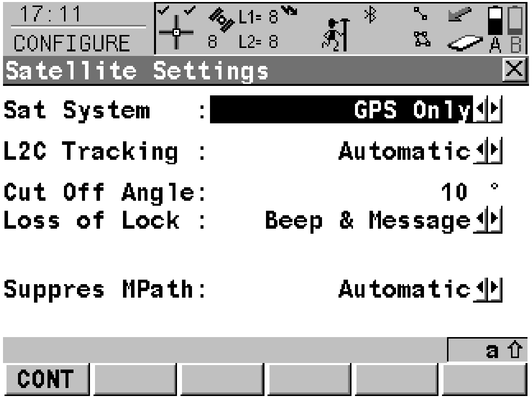
Select **Main Menu: Config...\SmartStation...\Satellite Settings**.

OR

Within the configuration set wizard.

Refer to "11.2 Accessing Configuration Set Management".

CONFIGURE Satellite Settings



CONT (F1)

To accept changes and return to **TPS1200 Main Menu**.

Description of fields

Field	Option	Description
<Sat System:>		Defines the satellite signals accepted by the receiver when tracking satellites.
	GPS Only	For normal survey applications requiring high accuracy. Phase solution for real-time and post-processing.
	GPS & Glonass	For applications requiring lower accuracy. Enables satellite tracking under noisier conditions like dense tree cover. Code solution for real-time and post-processing. A ’T’ appears in the number of visible satellites icon.
<L2C Tracking:>	**Automatic** or **Always Track**	Defines if the L2C signal will be tracked. The recommended setting is **Automatic**.
<Cut Off Angle:>	User input	Sets the elevation in degrees below which satellite signals are not recorded and are not shown to be tracked. Recommended settings: • For GPS real-time: 10°. • For other applications: 15°.
<Loss of Lock:>	**Beep & Message** or **No Beep/Message**	Activates an acoustic warning signal and a message given by SmartStation when satellites are lost and therefore no position can be computed.

Field	Option	Description
<Suppress MPath:>	**Automatic** or **Always On**	Defines if phase multipath mitigation techniques will be used. The recommended setting is **Automatic**.

Next step
CONT (F1) returns to **TPS1200 Main Menu**.

22.4 Local Time Zone

Description

The settings on this screen help SmartStation to quickly locate and track satellites.

Access

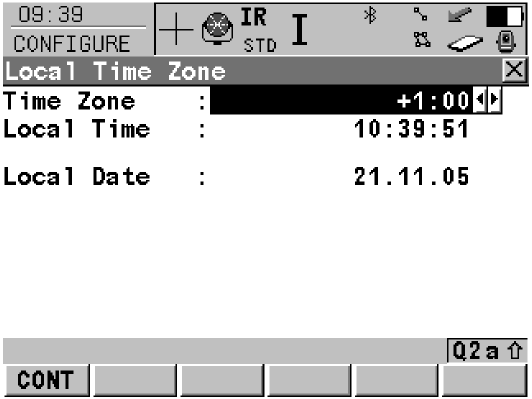
Select **Main Menu: Config...\SmartStation...\Local Time Zone**.

OR

Within the configuration set wizard.

Refer to "11.2 Accessing Configuration Set Management".

CONFIGURE Local Time Zone



CONT (F1)

To accept changes and to return to **TPS1200 Main Menu**.

Description of fields

Field	Option	Description
<Time Zone:>	From -**13:00** to **+13:00**	The time zone for the current location and local date.
<Local Time:>	User input	Setting the local time supports a very fast satellite acquisition.
<Local Date:>	User input	Setting the local date supports a very fast satellite acquisition.

Next step

CONT (F1) returns to **TPS1200 Main Menu**.

22.5 Quality Control Settings

Description

The settings on this screen define the limits for coordinate quality and DOP values accepted for point occupations.

Access

Select **Main Menu: Config...\SmartStation...\Quality Control Settings**.

OR

Press a hot key configured to access the screen **CONFIGURE Quality Control Settings**. Refer to "2.1 Hot Keys" for information on hot keys.

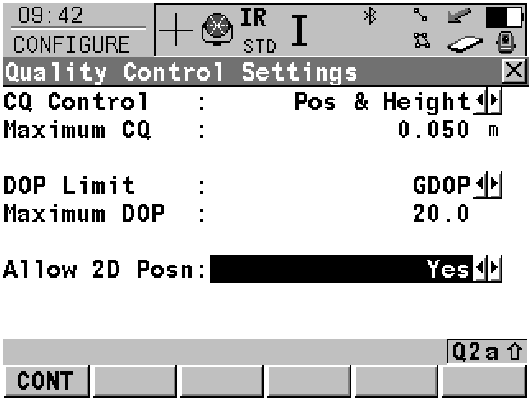
OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

OR

Within the configuration set wizard.
Refer to "11.2 Accessing Configuration Set Management".

CONFIGURE Quality Control Settings



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

Description of fields

Field	Option	Description
<CQ Control:>	None, Pos Only, Height Only or Pos & Height	The type of coordinate quality to be checked before storing a point. If activated, the limit defined in **<Maximum CQ:>** is checked before storing a point. A warning signal is given when the limit is exceeded. Refer to "6.3.1 Terminology" for information on coordinate quality.
<Maximum CQ:>	User input	Available unless **<CQ Control: None>**. The maximum acceptable coordinate quality.
<DOP Limit:>	None, GDOP, PDOP, HDOP or VDOP	If activated, the limit defined in **<Maximum DOP:>** is checked. GPS positions are unavailable when the limit is exceeded.
<Maximum DOP:>	User input	Available unless **<DOP Limit: None>**. The maximum acceptable DOP value.
<Allow 2D Posn:>	Yes	2D positions can be obtained with only three satellites available. The height is fixed to that of the last position computed with height.
	No	2D positions cannot be obtained with only three satellites available.

Next step
CONT (F1) returns to **TPS1200 Main Menu**.

22.6 Logging of Raw Obs

Description

- When using SmartStation, it is possible to add the ability to log raw GPS data.
- The settings on this screen define the logging of raw observations.
- This is a protected option and is only activated by the entry of a license key.

Access

This menu option is licence protected and is only activated by the entry of a licence key. The licence key can only be loaded from the CompactFlash card.

Select **Main Menu: Config...\Survey Settings...\Logging of Raw Obs**.

OR

Press a hot key configured to access the screen **CONFIGURE Logging of Raw Obs**. Refer to "2.1 Hot Keys" for information on hot keys.

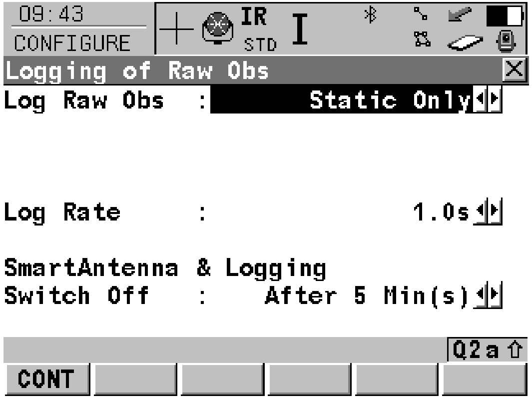
OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

OR

Within the configuration set wizard. Refer to "11.2 Accessing Configuration Set Management".

CONFIGURE
Logging of Raw Obs



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

Description of fields

Field	Option	Description
<Log Raw Obs:>	Never	Available unless **<R-Time Mode: Reference>**. No raw observation logging during either static or moving intervals.
	Static Only	Available unless **<R-Time Mode: Reference>**. Raw observation logging during static intervals when occupying a point. The receiver has to be stationary.
<Log Rate:>	From 0.05s to 300.0s	Available unless **<Log Raw Obs: Never>** or **<Log Raw Obs: No>**. Rate at which raw observations are logged.

Field	Option	Description
<Switch Off:>	Choicelist	This option determines when SmartAntenna is turned off. The selected time is activated whenever SmartStation leaves GPS mode. This option is directly linked to **<Switch Off:>** in **CONFIGURE Start Up & Power Down**. Refer to "18.6 Start Up & Power Down" for details.

Next step

CONT (F1) returns to **TPS1200 Main Menu**.

23 Tools...\Format Memory Device

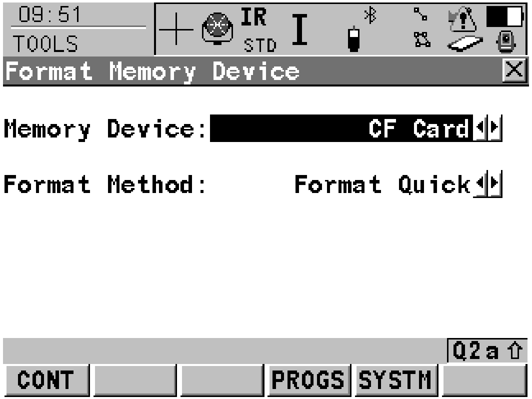
Description

Allows the CompactFlash card, the internal memory, if fitted, and the System RAM to be formatted. All data will be erased. Refer to "Appendix B Memory Types" for more information on the types of memory devices available.

Access

Select **Main Menu: Tools...\Format Memory Device**.

TOOLS
Format Memory Device



CONT (F1)
To format a memory device and return to the screen from where this screen was accessed.

PROGS (F4)
To format the application programs memory.

SYSTM (F5)
To format System RAM memory.

Description of fields

Field	Option	Description
<Memory Device:>		The type of memory to be formatted.
	Output	For instruments without internal memory.

Field	Option	Description
	CF Card or Internal Memory	For instruments with CompactFlash card and internal memory.
<Format Method:>	Format Quick	After formatting, data is not visible anymore but still exists on the memory device and is overwritten as and when required.
	Format Complete	Data is fully deleted.

Next step

IF	THEN
the CompactFlash card or internal memory is to be formatted	**CONT (F1)** to format the selected memory device and return to **TPS1200 Main Menu**.
the application programs memory is to be formatted	**PROGS (F4)** to format the application programs memory. All loadable application programs are deleted.
the System RAM is to be formatted	**SYSTM (F5)** to format the System RAM.

☞ If the System RAM is formatted all system data such as user defined configuration sets, user defined antennas, codelists, geoid field files and CSCS field files will be lost.

24 Tools...\Transfer Objects...

Description

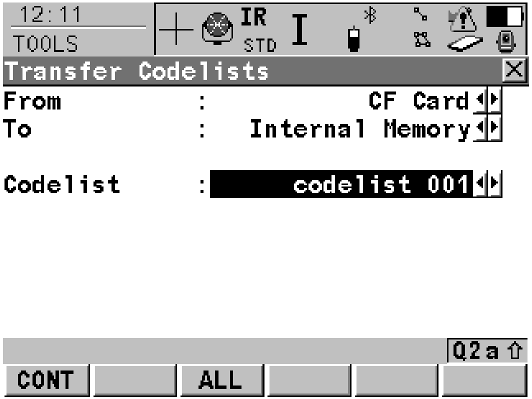
This chapter describes the basic procedure for transferring objects between the CompactFlash card, the System RAM and the internal memory, if fitted. Refer to "Appendix C Directory Structure of the Memory Device" for information about file types and locations of files on the CompactFlash card.

Access

Select **Main Menu: Tools...\Transfer Objects...\XX**.

TOOLS Transfer XX

The available fields on the screen depend on the option selected in **Main Menu: Tools...\Transfer Objects...**.



CONT (F1)
To transfer an object and return to the screen from where this screen was accessed.

ALL (F3)
Available for some transfer object options. To transfer all objects.

Description of fields

Field	Option	Description
<From:>		Memory device to transfer object from.
	CF card	Transfer from CompactFlash card.
	System RAM	Transfer from System RAM. Available unless object to transfer is a job.
	Internal Memory	Transfer from internal memory, if fitted. Available if the object to transfer is a job.
<To:>	Output	Memory device to transfer object to. Memory device not selected in **<From:>**.
<Codelist:>	Choicelist	To select the codelist to be transferred.
<Config Set:>	Choicelist	To select the configuration set to be transferred.
<Coord Sys:>	Choicelist	To select the coordinate system to be transferred.
<File:>	Choicelist	To select the geoid field file, the CSCS field file or the entire contents of the System RAM to be transferred, depending on the transfer option chosen.
	Output	The select the modem or GSM station or the server to be transferred as a binary file. CDMA stations are also transferred.
<Format File:>	Choicelist	To select the format files to be transferred.
<Job:>	Choicelist	Available for instruments with internal memory. To select the job to be transferred between Compact-Flash card and internal memory.

Field	Option	Description
<Antenna:>	Choicelist	To select the antenna records to be transferred.

Next step

IF all XX	THEN
are to be transferred	**ALL (F3)** transfers all objects in list.
are not to be transferred	**CONT (F1)** transfers selected object.

25 Tools...\Upload System Files...

25.1 Application Programs

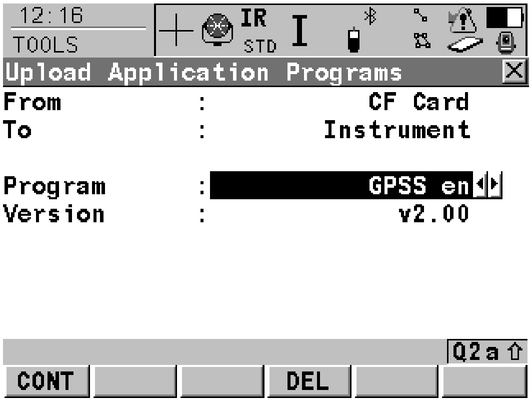
Description

Application program uploads are possible from the CompactFlash card to the application programs memory. These files are stored in the \SYSTEM directory of the memory device and use the extension *.a*.

Access

Select **Main Menu: Tools...\Upload System Files...\Application Programs**.

TOOLS Upload Application Programs



CONT (F1)
To upload an application program and return to the screen from where this screen was accessed.

DEL (F4)
To delete an application program.

Description of fields

Field	Option	Description
<From:>	Output	Upload from CompactFlash card.
<To:>	Output	Upload to application program memory.
<Program:>	Choicelist	List of program files stored on the CompactFlash card.
<Version:>	Output	Version of the program file chosen.

Next step

CONT (F1) uploads the selected application program.

25.2 System Languages

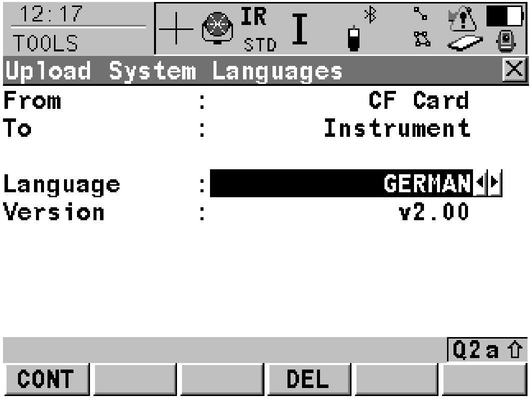
Description

System language uploads are possible from the CompactFlash card to the instrument. These files are stored in the \SYSTEM directory of the active memory device and use an extension that is individual to each language.

Access

Select **Main Menu: Tools...\Upload System Files...\System Languages**.

TOOLS Upload System Languages



CONT (F1)
To upload a system language and return to the screen from where this screen was accessed.

DEL (F4)
To delete a language from the System RAM.

Description of fields

Field	Option	Description
<From:>	Output	Upload from CompactFlash card.
<To:>	Output	Upload to the instrument.

Field	Option	Description
<Language:>	Choicelist	List of language files stored on the CompactFlash card.
<Version:>	Output	Version of the language file.

Next step

CONT (F1) uploads the selected language.

☞ It is not possible to have more than three language files stored on the instrument. English is always available as the default language and cannot be deleted.

25.3 Instrument Firmware

Description

Firmware uploads are possible from the CompactFlash card to the instrument, SmartAntenna or RX1200. These files are stored in the \SYSTEM directory of the active memory device and use the extension *.fw.

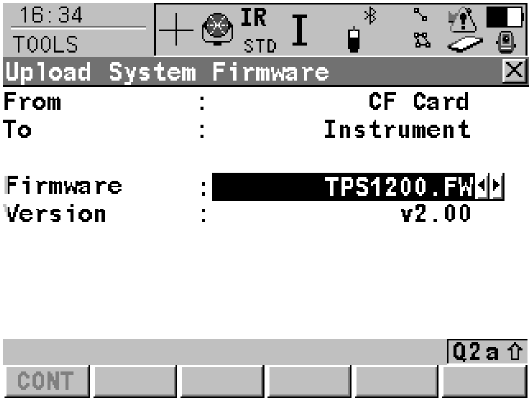
Firmware can be uploaded from LGO on a PC directly through a serial interface to the CompactFlash card in the instrument and from there to the instrument or the RX1200.

SmartAntenna must be connected to the instrument when uploading SmartAntenna firmware. Uploading SmartAntenna firmware takes some time.

Access

Select **Main Menu: Tools...\Upload System Files...\Instrument Firmware**.

TOOLS
Upload System
Firmware



CONT (F1)
To upload firmware and return to the screen from where this screen was accessed.

Description of fields

Field	Option	Description
<From:>	Output	Upload from CompactFlash card.
<To:>	Output	Upload to the instrument, SmartAntenna or the RX1200.
<Firmware:>	Choicelist	List of firmware files stored on the CompactFlash card. Firmware for SmartAntenna is a separate file independant from the instrument firmware. For the RX1200 firmware files, available languages are included in the firmware.
<Version:>	Output	Version of the firmware file.

Next step

CONT (F1) to upload firmware.

26 Tools...\Calculator

26.1 Overview

Description

The calculator can be used to perform the following arithmetic operations such as

- addition, subtraction, multiplication and division
- statistics
- trigonometry, hyperbolic trigonometry and calculations with Pi
- polar, rectangular and angle conversions
- powers, logs, roots and exponential functions.

Operating modes

The calculator has two operating modes - RPN mode and Standard mode.
The arithmetic operations available are identical, the difference lies in the way information is entered, stored and displayed on the screen.

Type	Description
RPN	**R**everse **P**olish **N**otation This operating mode was developed as a way of writing mathematical expressions without using parenthesis and brackets. Many scientific calculators, for example Hewlett Packard calculators, are implemented with this operating mode. Values are entered and kept in a working stack.
Standard	This operating mode is based on the principles of conventional pocket calculators. There is no stacking of values.

26.2 Accessing the Calculator

Access

Select **Main Menu: Tools...\Calculator**.

OR

Press a hot key configured to access the screen **TOOLS XX Calculator**. Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

OR

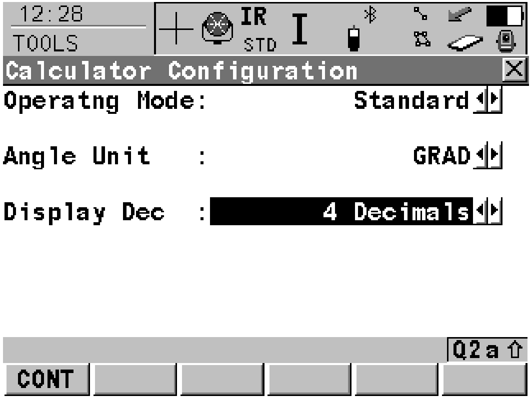
Press **CALC** in any screen when editing an input field for numeric characters, such as **<Azimuth:>** in **COGO Traverse Input**. Refer to "26.4.4 Calling and Closing the Calculator from an Input Field for Numeric Characters".

26.3 Configuring the Calculator

Access step-by-step

Step	Description
1.	Refer to "26.2 Accessing the Calculator" to access **TOOLS XX Calculator**.
2.	**SHIFT CONF (F2)** to access **TOOLS Calculator Configuration**.

TOOLS Calculator Configuration



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

Description of fields

Field	Option	Description
<Operatng Mode:>	**RPN**	The principle of, for example, Hewlett Packard calculators. Refer to "26.1 Overview" for more information. Refer to "26.4.1 RPN Mode" for a working example.

Field	Option	Description
	Standard	The principle of conventional pocket calculators. Refer to "26.1 Overview" for more information. Refer to "26.4.2 Standard Mode" for a working example.
<Angle Unit:>		The unit used for trigonometric functions in the calculator. The selection here is independent from the angle setting in **CONFIGURE Units & Formats**.
	DEG	Degrees
	RAD	Radians
	GRAD	Gon
<Display Dec:>	From **0 Decimals** to **10 Decimals**	The number of decimal places shown in **TOOLS Calculator**.

Next step

CONT (F1) confirms the selections made and returns to the screen from where **TOOLS Calculator Configuration** was accessed.

26.4 Using the Calculator

26.4.1 RPN Mode

Requirements

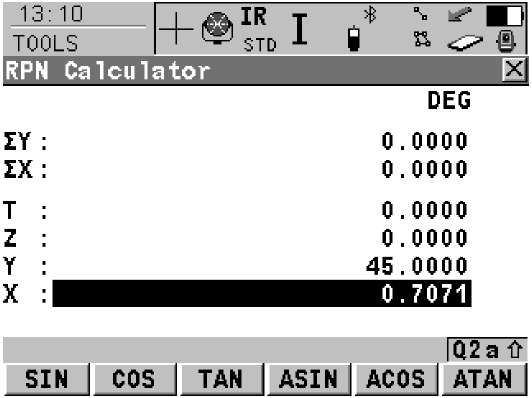
<Operatng Mode: RPN> in **TOOLS Calculator Configuration**.

Access

Refer to "26.2 Accessing the Calculator" to access **TOOLS RPN Calculator**.

TOOLS RPN Calculator

Refer to paragraph "Working example" for information about the operating principle.



The function keys **F1**-**F6** are allocated seven times. Using or the various allocations can be accessed. Refer to "26.4.3 Description of Softkeys" for information about the function keys.

Description of fields

Field	Option	Description
First field on the screen	Output	The unit used for trigonometric functions in the calculator as configured in **TOOLS Calculator Configuration**.
	DEG	Degrees
	RAD	Radians
	GRAD	Gon
<ΣY:>	Output	The result of the sum or difference of values in **<Y:>** using **Σ+ (F1)** and **Σ- (F2)**.
<ΣX:>	Output	The result of the sum or difference of values in **<X:>** using **Σ+ (F1)** and **Σ- (F2)**.
<T:>	Output	Third stack. After an operation, the value from **<Z:>** is written here.
<Z:>	Output	Second stack. After an operation, the value from **<Y:>** is written here.
<Y:>	Output	First stack. After an operation, the value from **<X:>** is written here.
<X:>	User input	The value for the next operation.

Next step

SHIFT DONE (F4) returns to **TPS1200 Main Menu**.

Working example

Task: Calculate (3 + 5) / (7 + 6).

Step	Description
1.	Type in 3.
2.	**ENTER**
3.	Type in 5.
4.	**ENTER**
☞	**<Y: 3>**, **<X: 5>**
5.	**+ (F1)**
☞	**<X: 8>**
6.	Type in 7.
7.	**ENTER**
☞	**<Y: 8>**, **<X: 7>**
8.	Type in 6.
9.	**ENTER**
☞	**<Z: 8>**, **<Y: 7>**, **<X: 6>**
10.	**+ (F1)**
☞	**<Y: 8>**, **<X: 13>**
11.	**/ (F4)**
☞	**<X: 0.61538>**

26.4.2 Standard Mode

Requirements

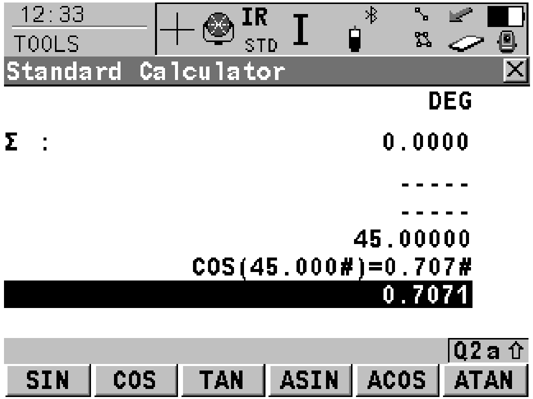
<Operatng Mode: Standard> in **TOOLS Calculator Configuration**.

Access

Refer to "26.2 Accessing the Calculator" to access **TOOLS Standard Calculator**.

TOOLS Standard Calculator

Refer to paragraph "Working example" for information about the operating principle.



The function keys **F1**-**F6** are allocated seven times. Using ▲ or ▼ the various allocations can be accessed. Refer to "26.4.3 Description of Softkeys" for information about the function keys.

Description of fields

Field	Option	Description
First field on the screen	Output	The unit used for trigonometric functions in the calculator as configured in **TOOLS Calculator Configuration**.
	DEG	Degrees

Field	Option	Description
	RAD	Radians
	GRAD	Gon
<Σ:>	Output	The result of the sum or difference of values in the last field on the screen using **Σ+ (F1)** and **Σ- (F2)**.
Third to sixth field on the screen	Output	Previously entered value OR Latest operation including result # indicates that the value is cut after the third decimal.
Last field on the screen	User input	The value for next operation or result from latest operation.

Next step
SHIFT DONE (F4) returns to **TPS1200 Main Menu**.

Working example

Task: Calculate (3 + 5) / (7 + 6).

Step	Description
1.	Type in 3.
2.	**ENTER**
3.	**+ (F1)**
4.	Type in 5.
5.	**ENTER**

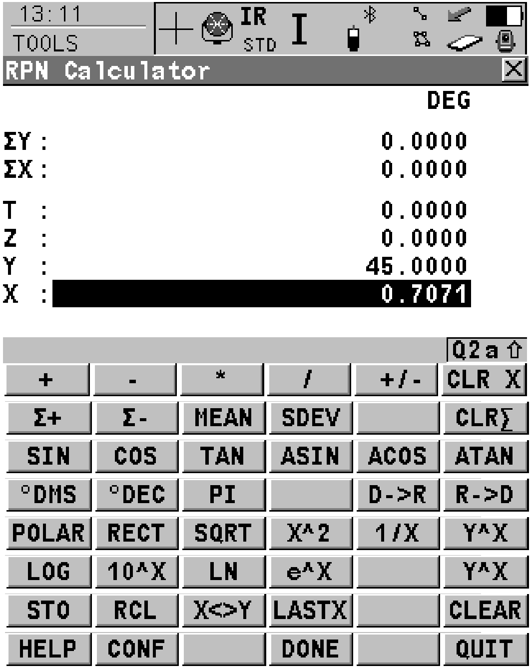
Step	Description
	Last field on the screen displays **8.00000**.
6.	such that **STO (F1)** is visible.
7.	**STO (F1)**
8.	such that **+ (F1)** is visible.
9.	Type in 7.
10.	**ENTER**
11.	**+ (F1)**
12.	Type in 6.
13.	**ENTER**
	Last field on the screen displays **13.00000**.
	Remember **13.00000**.
14.	such that **REC (F2)** is visible.
15.	**REC (F2)** to recall 8.00000.
16.	**ENTER**
17.	such that / **(F4)** is visible.
18.	**/ (F4)**
19.	Type in 13.
20.	**ENTER**
	Last field on the screen displays **0.61538**.

26.4.3 Description of Softkeys

Overview of softkeys

The softkeys shown and described are those of **<Operatng Mode: RPN>**. Most of the softkeys are identical and their functionality is similar to that for **<Operatng Mode: Standard>**.

The function keys **F1-F6** are allocated seven times with softkeys. Using or the various allocations can be accessed.



Description of softkeys

First level

+ (F1)
To add **<X:>** and **<Y:>**.

- (F2)
To subtract **<X:>** from **<Y:>**.

*** (F3)**
To multiply **<X:>** by **<Y:>**.

/ (F4)
To divide **<Y:>** by **<X:>**.

+/- (F5)
To change between positive and negative algebraic sign for **<X:>**.

CLR X (F6)
To clear **<X:>**.

to access the **Second level**

Σ+ (F1)
To add **<X:>** to **<ΣX:>** and **<Y:>** to **<ΣY:>**.

Σ- (F2)
To subtract **<X:>** from **<ΣX:>** and **<Y:>** from **<ΣY:>**.

MEAN (F3)
To calculate the mean **<ΣX>**.

SDEV (F4)
To calculate the standard deviation for **<ΣX>**.

CLRΣ (F6)
To clear **<ΣX>** and **<ΣX>**.

▼ to access the **Third level**

SIN	COS	TAN	ASIN	ACOS	ATAN

SIN (F1)
To calculate sine of **<X:>**.

COS(F2)
To calculate cosine of **<X:>**.

TAN (F3)
To calculate tangent of **<X:>**.

ASIN (F4)
To calculate arcsine of **<X:>**.

ACOS (F5)
To calculate arccosine of **<X:>**.

ATAN (F6)
To calculate arctangent of **<X:>**.

▼ to access the **Fourth level**

°DMS	°DEC	PI		D->R	R->D

°DMS (F1)
To convert decimal degrees into dd.mm.ss.

°DEC(F2)
To convert dd.mm.ss into decimal degrees.

PI (F3)
To insert **<X: 3.1415926536>**. The number of decimals depends on the selection for **<Display Dec:>** in **TOOLS Calculator Configuration**.

D -> R (F5)
To convert degrees into radians.

R -> D (F6)
To convert radians into degrees.

▼ to access the **Fifth level**

POLAR	RECT	SQRT	X^2	1/X	Y^X

POLAR (F1)

Conversion of rectangular coordinates into polar coordinates. The y coordinate must be visible in **<Y:>** and the x coordinate in **<X:>** when pressing this key. The angle is displayed in **<Y:>** and the distance in **<X:>**.

RECT(F2)

Conversion of polar coordinates into rectangular coordinates. The angle must be visible in **<Y:>** and the distance in **<X:>** when pressing this key. The y coordinate is displayed in **<Y:>**, the x coordinate in **<X:>**.

SQRT (F3)

To calculate $\sqrt{\ }$ **<X:>**.

X^2 (F4)

To calculate **<X:>**^{2}.

1/X (F5)

To inverse **<X:>**.

Y^X (F6)

To calculate **<Y:>**$^{\mathbf{<X:>}}$.

▼ to access the **Sixth level**

LOG	10^X	LN	e^X		Y^X

LOG (F1)

To calculate the $\log_{10}{}^{\mathbf{<X:>}}$.

10^X(F2)

To calculate $10^{\mathbf{<X:>}}$.

LN (F3)

To calculate the $\log_{e}{}^{\mathbf{<X:>}}$.

e^X (F4)
To calculate $e^{\mathbf{<X:>}}$.

Y^X (F6)
To calculate $\mathbf{<Y:>}^{\mathbf{<X:>}}$.

to access the **Seventh level**

STO	RCL	X<>Y	LASTX		CLEAR

STO (F1)
To store **<X:>** to the memory. Up to ten values can be stored.

RCL (F2)
To recall a value for **<X:>** from the memory. Up to ten values can be recalled.

X<>Y (F3)
To swap the values for **<X:>** and **<Y:>**.

LASTX (F4)
To recall the last **<X:>** before recent calculation.

CLEAR (F6)
To delete everything.

SHIFT to access the second level of function keys

HELP	CONF		DONE		QUIT

SHIFT CONF (F2)
To configure the calculator.

SHIFT DONE (F4)
To return to **TPS1200 Main Menu**.

26.4.4 Calling and Closing the Calculator from an Input Field for Numeric Characters

COGO traverse calculation is used as example.

Call and close calculator step-by-step

Step	Description	Refer to chapter
1.	Select **Main Menu: Programs...\COGO** to access the screen **COGO COGO Begin**.	
2.	**COGO COGO Begin** Check the settings.	
3.	**CONT (F1)** to access **COGO COGO Menu**.	
4.	**COGO COGO Menu** Highlight **Traverse**.	
5.	**CONT (F1)** to access **COGO Traverse Input**.	
6.	**COGO Traverse Input** Highlight **<Azimuth:>**.	
7.	**ENTER**	
8.	**CALC (F5)** to access **TOOLS XX Calculator**.	
	If a value had already been typed in for **<Azimuth:>**, this value is taken over into the input field in **TOOLS XX Calculator**.	
9.	**TOOLS XX Calculator**	

Step	Description	Refer to chapter
	Perform the calculations.	26.4.1, 26.4.2
10.	**SHIFT DONE (F4)** to return to **COGO Traverse Input**.	
☞	The calculated value is taken over for **<Azimuth:>**.	

27 Tools...\File Viewer

Description

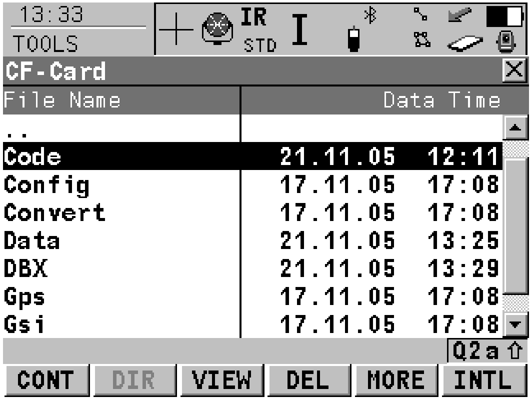
Allows ASCII files on the memory device to be viewed. The ASCII file can have up to 500 KB. Refer to "Appendix C Directory Structure of the Memory Device" for more information on the contents of folders on the memory device.

The \DBX directory cannot be accessed to view files.

Access

Select **Main Menu: Tools...\File Viewer**.

TOOLS Device\Directory



CONT (F1)
To access the highlighted directory or to view the highlighted file.

DIR (F2)
Available for a directory or **..** being highlighted. To access the highlighted directory or to move up one directory.

VIEW (F3)
Available for a file being highlighted. To view the highlighted file. Accesses **TOOLS View File: File Name**. Refer to "TOOLS View File: File Name".

DEL (F4)
Available for a file being highlighted. To delete the highlighted file.

MORE (F5)
To display information about the size of a directory or file.

CFCRD (F6) or **INTL (F6)**
Available for instruments with internal memory. To change between viewing jobs stored on the CompactFlash card or internal memory.

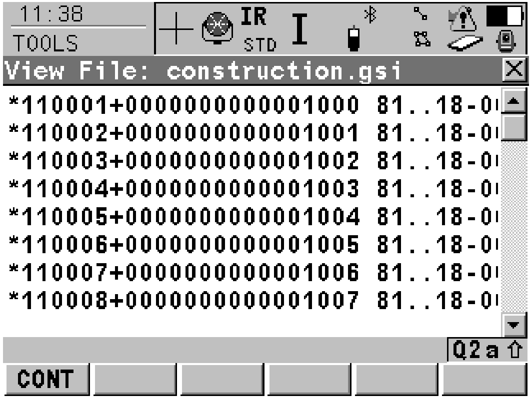
Description of columns

Column	Description
First	Directories and files are displayed if available. The file extension is shown for files. \ at the beginning of a line indicates a directory. .. is displayed at the top of the list if a directory has been accessed.
Second	Date of the directory or file.
Third	Time of the directory or file.

Next step

IF	THEN
the screen is to be quit	**ESC** to return to **TPS1200 Main Menu**.
a directory is to accessed	highlight the directory and **DIR (F2)**.
a file is to be viewed	highlight the file and **VIEW (F3)**. Refer to "TOOLS View File: File Name".

TOOLS View File: File Name



CONT (F1)
To return to the screen from where this screen was accessed.

Keys

Keys	Function
	Moves up.
	Moves down.
	Moves right.
	Moves left.

Next step

CONT (F1) returns to the screen from where **TOOLS View File: File Name** was accessed.

28 Tools...\Licence Keys

Description

- A licence key can be used to activate application programs and protected options and can be used to define the expiry date of the software maintenance. Refer to "30.4 STATUS: System Information" to find out how to check the expiry date of the software maintenance.
- A licence key file can be uploaded to the instrument. To upload a licence key file the file should be located on the \SYSTEM directory of the CompactFlash card. Licence key files use the naming convention L_123456.key, where 123456 is the instrument serial number.
- Licence keys can also be typed in manually in **Main Menu: Tools...\Licence Keys** or the first time the application program is started.

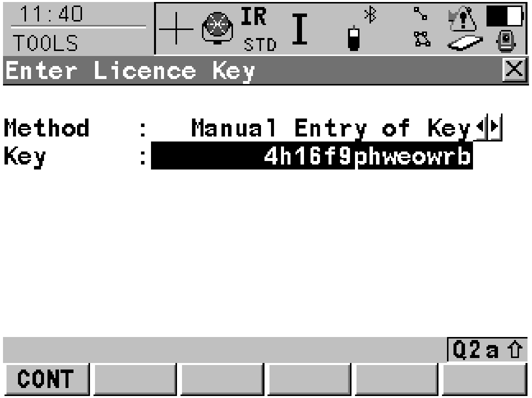
Access

Select **Main Menu: Tools...\Licence Keys**.

OR

Select an application program not yet activated.

TOOLS
Enter Licence Key



CONT (F1)
To accept changes and return to **TPS1200 Main Menu** or continue with application program.

SHIFT DEL (F4)
To delete all licence keys on the instrument.

Description of fields

Field	Option	Description
<Method:>		The method used to input the licence key to activate the application program or the protected options or the software maintenance.
	Upload Key File	The licence key file is uploaded from the CompactFlash card. The licence key file must be stored in the \SYSTEM directory on the CompactFlash card.
	Manual Entry of Key	Allows the licence key to be typed in manually.

Field	Option	Description
<Key:>	User input	Available for **<Method: Manual Entry of Key>**. The licence key required to activate an application program. Entry is not case sensitive.

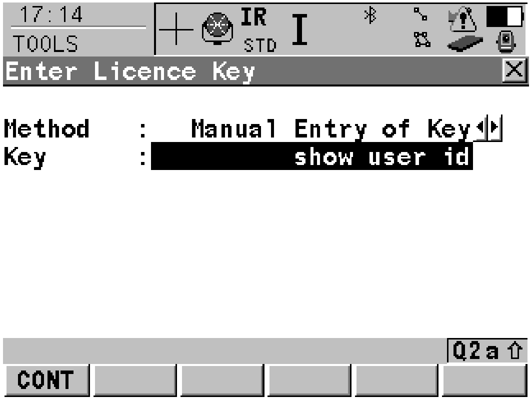
Next step

CONT (F1) returns to **TPS1200 Main Menu** or continues with selected application program.

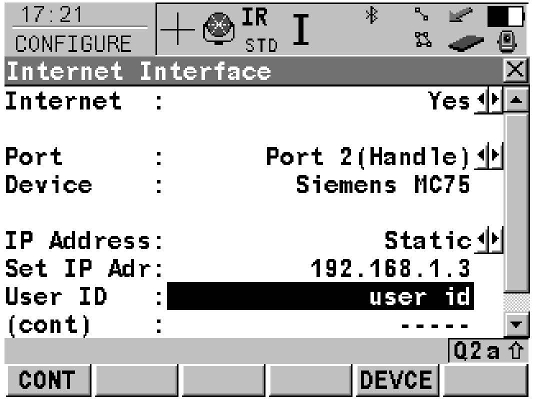
Showing/Hiding the User ID for the Internet Interface

Showing The User ID

1) Type "show user id" (not case sensitive) and press **CONT (F1)** to continue.

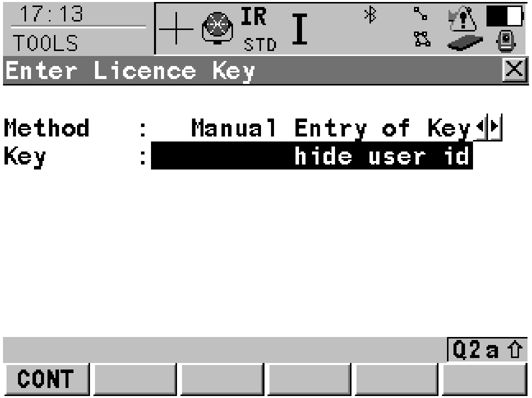


2) The user Id will then always be displayed.

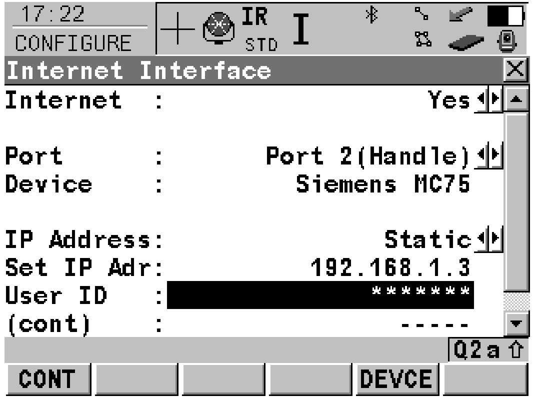


Hiding the User ID

1) Type "hide user id" (not case sensitive) and press **CONT (F1)** to continue.



2) The user Id will then always be hidden.



29 Tools...\Check & Adjust

29.1 Overview

Description

Leica instruments are manufactured, assembled and adjusted to the best possible quality. Quick temperature changes, shock or stress can cause deviations and influence the instrument accuracy.

It is therefore recommended to check and adjust the instrument from time to time. This can be done in the field by running through specific measurement procedures. The procedures are guided and have to be followed carefully and precisely as described in the following chapters. Some other instrument errors and mechanical parts can be adjusted mechanically.

Electronic adjustment

The following instrument errors can be checked & adjusted electronically:

l, t	Compensator longitudinal and transversal index errors
i	Vertical index error, related to the standing axis
c	Hz collimation error, also called line of sight error
a	Tilting axis error
ATR	ATR zero point error for Hz and V - option

Every angle measured in the daily work is corrected automatically if the compensator and the Hz-corrections are activated in the instrument configuration. Select **Main Menu: Config...\Instrument Settings...\Compensator** to check the settings.

The results from check and adjust are displayed as errors but used with the opposite sign as corrections when applied to measurements.

Mechanical adjustment

Refer to the Leica TPS1200 User Manual for details.

Precise measurements

To get precise measurements in the daily work, it is important:

- To check and adjust the instrument from time to time.
- To take high precision measurements during the check and adjust procedures.
- To measure targets in two faces. Some of the instrument errors are eliminated by averaging the angles from both faces.
- To follow the four advices below.

☞ During the manufacturing process, the instrument errors are carefully determined and set to zero. As mentioned above, these errors can change and it is highly recommended to redetermine them in the following situations:

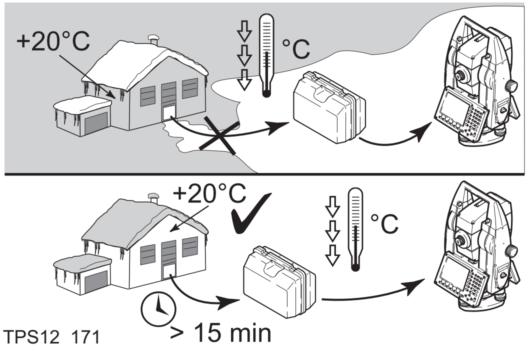
- Before the first use
- Before every high precision survey
- After rough or long transportations
- After long working periods
- After long storage periods
- If the temperature difference between current environment and the temperature at the last calibration is more than 20°C

☞ Before determining the instrument errors, the instrument has to be levelled up using the electronic level. **SHIFT F12** to access **STATUS Level & Laser Plummet**, Refer to "30.7 STATUS: Level & Laser Plummet".

The tribrach, the tripod and the underground should be very stable and secure from vibrations or other disturbances.

The instrument should be protected from direct sunlight in order to avoid thermal warming in general and especially on one side of the instrument housing.

It is also recommended to avoid strong heat shimmer and air turbulences. The best conditions can be found usually early in the morning and with overcast sky.



TPS12_171

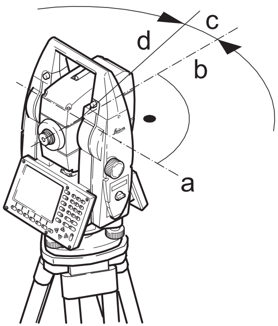
Before starting to work, the instrument has to become acclimatised to the ambient temperature. Approximately two minutes per °C temperature difference from storage to working environment but at least 15 min should be taken into account.

29.2 Details on Instrument Errors

General

Instrument errors occur, if the standing axis, the tilting axis and the line of sight are not precisely perpendicular to each other.

Hz collimation error (c)

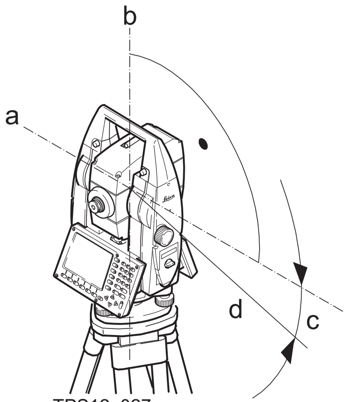


TPS12_026

a) Tilting axis
b) Line perpendicular to tilting axis
c) Hz collimation error (c), also called line of sight error
d) Line of sight

The Hz collimation error (c) is also called line of sight error. It is caused by the deviation between the optical line of sight, which means the direction in which the crosshairs points and the line perpendicular to the tilting axis. This error affects all Hz readings and increases with steep sightings.

Tilting axis error (a)



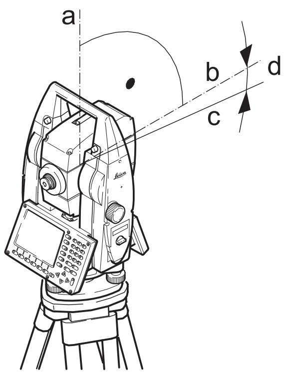
TPS12_027

a) Axis perpendicular to the vertical axis
b) Mechanical vertical axis of the instrument, also called standing axis
c) Tilting axis error
d) Tilting axis

The tilting axis error (a) is caused by the deviation between the mechanical tilting axis and the line perpendicular to the vertical axis.

This error affects Hz angles. The affection is 0 in the horizon and increases with steep sights. To determine this error, it is necessary to point to a target located significantly below or above the horizontal plane. To avoid influences from the Hz collimation error (c), this has to be determined prior to the tilting axis error.

Vertical index error (i)

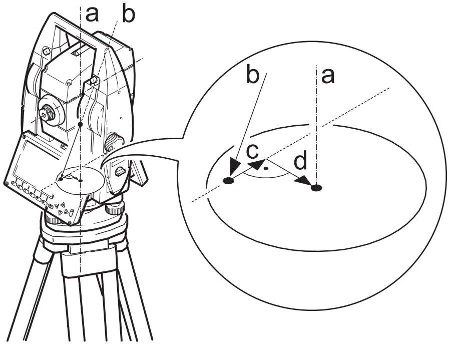


TPS12_023

a) Mechanical vertical axis of the instrument, also called standing axis
b) Axis perpendicular to the vertical axis
c) V = 90° reading in a specific face
d) Vertical index error

A vertical index error (i) exists, if the 0° mark of the vertical circle reading doesn't coincide with the mechanical vertical axis of the instrument, also called standing axis.
The V index error (i) is a constant error that affects all vertical angle readings.

Compensator index errors (l, t)



TPS12_022

a) Mechanical vertical axis of the instrument, also called standing axis
b) Plumb line
c) Longitudinal component (l) of the compensator index error
d) Transversal component (t) of the compensator index error

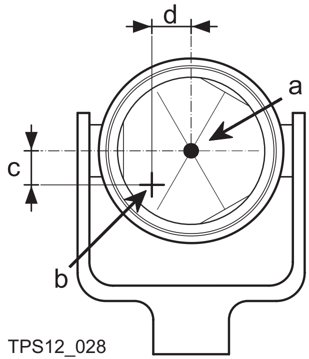
The compensator index errors (l, t) occur, if the vertical axis of the instrument and the plumb-line are parallel but the zero points of the compensator and the circular level do not coincide. The calibration procedure electronically adjusts the zero point of the compensator.

The plane of the dual axis compensator of the TPS1200 is defined by a longitudinal component in direction of the telescope and a transversal component perpendicular to the telescope.

The longitudinal compensator index error (l) has a similar effect as the vertical index error and affects all vertical angle readings.

The transversal compensator index error (t) is similar to the tilting axis error. The effect of this error to the Hz angle readings is 0 at the horizon and increases with steep sightings.

ATR collimation errors



a) Centre of prism
b) Crosshairs
c) V component of ATR collimation error
d) Hz component of ATR collimation error

The ATR collimation error is the angular divergence between the line of sight, which means the direction in which the crosshairs points, and the ATR CCD camera axis, which detects the centre of the prism. Hz and V angles are corrected by the Hz and V components of the ATR calibration errors to measure exactly to the centre of the prism.

☞ Note, that even after adjustment of the ATR, the crosshairs might not be positioned exactly on the centre of the prism after an ATR search. This is a normal effect. To speed up the ATR search, the telescope is not positioned exactly on the centre of the prism. The small rest deviations, the ATR offsets, are measured individually for each measurement and corrected electronically. This means that the Hz- and V- angles are corrected twice: first by the determined ATR errors for Hz and V and then by the individual small deviations of the current pointing, the ATR offsets.

Summary of errors to be adjusted electronically

Instrument error	Effects Hz	Effects V	Elimination with two face measurement	Automatically corrected with proper adjust-ment
c - Hz collimation error	✓	-	✓	✓
a - Tilting axis error	✓	-	✓	✓
l - Compensator index error	-	✓	✓	✓
t - Compensator index error	✓	-	✓	✓
i - V-Index error	-	✓	✓	✓
ATR Collimation error	✓	✓	-	✓

29.3 Accessing Check & Adjust Menu

Access

Select **Main Menu: Tools...\Check & Adjust...**

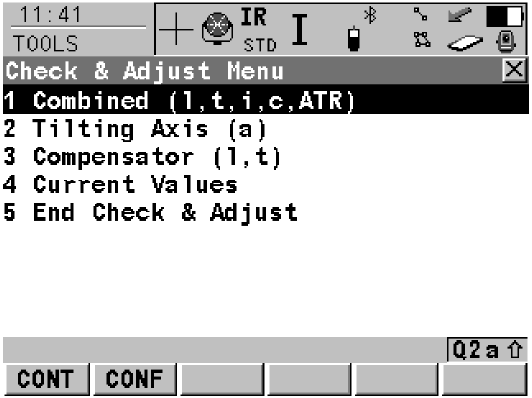
OR

Press a hot key configured to access the screen **TOOLS Check & Adjust Menu**. Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

TOOLS Check & Adjust Menu



CONT (F1)
To select the highlighted option and to continue with the subsequent screen.

CONF (F2)
To access the **TOOLS Configuration** screen. Refer to "29.4 Configure Check & Adjust".

Description of the Check & Adjust functions

Function	Description	Refer to chapter
Combined (l,t,i,c,ATR)	To determine the l, t, i, c and ATR instrument errors.	29.5
Tilting Axis (a)	To determine the tilting axis (a) error.	29.6
Compensator (l,t)	To determine the compensator (l, t) errors.	29.7
Current Values	To view the current instrument errors	29.8
End Check & Adjust	To exit the **TOOLS Check & Adjust Menu**.	

Next step

IF the task is to	THEN
determine the instru-ment errors	select one of the three available check and adjust procedures: **Combined (l, t, i, c, ATR)**, **Tilting Axis (a)** or **Compensator (l, t)**.
adjust the circular level	Refer to "29.9 Adjusting the Circular Level of the Instrument and Tribrach".
adjust the EDM	Refer to "29.10 Adjustment of the Reflectorless EDM".
inspect the laser plummet	Refer to "29.12 Inspecting the Laser Plummet of the Instrument".
adjust the tripod	Refer to "29.13 Servicing the Tripod".
to end check and adjust	select **End Check & Adjust**.

29.4 Configure Check & Adjust

Access step-by-step

Step	Description
1.	Refer to "29.3 Accessing Check & Adjust Menu" to access **TOOLS Check & Adjust Menu**.
2.	**CONF (F2)** to access **TOOLS Configuration**.

TOOLS Configuration, Parameters page

CONT (F1)
To accept the settings and to return to the screen **TOOLS Check & Adjust Menu**

PAGE (F6)
To change to another page on this screen.

Description of fields

Field	Option	Description
<Adjust Reminder:>	**2 weeks, 1 month, 3 months, 6 months, 12 months** or	A reminder message is displayed each time the instrument is turned on if one or more adjustment values were determined longer ago than the time specified with this parameter. This helps to redetermine the instrument errors on a regular basis.
	Never	A reminder message to readjust the instrument is never displayed. This setting is not recommended.

Next step

PAGE (F6) changes to the **Logfile** page.

TOOLS Configuration, Logfile page

Description of fields

Field	Option	Description
<Write Logfile:>	**Yes** or **No**	To generate a logfile when the application program is exited. A logfile is a file to which data from an application program is written to. It is generated using the selected **<Format File:>**.
<File Name:>	Choicelist	Available for **<Write Logfile: Yes>**. The name of the file to which the data should be written. A logfile is stored in the \DATA directory of the active memory device. The data is always appended to the file.

Field	Option	Description
		Opening the choicelist accesses **XX Logfiles** where a name for a new logfile can be created and an existing logfile can be selected or deleted.
<Format File:>	Choicelist	Available for **<Write Logfile: Yes>**. A format file defines which and how data is written to a logfile. Format files are created using LGO. A format file must first be transferred from the CompactFlash card to the System RAM before it can be selected. Refer to "24 Tools...\Transfer Objects..." for information on how to transfer a format file. Opening the choicelist accesses **XX Format Files** where an existing format file can be selected or deleted.

Next step
PAGE (F6) changes back to the **Parameters** page.

29.5 Combined Adjustment (l, t, i, c and ATR)

Access step-by-step

Step	Description
1.	Refer to "29.3 Accessing Check & Adjust Menu" to access **TOOLS Check & Adjust Menu**.
2.	In **TOOLS Check & Adjust Menu** highlight **Combined (l,t,i,c,ATR)**.
3.	**CONT (F1)** to access **TOOLS Combined l**.

Description

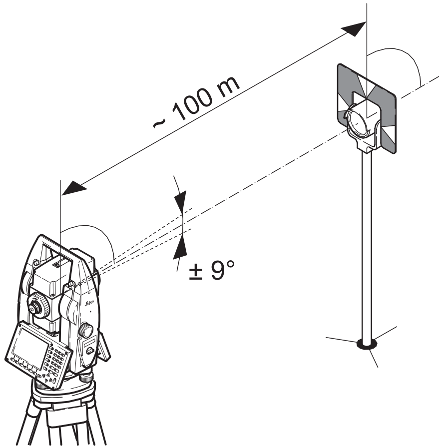
The combined adjustment procedure determines the following instrument errors in one process:

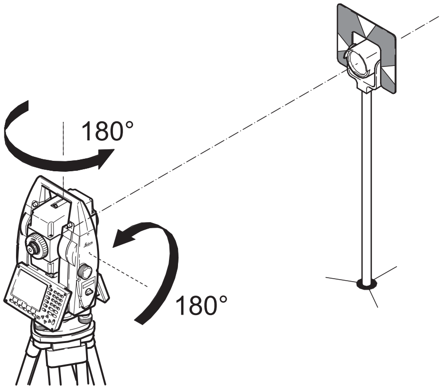
l, t	Compensator longitudinal and transversal index errors
i	Vertical index error, related to the standing axis
c	Hz collimation error, also called line of sight error
ATR Hz	ATR zero point error for Hz angle - option
ATR V	ATR zero point error for V angle - option

Combined procedure step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

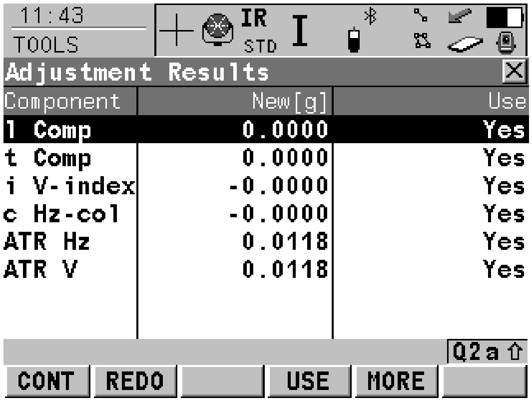
Step	Description	Refer to chapter
	Before determining the instrument errors, the instrument has to be: • levelled up using the electronic level • protected from direct sunlight • acclimatised to the ambient temperature, approximately two minutes per °C difference compared to the storage place. • Refer to "29.1 Overview" paragraph "Precise measurements" for more details.	
1.	**TOOLS Check & Adjust Menu** Select the option **Combined (l,t,i,c,ATR)**	
2.	**TOOLS Combined I** **<ATR Adjust: On>** Includes the determination of the ATR, Hz and V adjustment values if an ATR is available. It is recommended to use a clean Leica circular prism as target, for example a GPR1. Do not use a 360° prism. **<ATR Adjust: Off>** ATR Hz and V adjustment value determination is not included. A prism is not necessarily required to run the procedure.	

Step	Description	Refer to chapter
3.	 Aim the telescope accurately at a target at a distance of about 100 m. The target must be positioned within ± 9°/± 10 gon of the horizontal plane ☞ The procedure can be started in any telescope face. ☞ The fine pointing has to be performed manually in both faces.	

Step	Description	Refer to chapter
4.	**MEAS (F1)** to measure and to continue to the next screen.  TPS12_025 Motorised instruments change automatically to the other face. Non-motorised instruments guide to the other face using the **TOOLS Telescope Positioning** screen.	31
5.	**TOOLS Combined II** **MEAS (F1)** to measure the same target in the other face and to calculate the instrument errors.	
☞	If one or more errors are bigger than the predefined limits, the procedure has to be repeated. All measurements of the current run are rejected and are not averaged with the results from previous runs.	
6.	**TOOLS Adjustment Accuracy**	

Step	Description	Refer to chapter
	<No. of Meas:> Shows the number of runs executed. One run consists of a measurement in face I and face II. All other fields display the standard deviations of the determined adjustment errors. The standard deviations can be calculated from the second run onwards.	
	It is recommended to measure at least two runs.	
7.	**MEAS (F5)** if more runs have to be added. Continue with step 2. OR **CONT (F1)** to accept the measurements and to access **TOOLS Adjustment Results**. No more runs can be added later.	

TOOLS Adjustment Results



CONT (F1)
To accept and store the new determined instrument errors, where **Yes** is set in the Use column. Writes to or appends to an existing logfile, if the logfile recording has been enabled. Refer to "29.4 Configure Check & Adjust".

USE (F4)
To set **Yes** or **No** in the **Use** column for the highlighted set.

MORE (F5)
To view additional information about the current used old instrument errors.

REDO (F2)
To reject all results and to repeat the complete check and adjust procedure. Refer to step 2. of paragraph "Combined procedure step-by-step".

Description of columns and fields

Column	Option	Description
New [g]	**-----**	Shows the new determined and averaged instrument errors. The unit is displayed in [].
Use	**Yes** **No**	Stores the new adjustment error. Keeps the currently used error active on the instrument and rejects the new one.
Old [g]	**-----**	Shows the old adjustment errors, which are currently valid on the instrument. The unit is displayed in [].

Next step

IF the results are	THEN
to be stored	**CONT (F1)** overwrites the old adjustment errors with the new ones, if **Yes** is set in the **Use** column.

IF the results are	THEN
to be determined again	**REDO (F2)** rejects all new determined adjustment values and repeats the whole procedure. Refer to step 2. of paragraph "Combined procedure step-by-step".

29.6 Tilting Axis Adjustment (a)

Access step-by-step

Step	Description
1.	Refer to "29.3 Accessing Check & Adjust Menu" to access **TOOLS Check & Adjust Menu**.
2.	In **TOOLS Check & Adjust Menu** highlight **Tilting Axis (a)**.
3.	**CONT (F1)** to access **TOOLS Tilting-Axis Adjustment I**.

Description

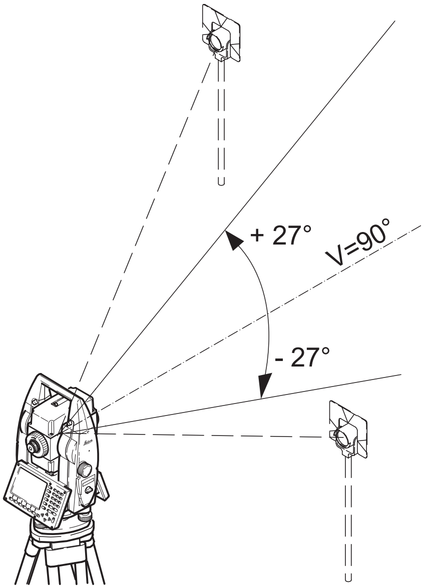
This procedure determines the following instrument error:

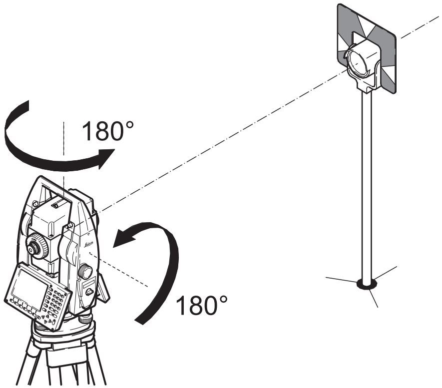
a Tilting axis error

Tilting axis adjustment step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

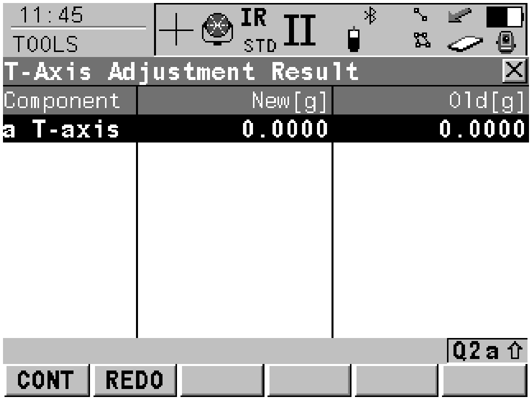
Step	Description	Refer to chapter
	Before determining the tilting axis error, the instrument has to be: • levelled up using the electronic level • protected from direct sunlight • acclimatised to the ambient temperature, approximately two minutes per °C difference compared to the storage place. • The Hz collimation error has to be determined before.	29.1, 29.5
1.	**TOOLS Check & Adjust Menu** Select the option: **Tilting Axis (a)**	

Step	Description	Refer to chapter
2.	**TOOLS Tilting-Axis Adjustment I**  Aim the telescope accurately at a target at a distance of about 100 m. For distances less than 100 m make sure to precisely point to the target. The target must be positioned within at least 27°/30 gon above or beneath the horizontal plane. ☞ The procedure can be started in any telescope face. ☞ The fine pointing has to be performed manually in both faces.	

Step	Description	Refer to chapter
3.	**MEAS (F1)** to measure and to continue to the next screen.  Motorised instruments change automatically to the other face. TPS12_025 Non-motorised instruments guide to the other face using the **TOOLS Telescope Positioning** screen.	31
4.	**TOOLS Tilting Axis Adjustment II** **MEAS (F1)** to measure the same target in the other face and to calculate the tilting axis error.	
☞	If the error is bigger than the predefined limit, the procedure has to be repeated. The measurements of the current run are then rejected and not averaged with the results from previous runs.	
5.	**TOOLS T-Axis Adjustment Accuracy**	

Step	Description	Refer to chapter
	<No. of Meas:> Shows the number of runs executed. One run consists of a measurement in face I and face II. **<σ a T-axis:>** shows the standard deviation of the determined tilting axis error. The standard deviation can be calculated from the second run onwards.	
	It is recommended to measure at least 2 runs.	
6.	**MEAS (F5)** if more runs have to be added. Continue with step 2. OR **CONT (F1)** to accept the measurements and to access **TOOLS T-Axis Adjustment Result**. No more runs can be added later.	

TOOLS
T-Axis Adjustment Result



CONT (F1)
To accept and record the new determined tilting axis error. Writes to or appends to an existing logfile, if the logfile recording has been enabled. Refer to "29.4 Configure Check & Adjust".

REDO (F2)
To reject the result and to repeat the complete check and adjust procedure. Refer to step 2. of paragraph "Tilting axis adjustment step-by-step".

Description of columns and fields

Column	Option	Description
New [g]	**-----**	Shows the new determined and averaged tilting axis error. The unit is displayed in [].
Old [g]	**-----**	Shows the old instrument error, which is currently valid on the instrument. The unit is displayed in [].

Next step

IF the result is	THEN
to be stored	**CONT (F1)** overwrites the old tilting axis error with the new one.
to be determined again	**REDO (F2)** rejects the new determined tilting axis error and repeats the whole procedure. Refer to step 2. of paragraph "Tilting axis adjustment step-by-step".

29.7 Compensator Adjustment (l, t)

Access step-by-step

Step	Description
1.	Refer to "29.3 Accessing Check & Adjust Menu" to access **TOOLS Check & Adjust Menu**.
2.	In **TOOLS Check & Adjust Menu** highlight **Compensator (l,t)**.
3.	**CONT (F1)** to access **TOOLS Compensator Adjustment**.

Description

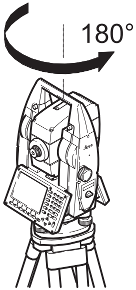
The compensator adjustment procedure determines the following instrument errors:

l Compensator longitudinal index error
t Compensator transversal index error

Compensator index adjustment step-by-step

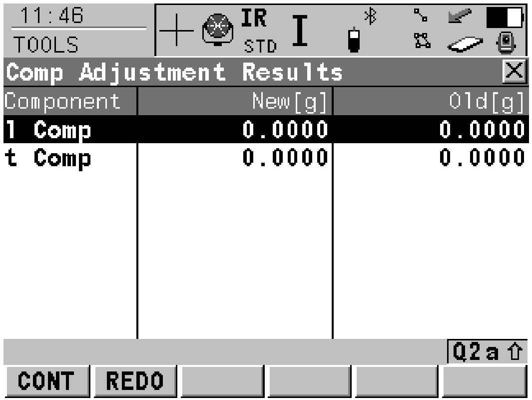
The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
☞	Before determining the compensator index errors, the instrument has to be: • levelled up using the electronic level • protected from direct sunlight • acclimatised to the ambient temperature, approximately two minutes per °C difference compared to the storage place.	29.1
1.	**TOOLS Check & Adjust Menu**	

Step	Description	Refer to chapter
	Select the option: **Compensator (l, t)**	
2.	**TOOLS Compensator Adjustment** **MEAS (F1)** to measure the first face. No target has to be aimed at.  TPS12_025a Motorised instruments change to the other face and release a measurement automatically. Non-motorised instruments guide to the other face using the **TOOLS Telescope Positioning** screen. **MEAS (F1)** to release the measurement in the other face.	
☞	If one or more errors are bigger than the predefined limits, the procedure has to be repeated. All measurements of the current run are rejected and are not averaged with the results from previous runs.	
3.	**TOOLS Comp Adjustment Accuracy** **<No. of Meas:>** Shows the number of runs executed. One run consists of a measurement in face I and face II. **<σ l Comp:>** and **<σ t Comp:>** show the standard deviations of the determined adjustment errors. The standard deviations can be calculated from the second run onwards.	
☞	It is recommended to measure at least two runs.	

Step	Description	Refer to chapter
4.	**MEAS (F5)** if more runs have to be added. Continue with step 2. OR **CONT (F1)** to accept the measurements and to access **TOOLS Comp Adjustment Results**. No more runs can be added later.	

TOOLS Comp Adjustment Results



CONT (F1)
To accept and record the new determined instrument errors. Writes to or appends to an existing logfile, if the logfile recording has been enabled. Refer to "29.4 Configure Check & Adjust".

REDO (F2)
To reject all results and to repeat the complete check and adjust procedure. Refer to step 2. of paragraph "Compensator index adjustment step-by-step".

Description of columns and fields

Column	Option	Description
New [g]	**-----**	Shows the new determined and averaged instrument errors. The unit is displayed in [].

Column	Option	Description
Old [g]	**-----**	Shows the old instrument errors, which are currently valid on the instrument. The unit is displayed in [].

Next step

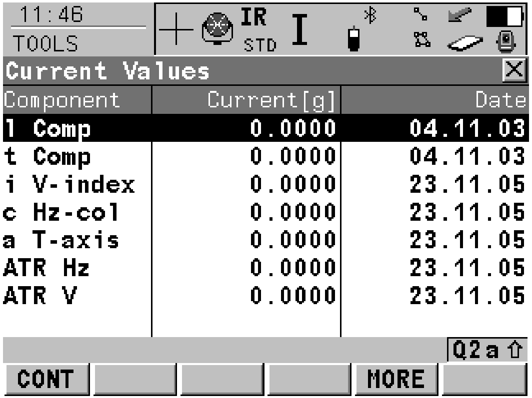
IF the results are	THEN
to be stored	**CONT (F1)** overwrites the old instrument errors with the new ones.
to be determined again	**REDO (F2)** rejects the new determined instrument errors and repeats the whole procedure. Refer to step 2. of paragraph "Compensator index adjustment step-by-step".

29.8 Current Instrument Errors

Access

Step	Description
1.	Refer to "29.3 Accessing Check & Adjust Menu" to access **TOOLS Check & Adjust Menu**.
2.	In **TOOLS Check & Adjust Menu** highlight **Current Values**.
3.	**CONT (F1)** to access **TOOLS Current Values**.

TOOLS Current Values



CONT (F1)
To return to the **TOOLS Check & Adjust Menu** screen. Refer to "29.3 Accessing Check & Adjust Menu".

MORE (F5)
To display information about the date of the determination, the standard deviation of the errors and the temperature during the determination.

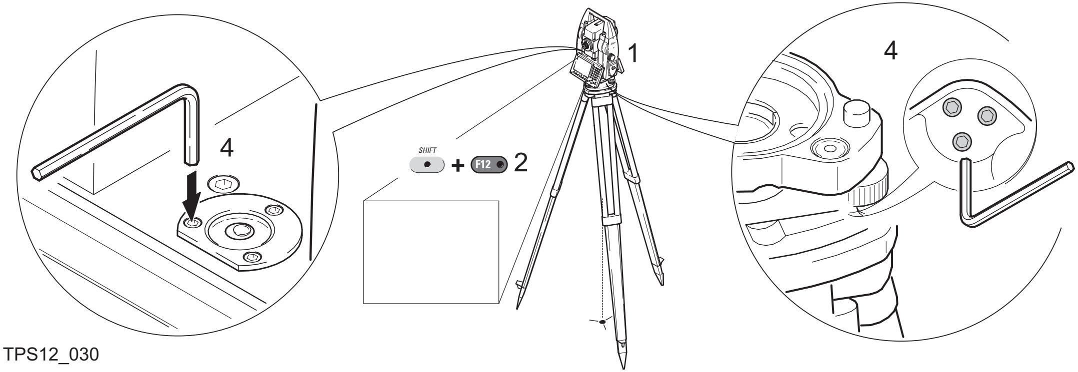
Next step

CONT (F1) returns to **TOOLS Check & Adjust Menu** screen. Refer to "29.3 Accessing Check & Adjust Menu".

☞ Note that the temperature of the environment around the instrument may differ from the temperature shown on the screen as it is the internal temperature of the instrument.

29.9 Adjusting the Circular Level of the Instrument and Tribrach

Adjusting the circular level step-by-step



TPS12_030

Step	Description
1.	Place and secure the instrument into the tribrach and onto a tripod.
2.	Using the tribrach footscrews, level the instrument with the electronic level. **SHIFT F12** to access **STATUS Level & Laser Plummet**.
3.	Check the position of the circular level on the instrument and tribrach.
4.	a) If both circular levels are centered, no adjustments are necessary
	b) If one or both circular levels are not centered, adjust as follows:
	Instrument: If it extends beyond the circle, use the supplied allen key to centre it with the adjustment screws. Turn the instrument by 200 gon (180°). Repeat the adjustment procedure if the circular level does not stay centered.

Step	Description
	Tribrach: If it extends beyond the circle, use the supplied allen key to centre it with the adjustment screws.
☞	After the adjustments, all adjusting screws should have the same tightening tension and no adjusting screw shall be loose.

29.10 Adjustment of the Reflectorless EDM

Chapter validity

Refer to the Leica TPS1200 User Manual for details.

General

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

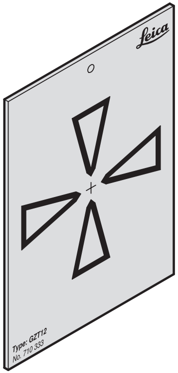
☞ The direction of the beam should be inspected before precise measurements of distances are attempted, because an excessive deviation of the laser beam from the line of sight can result in unprecise distance measurements.

☞ Direct intrabeam viewing is always hazardous.

Precautions:

Do not stare into the beam or direct it towards other people unnecessarily. These measures are also valid for the reflected beam.

Inspecting the direction of the beam step-by-step



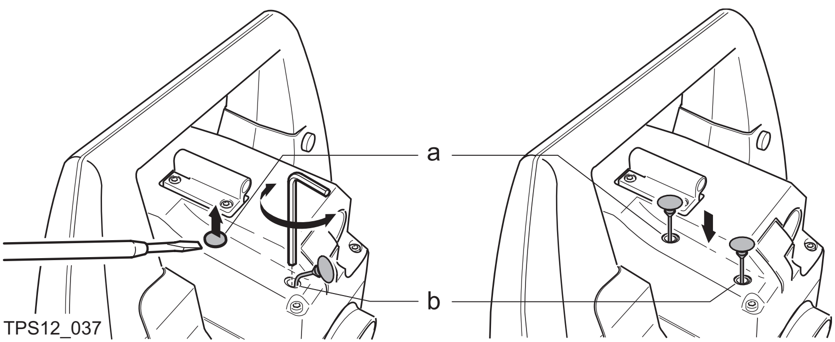
TPS12_36

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Set up the provided target plate between 5 m and 20 m with the grey reflective side facing the instrument.	
2.	Move the telescope to face II.	
3.	Switch on the red laser beam by activating the laser pointer function. **SHIFT F11** to access **CONFIGURE Lights, Display, Beeps, Text** and then select the **Lights** page.	18.5

Step	Description	Refer to chapter
4.	Align the instrument crosshairs to the centre of the target plate and then inspect the position of the red laser dot on the target plate. ☞ The red dot cannot be seen through the telescope. Look at the target plate from just above the telescope or from just to the side of it.	
5.	If the dot illuminates the cross, the achievable adjustment precision has been reached; if it lies outside the limits of the cross, the direction of the beam needs to be adjusted. Refer to "Adjusting the direction of the beam step-by-step" in this chapter. ☞ If the dot on the more reflective side of the plate is too bright and dazzling, use the white side instead to carry out the inspection.	

Adjusting the direction of the beam step-by-step



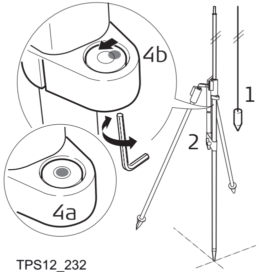
a) Rear adjustment port
b) Front adjustment port

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Carefully pull the two plugs out from the adjustment ports on top side of the telescope housing in face II. Make sure not to break the strings of the two plugs.	
2.	To correct the height of the beam, insert the supplied screwdriver into the rear adjustment port and turn it clockwise to move the dot on the target plate obliquely upwards or anticlockwise to move in the opposite side.	
3.	To correct the beam laterally, insert the screwdriver into the front adjustment port and turn it clockwise to move the dot on the target plate to the right or anticlockwise to move it to the left.	
	Throughout the adjustment procedure, keep the telescope pointing to the target plate.	
4.	After each adjustment, put the plugs back into the ports to keep out damp and dirt.	

29.11 Adjusting the Circular Level of the Prism Pole

Adjusting the circular level step-by-step



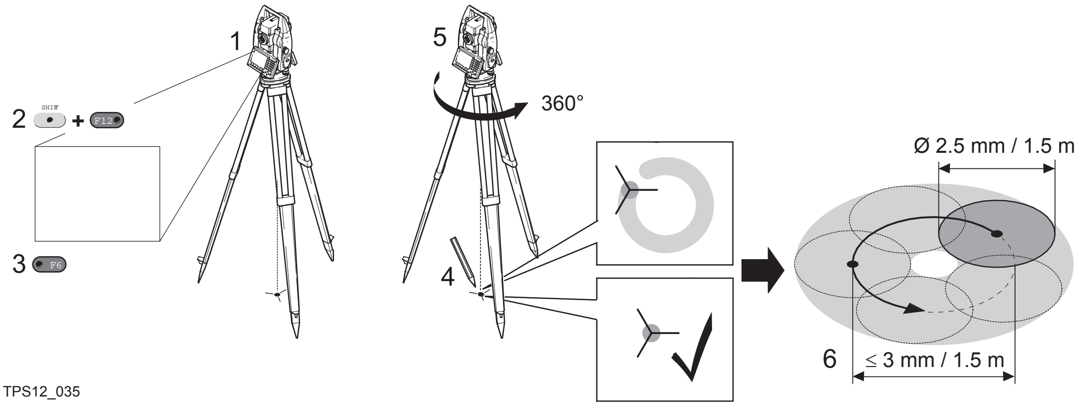
TPS12_232

Step	Description
1.	Suspend a plumb line.
2.	Using a pole bipod, align the prism pole parallel to the plumb line.
3.	Check the position of the circular level on the prism pole.
4.	a) If the circular level is centered, no adjustment is necessary.
	b) If the circular level is not centered, use an allen key to centre it with the adjustment screws.
☞	After the adjustments, all adjusting screws should have the same tightening tension and no adjusting screw shall be loose.

29.12 Inspecting the Laser Plummet of the Instrument

☞ The laser plummet is located in the vertical axis of the instrument. Under normal conditions of use, the laser plummet does not need adjusting. If an adjustment is necessary due to external influences, the instrument has to be returned to any Leica Geosystems authorized service workshop.

Inspecting the laser plummet step-by-step



TPS12_035

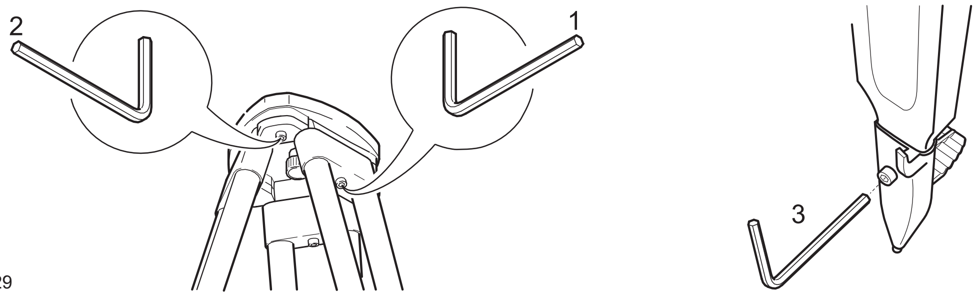
The following table explains the most common settings.

Step	Description
1.	Place and secure the instrument into the tribrach and onto a tripod.
2.	Using the tribrach footscrews, level the instrument with the electronic level. **SHIFT F12** to access **STATUS Level & Laser Plummet**.

Step	Description
3.	**PAGE (F6)** to access the **Laser Plummet** page. Switch on the laser plummet. Inspection of the laser plummet should be carried out on a bright, smooth and horizontal surface, like a sheet of paper.
4.	Mark the centre of the red dot on the ground.
5.	Turn the instrument through 360° slowly, carefully observing the movement of the red laser dot.
☞	The maximum diameter of the circular movement described by the centre of the laser point should not exceed 3 mm at a distance of 1.5 m.
6.	If the centre of the laser dot describes a perceptible circular movement or moves more than 3 mm away from the point which was first marked, an adjustment may be required. Inform your nearest Leica Geosystems authorized service workshop. Depending on brightness and surface, the diameter of the laser dot can vary. At 1.5 m it is about 2.5 mm.

29.13 Servicing the Tripod

Servicing the tripod step-by-step



TPS12_029

The following table explains the most common settings.

Step	Description
☞	The connections between metal and timber components must always be firm and tight.
1.	Tighten the leg cap screws moderately, with the supplied allen key.
2.	Tighten the articulated joints on the tripod head just enough to keep the tripod legs open when lifting the tripod off the ground.
3.	Tighten the allen screws of the tripod legs.

30 STATUS

30.1 STATUS Functions

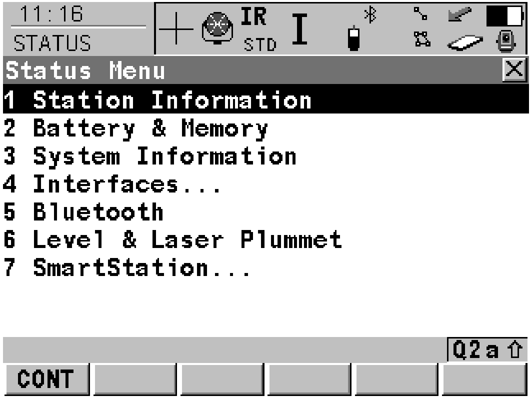
Description

The STATUS functions help using the instrument by showing the state of many instrument functions. All fields are output fields. Unavailable information is indicated by -----.

Access

Press **USER** and then **STAT (F3)**. Refer to "2.2 USER Key" for information on the **USER** key.

STATUS
Status Menu



CONT (F1)
To select the highlighted option and to continue with the subsequent screen.

Description of the STATUS functions

STATUS function	Description	Refer to chapter
Station Information	Information related to the current station set on the instrument.	30.2
Battery & Memory	Information related to use and status of battery and memory.	30.3
System Information	Information related to the instrument hardware and firmware.	30.4
Interfaces...	Information related to the configuration and use of interfaces, port and devices.	30.5
Bluetooth	Information related to the configuration and use of Bluetooth interfaces.	30.7
Level & Laser Plummet	Information related to electronic level and laser plummet.	30.8
SmartStation...	Information related to the active survey and Smart-Station firmware.	30.8

30.2 STATUS: Station Information

Access

Select **STATUS: Station Information**.

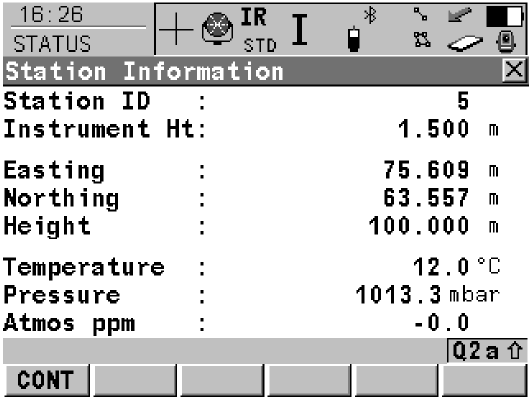
Refer to "30.1 STATUS Functions" on how to access the STATUS menu.

OR

Press a hot key configured to access the screen **STATUS Station Information**.

Refer to "2.1 Hot Keys" for information on hot keys.

STATUS Station Information



CONT (F1)
To exit **STATUS Station Information**.

Description of fields

Field	Description
<Station ID:>	Station ID of the current station set-up.
<Instrument Ht:>	Instrument height of the current station set-up.

Field	Description
<Easting:>	Easting value of the instrument position.
<Northing:>	Northing value of the instrument position.
<Height:>, **<Local Ell Ht:>** or **<Ortho Ht:>**	If no coordinate system is selected the orthometric height **<Height:>** of the instrument position is displayed. For a selected coordinate system, orthometric or ellipsoidal height can be displayed.
<Temperature:>	Temperature set on the instrument.
<Pressure:>	Pressure set on the instrument.
<Atmos ppm:>	Atmospheric ppm set on the instrument.

Next step

CONT (F1) to exit **STATUS Station Information**.

30.3 STATUS: Battery & Memory

Access

Select **STATUS: Battery & Memory**.
Refer to "30.1 STATUS Functions" on how to access the STATUS menu.

OR

Press a hot key configured to access the screen **STATUS Battery & Memory**.
Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

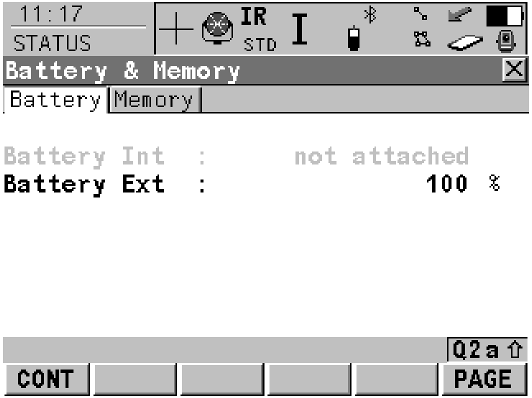
OR

Tap the battery icon. Refer to the TPS1200 System Field Manual for information on icons.

OR

Tap the CompactFlash card/internal memory icon.
Refer to the TPS1200 System Field Manual for information on icons.

STATUS
Battery & Memory, Battery page



CONT (F1)
To exit **STATUS Battery & Memory**.

PAGE (F6)
To change to another page on this screen.

Description of fields

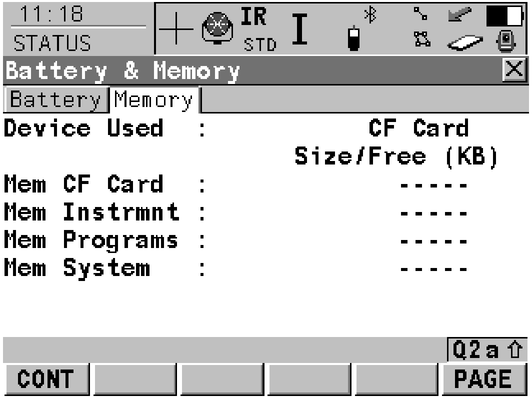
Field	Description
Any field	The percentage of remaining power capacity for all batteries are displayed numerically. Batteries not in use are shown in grey. For internal and external battery being attached at the same time the internal battery is used until it is empty and then the external battery is used.

Next step

PAGE (F6) changes to the **Memory** page.

STATUS
Battery & Memory,
Memory page

If no information for a field is available, for example no CompactFlash card is inserted, then ----- is displayed.



CONT (F1)
To exit **STATUS Battery & Memory**.

PAGE (F6)
To change to another page on this screen.

Description of fields

Field	Description
<Device Used:>	The memory device in use.
<Mem CF Card:>	The total/free memory for data storage on the CompactFlash card.
<Mem Instrmnt:>	The total/free memory for data storage on the internal memory. A grey field and grey ----- indicate an unavailable internal memory.
<Mem Programs:>	The total/free system memory used for application programs.

Field	Description
<Mem System:>	The total/free system memory. The system memory stores • instrument related files such as system settings. • survey related files such as codelists and configuration sets.

Next step

CONT (F1) to exit **STATUS Battery & Memory**.

30.4 STATUS: System Information

Access

Select **STATUS: System Information**.
Refer to "30.1 STATUS Functions" on how to access the STATUS menu.

OR

Press a hot key configured to access the screen **STATUS System Information**.
Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

STATUS System Information, Instrument page

Shows the type of instrument, the serial number, the currently active system language and displays available instrument hardware options such as ATR or PowerSearch.

Description of fields

Field	Description
<Instr Type:>	Type of instrument.
<Serial No.:>	Serial number of instrument.
<Eqpmnt No.:>	Equipment number of instrument.
<Instrmnt ID:>	User defined instrument ID.
<Sys Lnguage:>	Currently selected system language.
<Reflectless:>	The reflectorless EDM to be PinPoint R100, R300 or none.
<ATR:>	Instrument equipped with automated target recognition or not.
<PowerSearch:>	Instrument equipped with PowerSearch or not.

Field	Description
<GUS74:>	Instrument equipped with GUS74 or not.
<Extd GeoCOM:>	Instrument equipped with extended GeoCOM or not.
<L2C tracking:>	SmartStation option. The ability to track the L2C signal.
<MMT:>	SmartStation option. The availability of multipath mitigation.
<GLONASS ready:>	SmartStation option. The availability of GLONASS each Wed.
<GLONASS perm:>	SmartStation option. The permanent availability of GLONASS.

Next step

PAGE (F6) changes to the **Firmware** page.

STATUS System Information, Firmware page

Shows the versions of all system firmware.

Description of fields

Field	Description
<Firmware:>	Firmware version of the onboard software.
<Maintenance End:>	Expiry date of the software maintenance.
<Build User Iface:>	Build version of the onboard software.
<Build Processb.:>	Build version of the processor board.
<ATR:>	Firmware version of the **A**utomatic **T**arget **R**ecognition.
<EDM:>	Firmware version of the **E**lectronic **D**istance **M**easurement.
<PS:>	Firmware version of the **P**ower**S**earch.

Field	Description
<Boot:>	Firmware version of the boot software.
<API:>	Firmware version for the application program interface.
<EF Interface:>	Firmware version for the electric front interface.
<Keyboard/Display:>	Firmware version for the graphical user interface.

Next step
PAGE (F6) changes to the **Application** page.

STATUS System Information, Application page

Shows the versions of all uploaded application programs.

Next step
CONT (F1) exits **STATUS System Information**.

30.5 STATUS: Interfaces...

Description

STATUS Interfaces gives an overview of all interfaces with the port and the devices currently assigned.

Access

Select **STATUS: Interfaces...**.

Refer to "30.1 STATUS Functions" on how to access the STATUS menu.

OR

Press a hot key configured to access the screen **STATUS Interfaces**.

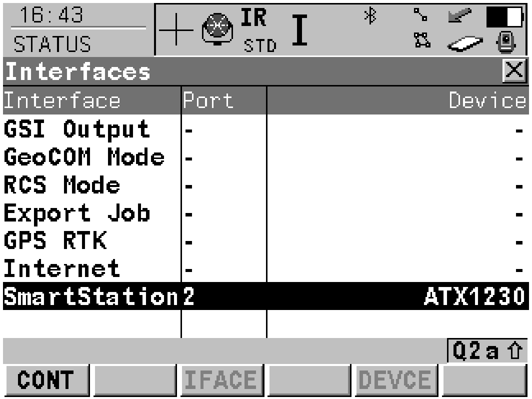
Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

STATUS Interfaces

The screen gives an overview of all interfaces with the currently assigned port and device. Unavailable information is indicated by -----.



CONT (F1)

To exit **STATUS Interfaces**.

IFACE (F3)

Available for **GPS RTK** or **Internet** being highlighted. To view information related to real-time data or the internet connection. For real-time refer to "30.8.2 Real-Time Status".

DEVCE (F5)

Available for **GPS RTK** or **Internet** being highlighted. To view the status of the attached device. Refer to "30.8.2 Real-Time Status" paragraph "STATUS Real-Time Input, Device page".

Next step

CONT (F1) exits **STATUS Interfaces**.

30.6 STATUS: Bluetooth

Description

This screen shows

- Bluetooth ports available and configured.
- the device attached and connected to each Bluetooth port.
- the ID address of each device.

Access

Select **STATUS: Bluetooth**.
Refer to "30.1 STATUS Functions" on how to access the STATUS menu.

OR

Tap the Bluetooth icon.
Refer to the GPS1200 System Field Manual for information on icons.

STATUS Bluetooth

The way information is displayed indicates the configuration status of the Bluetooth port and the connection status of the device.

Information displayed	Bluetooth port configured	Device connected
in black	✓	✓
in grey	✓	-
as **-----**	-	-

Next step
CONT (F1) exits **STATUS Bluetooth**.

30.7 STATUS: Level & Laser Plummet

Description

The electronic level is shown and can be centred.

Access

Select **STATUS: Level & Laser Plummet**.
Refer to "30.1 STATUS Functions" on how to access the STATUS menu.

OR

Press **SHIFT F12**.

OR

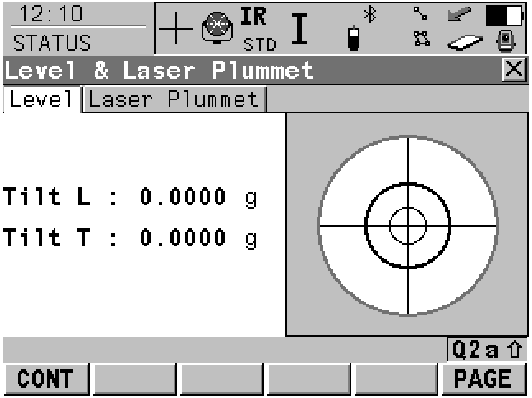
Press a hot key configured to access the screen **STATUS Level & Laser Plummet**.
Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

☞ The level moves linear with the inclination values **<Tilt L:>** and **<Tilt T:>.** On the screen closest to the circular level, the electronic level moves down if the value in **<Tilt L:>** gets bigger and vice versa. If the value for **<Tilt T:>** gets bigger the level moves left and vice versa.

STATUS
Level & Laser Plummet, Level page



CONT (F1)
To exit **STATUS Level & Laser Plummet**.

PAGE (F6)
To change to another page on this screen.

Description of fields

Field	Description
<Tilt L:>	Longitudinal tilt of the vertical axis.
<Tilt T:>	Transversal tilt of the vertical axis.

Next step

PAGE (F6) changes to the **Laser Plummet** page.

STATUS Level & Laser Plummet, Laser Plummet page

Description of fields

Field	Option	Description
<Laser Plummet:>	**On** or **Off**	To turn the laser plummet on or off. Is always set on when accessing this screen. Changing this setting turns the laser plummet on or off immediately.
<Intensity:>	From **0 %** to **100 %**	The percentage of the intensity of the laser plummet is displayed numerically and graphically. The minimum value is 10%. Changing this value with the right and left arrow keys changes the intensity of the laser plummet immediately.

Next step

CONT (F1) exits **STATUS Level & Laser Plummet**.

30.8 STATUS: SmartStation

30.8.1 Satellite Status

Description

This screen shows information related to the satellites ordered by the elevation angle.

Access

Select **STATUS: SmartStation...\Satellite Status**.
Refer to "30.1 STATUS Functions" on how to access the STATUS menu.

OR

Press a hot key configured to access the screen **STATUS Satellites**.
Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

OR

Tap the number of visible satellites icon.
Refer to the TPS1200 System Field Manual for information on icons.

OR

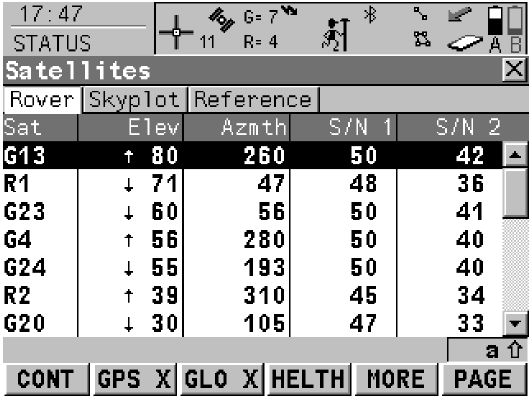
Tap the contributing satellites icon.
Refer to the TPS1200 System Field Manual for information on icons.

STATUS Satellites, Satellites page; STATUS Satellites, Rover page

The name of the page changes depending on the active SmartStation configuration.

Satellites page:	SmartStation is not used as a real-time rover.
Rover page	SmartStation is configured for real-time rover operations.

Satellites below the **<Cut Off Angle:>** configured in **CONFIGURE Satellite Settings** are shown in grey.



CONT (F1)
To exit **STATUS Satellites**.

GPS X (F2)
To hide or view the GPS satellites (shown by the prefix G). Only available for **SmartStation** with the **ATX1230 GG** antenna, where the configured Sat System is GPS&GLONASS.

GLO X (F3)
To hide or view the GLONASS satellites (shown by the prefix R). Only available for **SmartStation** with the **ATX1230 GG** antenna, where the configured Sat System is GPS&GLONASS.

HELTH (F4)
To view the PRN numbers of satellites categorised in good, bad and unavailable.

MORE (F5)
To open and close a window showing the date of the used almanac, the number of satellites tracked as shown on the skyplot and the number of all satellites available above the cut off elevation mask as shown on the skyplot.

PAGE (F6)
To change to another page on this screen.

Description of columns

Column	Description
Sat	The **P**seudo **R**andom **N**oise number (GPS) or the slot number (GLONASS) of the satellites.
Elev	The elevation angle in degrees. The arrows indicate if the satellite is rising or falling.
Azmth	The azimuth of the satellite.
S/N 1 and **S/N 2**	The signal to noise ratio on L1 and L2. The number is shown in brackets if the signal is currently not being used in the position calculations.

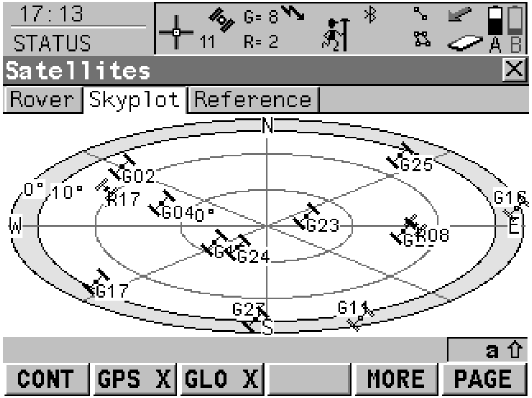
Next step

PAGE (F6) changes to the **Skyplot** page. Refer to paragraph "STATUS Satellites, Satellites page; STATUS Satellites, Rover page".

STATUS Satellites, Skyplot page

The skyplot shows satellite information in a graphical way.

The part of the skyplot between the 0° elevation and the cut-off angle is marked grey.



CONT (F1)
To exit **STATUS Satellites**.

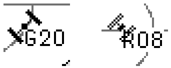
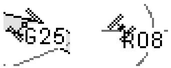
GPS X (F2)
To hide or view the GPS satellites (shown by the prefix G). Only available for **SmartStation** with the **ATX1230 GG** antenna, where the configured Sat System is GPS&GLONASS.

GLO X (F3)
To hide or view the GLONASS satellites (shown by the prefix R). Only available for **SmartStation** with the **ATX1230 GG** antenna, where the configured Sat System is GPS&GLONASS.

MORE (F5)
To open and close a window showing the date of the used almanac, the number of satellites tracked as shown on the skyplot and the number of all satellites available above the cut off elevation mask as shown on the skyplot.

PAGE (F6)
To change to another page on this screen.

Description of symbols

Symbol	Description
	Satellites above the **<Cut Off Angle:>** configured in **CONFIGURE Satellite Settings**.
	Satellites below the **<Cut Off Angle:>** configured in **CONFIGURE Satellite Settings**.

Next step

IF	THEN
the receiver is a real-time rover	**PAGE (F6)** changes to the **Reference** page. Refer to paragraph "STATUS Satellites, Reference page".
the receiver is not a real-time rover	**CONT (F1)** exits **STATUS Satellites**.

STATUS Satellites, Reference page

The information about the satellites at the reference shown on this page is identical with the information shown on **STATUS Satellites**, **Rover** page. Refer to paragraph "STATUS Satellites, Satellites page; STATUS Satellites, Rover page".

Next step

CONT (F1) exits **STATUS Satellites**.

30.8.2 Real-Time Status

Description

This screen shows information related to real-time data, for example the data link and the device used to receive real-time data.

Access

This screen is accessible for **<R-Time Mode: Rover>** in **CONFIGURE Real-Time Mode**.

Select **STATUS: SmartStation...\Real-Time Status**.

OR

Press a hot key configured to access the screen **STATUS Real-Time Input**.

Refer to "2.1 Hot Keys" for information on hot keys.

OR

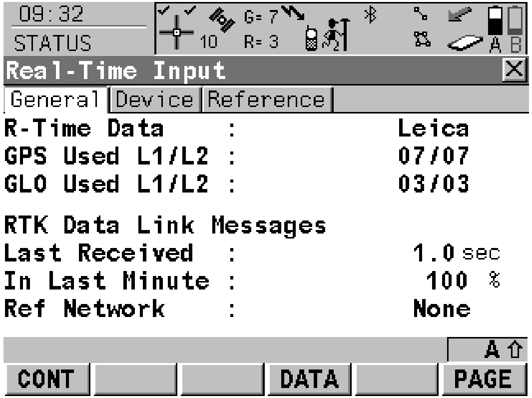
Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

OR

Tap the real-time device and real-time status icon.

Refer to the TPS1200 System Field Manual for information on icons.

STATUS Real-Time Input, General page



CONT (F1)
To exit **STATUS Real-Time Input**.

DATA (F4)
To view the data being received. Depending on **<R-Time Data:>**, the shown data differ. Refer to paragraph "STATUS Real-Time Input Data".

PAGE (F6)
To change to another page on this screen.

Description of fields

Field	Description
<R-Time Data:>	The received real-time data format message type.
<GPS used L1/L2:>	The number of satellites on L1 and L2 being used in the current position solution.
<GLO used L1/L2:>	The number of satellites on L1 and L2 being used in the current position solution.
<Last Received:>	Seconds since the last message from the reference was received.
<In Last Minute:>	The percentage of real-time data received from the reference compared with the data received from the SmartAntenna within the last minute. This indicates how well the datalink is working.

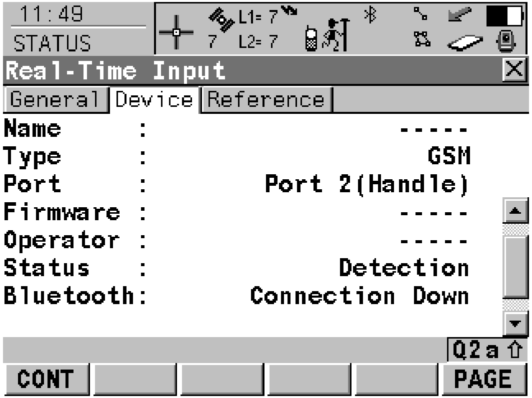
Field	Description
<Ref Network:>	The type of reference network in use.

Next step

PAGE (F6) changes to the **Device** page. Refer to paragraph "STATUS Real-Time Input, Device page".

STATUS Real-Time Input, Device page

The content of this page differs for each type of device in use.



CONT (F1)
To exit **STATUS Real-Time Input**.

PAGE (F6)
To change to another page on this screen.

For all devices available

Description of fields

Field	Description
<Name:>	The name of the device.

For RS232

Description of fields

Field	Description
<Type:>	The type of device.
<Port:>	The port to which the device is connected.
<Bluetooth:>	Available if device is connected via bluetooth. Indicates the state of the connection.

For digital cellular phones and modems

Description of fields

Field	Description
<Type:>	The type of device.
<Port:>	The port to which the device is connected.
<Firmware:>	The software version of the attached digital cellular phone.
<Operator:>	The name of the network operator in which the digital cellular phone is operating.

Field	Description
<Status:>	The actual mode of the digital cellular phone. The options are **Unknown**, **Detection** and **Registered**.
<Bluetooth:>	Available if device is connected via bluetooth. Indicates the state of the connection.
<Signal:>	Indication of received signal strength of the digital cellular phone network.

For radios

Description of fields

Field	Description
<Port:>	The port to which the device is connected.
<Type:>	The type of device.
<Channel:>	The radio channel.
<Bluetooth:>	Available if device is connected via bluetooth. Indicates the state of the connection.

Next step

PAGE (F6) changes to the **Reference** page. Refer to paragraph "STATUS Real-Time Input, Reference page; STATUS Real-Time Input, Ref (VRS) page".

STATUS Real-Time Input, Reference page; STATUS Real-Time Input, Ref (VRS) page

The name of the page changes depending on the type of reference being used.

Reference page:	Reference is a real reference station.
Ref (VRS) page	Reference is a virtual reference station.

Description of fields

Field	Description
<Ref Stn ID:>	An identification for a reference station. The ID is converted into a compact format to be send out with real-time data in all real-time data formats. It is different from the point ID of the reference station.
<Antenna Ht:>	• For **<R-Time Data: Leica>**, **<R-Time Data: RTCM v3.0>** or **<R-Time Data: RTCM X v2>** with **<RTCM Version: 2.3>**: The antenna height at the reference from the marker to the MRP. • For **<R-Time Data: CMR/CMR+>** and **<R-Time Data: RTCM 18, 19 v2>** or **<R-Time Data: RTCM 18, 19 v2>** with **<RTCM Version: 2.2>** The antenna height at the reference from the marker to the phase center. • For all other **<R-Time Data:>**: **-----** is displayed because the data format does not include information about the antenna height.
<Coords of:>	The coordinates for the reference station which are transferred depend on the active real-time data format. • For real-time messages which include antenna height and antenna type: **Marker**.

Field	Description
	• For real-time messages which do not include antenna Information: **Phase Centre** of L1.

Next step

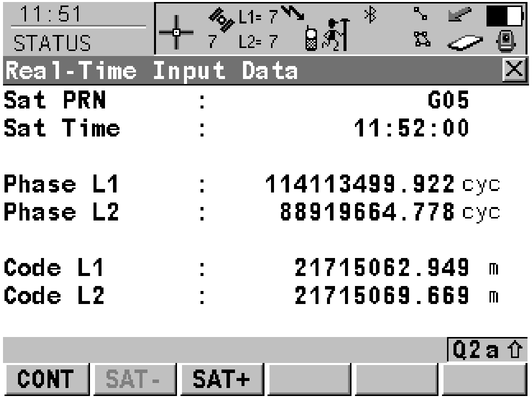
IF	THEN
other coordinate types are to be viewed	**COORD (F2)**. Local coordinates are available when a local coordinate system is active.
this screen is to be quit	**CONT (F1)** exits **STATUS Real-Time Input**.

STATUS Real-Time Input Data

The following provides additional information on the satellite data received via real-time message. Information of those satellites is displayed, which are used on both reference and rover.

Access

DATA (F4) on **STATUS Real-Time Input, General** page.



CONT (F1)
To return to **STATUS Real-Time Input**.

SAT- (F2)
To display information about the satellite with the next smaller PRN.

SAT+ (F3)
To display information about the satellite with the next larger PRN.

Description of fields

The data being received from the satellites and the layout of the screen depend on the active real-time data format.

Field	Description
<Sat PRN:>	The PRN number (GPS) or the slot number (GLONASS) of the satellites shown with the prefix G (GPS) or R (GLONASS).
<Sat Time:>	The GPS time of the satellite.
<Phase L1:>, <Phase L2:>	The number of phase cycles from the antenna to the satellite on L1 and L2.

Field	Description
<Msg 18 L1:>, <Msg 18 L2:>	The uncorrected carrier phases for L1 and L2.
<Msg 20 L1:>, <Msg 20 L2:>	The carrier phase corrections for L1 and L2.
<Code L1:>, <Code L2:>	The pseudorange between the antenna to the satellite for L1 and L2.
<Msg 19 L1:>, <Msg 19 L2:>	The uncorrected pseudoranges for L1 and L2.
<Msg 21 L1:>, <Msg 21 L2:>	The pseudorange corrections for L1 and L2.
<PRC:>	Pseudorange corrections.
<RRC:>	Rate of change of the corrections.
<IODE:>	**I**ssue **O**f **D**ata **E**phemeris. The identification number of the ephemeris for a satellite.

Next step

CONT (F1) returns to the screen from where **STATUS Real-Time Input Data** was accessed.

30.8.3 Current Position

Description

This screen shows information related to the current SmartStation position. For real-time rover configurations the baseline vector is also shown. MapView shows the current position in a graphical format.

Access

Select **STATUS: SmartStation...\Current Position**.
Refer to "30.1 STATUS Functions" on how to access the STATUS menu.

OR

Press a hot key configured to access the screen **STATUS Position**.
Refer to "2.1 Hot Keys" for information on hot keys.

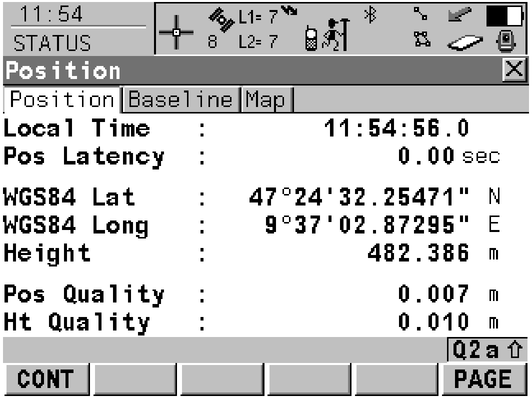
OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

OR

Tap the position status icon.
Refer to the TPS1200 System Field Manual for information on icons.

STATUS Position, Position page



CONT (F1)
To exit **STATUS Position**.

COORD (F2)
To see other coordinate types. Local coordinates are available when a local coordinate system is active.

PAGE (F6)
To change to another page on this screen.

SHIFT ELL H (F2) and **SHIFT ORTH (F2)**
Available for local coordinates. To change between the ellipsoidal and the orthometric height.

Description of fields

Field	Description
<Pos Latency:>	The latency of the computed position. Latency is mainly due to time required for data transfer and computation of position.
Pos Quality and **Ht Quality**	Available for phase fixed and code only solutions. The 2D coordinate and height quality of the computed position. Refer to "6.3.1 Terminology" for information on coordinate quality.
HDOP and **VDOP**	Available for navigated solutions.

Next step

IF	THEN
the receiver is a real-time rover	**PAGE (F6)** changes to the **Baseline** page. Refer to paragraph "STATUS Position, Baseline page".
the receiver is not configured for real-time	**CONT (F1)** exits **STATUS Position**.

STATUS Position, Baseline page

Information on the baseline vector is displayed.

Next step
CONT (F1) exits **STATUS Position**.

30.9 Logging Status

Description

This screen shows information related to logging of raw observations.

Access

Select **STATUS: Survey...\Logging Status**.
Refer to "30.1 STATUS Functions" on how to access the STATUS menu.

OR

Press a hot key configured to access the screen **STATUS Logging**.
Refer to "2.1 Hot Keys" for information on hot keys.

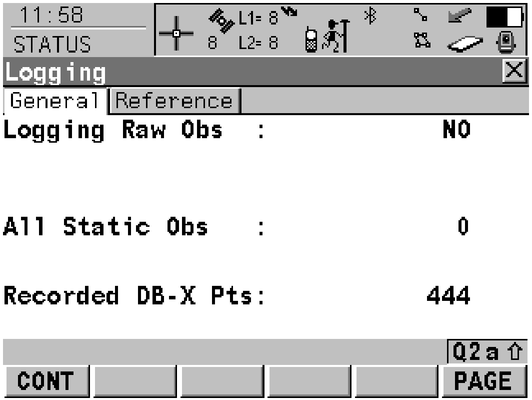
OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

OR

Tap the logging information icon.
Refer to the TPS1200 System Field Manual for information on icons.

STATUS Logging, General page



CONT (F1)
To exit **STATUS Logging**.

PAGE (F6)
To change to another page on this screen.

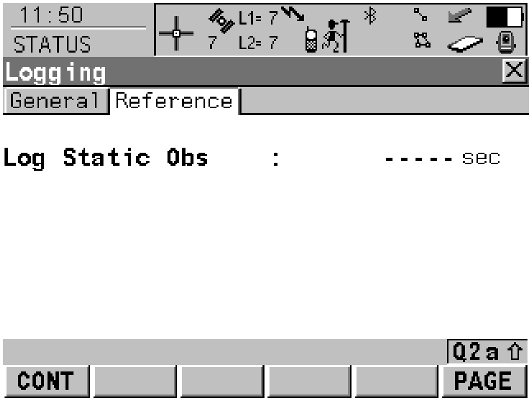
Description of fields

Field	Description
<Logging Raw Obs:>	**YES** or **NO**.
<All Static Obs:>	The number of static epochs recorded in the current job.
<Recorded DB-X Pts:>	The number of manually occupied points and auto points stored in the job.

Next step

PAGE (F6) changes to the **Reference** page.

STATUS Logging, Reference page



CONT (F1)
To exit **STATUS Logging**.

PAGE (F6)
To change to another page on this screen.

Description of fields

Field	Description
<Log Static Obs:>	The logging rate at the reference. This information is shown if the real-time message format supports this information and raw observations are being logged at the reference.

Next step

CONT (F1) exits **STATUS Logging**.

30.9.1 SmartAntenna System Info

Access

Select **STATUS: SmartAntenna System Info**.
Refer to "30.1 STATUS Functions" on how to access the STATUS menu.

OR

Press a hot key configured to access the screen **STATUS SmartAntenna Information**.
Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

STATUS SmartAntenna Information

Shows the versions of all system firmware.

Description of fields

Field	Description
<Type:>	The type of antenna.
<Meas Engine:>	The firmware version for the measurement engine.
<Meas Eng Boot:>	The firmware version of the boot software for the measurement engine.

Next step
CONT (F1) exits **STATUS SmartAntenna Information**.

31 Telescope Positioning

Description

Motorised instruments turn to a target point or change face automatically. On non motorised instruments the **XX Telescope Positioning** screen assists in manual aiming. This screen helps reducing the possibility for errors in target point identification. The horizontal and vertical angle differences between the current telescope position and the target position are displayed. The telescope needs to be turned until the displayed values are zero.

Access

Press **SHIFT USER**, highlight **<Change Face>** and press **ENTER**.

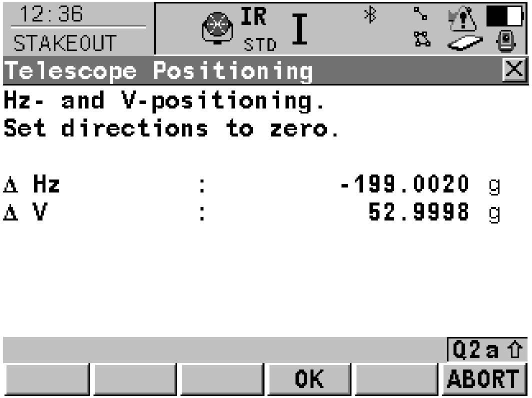
OR

Press a hot key configured to access the screen **XX Telescope Positioning**. Refer to "2.1 Hot Keys".

OR

Press **ALL (F1)** or **POSIT (F5)** in some application programs, where telescope positioning to a certain point is needed.

XX
Telescope Positioning



OK (F4)
To confirm angles and return to the screen this screen was accessed from.

ABORT (F6)
To abort the telescope positioning.

Description of fields

Field	Option	Description
<ΔHz:>	Output	The difference between the horizontal angle of the current telescope position and of the telescope position to aim at is displayed.
<ΔV:>	Output	The difference between the vertical angle of the current telescope position and of the telescope position to aim at is displayed.

Next step

OK (F4) to confirm the current telescope position and return to the screen **XX Telescope Positioning** was accessed from.

32 Functions

32.1 EDM

Description

Electronic **D**istance **M**easurement **EDM** is the sensor used for distance measurements with infrared laser or visible red laser.

There are three different **<EDM Type:>** and four different **<EDM Mode:>** the instrument can work in. These terms are described below.

Refer to "17.1 EDM & ATR Settings" and to "3 Quick Settings - SHIFT USER" for more information.

EDM types

EDM Type	Description
IR	**<EDM Type: Reflector (IR)>** and allows to measure the distance to a prism or reflector tape with the infrared laser. The last used options for **<Reflector:>**, **<Add. Constant:>**, **<Reflector Ht:>** and **<EDM Mode:>** are applied. For **<Automation: ATR>** or **<Automation: LOCK>, <EDM Type: Reflector (IR)>** is automatically set. It is important to select the currently used **<Reflector:>** from the list to gain correct results.
RL	Available for instruments equipped with reflectorless EDM. **<EDM Type: Reflctrless (RL)>** allows to measure distances to objects without a reflector, using the visible red laser. The last used option for **<EDM Mode:>** is applied, **<Reflector: Reflectorless>** and **<Reflector Ht: 0.000>** are set. **<Automation: None>** is set.

EDM Type	Description
LO	Available for instruments equipped with reflectorless EDM. **<EDM Type: Long Range (LO)>** allows to measure very long distances to prisms. The last used option for **<EDM Mode:>** and **<Reflector:>** are applied, **<Automation: None>** is set.

EDM modes

EDM Mode	Description
Standard	Pressing **ALL (F1)** or **DIST (F2)** a single measurement is performed with focus on accuracy and not on time.
Fast	Pressing **ALL (F1)** or **DIST (F2)** a single measurement is performed with focus on time, accuracy not as high as for **<EDM Mode: Standard>**.
Tracking	Pressing **ALL (F1)** or **DIST (F2)** continuous measurements are performed with focus on fast measurements. Press **REC (F3)** to store the measurements. **STOP (F1)** to stop tracking.
Average	Pressing **ALL (F1)** or **DIST (F2)** with **<Avg Max #Dist: n>** n measurements are performed with **<EDM Mode: Standard>**. During measurements the current average and standard deviation are displayed.

32.2 Prism Search Methods

32.2.1 ATR

Description

Automatic **T**arget **R**ecognition **ATR** is the sensor which recognises and measures the position of a prism by means of a CCD array. A laser beam is transmitted and the reflected beam is received by the built in CCD array. The position of the reflected spot with respect to the centre of the CCD is computed. These ATR offsets are used to correct the horizontal and vertical angles. The ATR offsets are also used to control the motors which turn the instrument to centre the crosshairs to the prism. In order to minimise the time for measuring, the crosshairs are not moved to the exact centre of the prism. The ATR offset can be up to 500 cc depending on selected **<EDM Mode:>**. The ATR measures the ATR offsets between the crosshairs and prism centre and corrects the Hz and V angles accordingly. Therefore the Hz and V angles are measured to the prism-centre, even if the crosshairs are not aimed precisely at the centre of the prism.

Motorised instruments can be equipped with ATR. For **<Automation: ATR>** the instrument can find a static prism and measure a distance once **ALL (F1)** or **DIST (F2)** is pressed. The instrument does not follow a moving prism.
Refer to "17.1 EDM & ATR Settings" and to "3 Quick Settings - SHIFT USER" for more information.

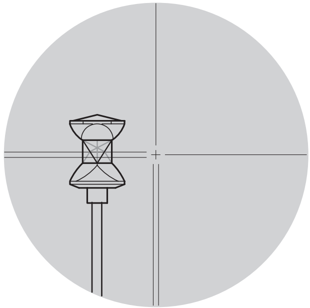
Field of view

The telescope field of view is the region seen when looking through the telescope. The ATR field of view is the region seen by the ATR. Both are identical on TPS1200 instruments.

Next step

IF the reflector is	THEN
in the field of view	Refer to paragraph "ATR measurement" for more information.
not in the field of view	Refer to paragraph "ATR search" for more information.

ATR measurement

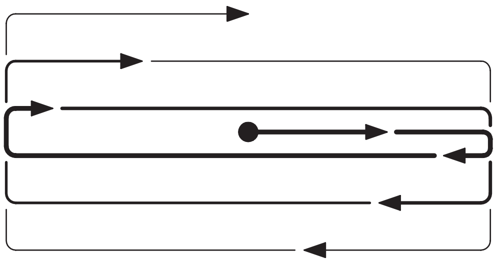


TPS12_080

If the reflector is in the field of view and **<Automation: ATR>** the crosshairs are automatically positioned to the reflector when, for example **ALL (F1)** or **DIST (F2)** is pressed. No ATR search is started.

The displayed values are always related to the centre of the prism after **ALL (F1)** or **DIST (F2)** is pressed. The crosshairs of the telescope may not fully coincide with the centre of the prism when viewed through the telescope. The remaining ATR offsets for the horizontal and vertical angles are measured by the ATR sensor and applied to the measured and displayed angles.

ATR search



TPS12_042

If the reflector is not in the field of view when **ALL (F1)** or **DIST (F2)** is pressed, an ATR search is started. For the ATR search the ATR window is scanned line by line starting at the current telescope position.
If the

- prism was not found: **RETRY (F5)** can be pressed to search for the reflector in an increased area.
- prism was found: The ATR measurement is performed to position the telescope to the centre of the prism.

ATR window

The ATR window is a relative window based on the current telescope position. The horizontal and vertical extent can be defined. Pressing **ALL (F1)**, **DIST (F2)** or **L.GO (F5)** starts an ATR search in the ATR window.

Dynamic ATR window

For **<Search with: ATR>** after loss of lock and prediction the prism is searched for with ATR in a dynamic ATR window. This window covers a horizontal region from the position of loss of lock to the current telescope position and the same extent on the other side. The vertical dimension of the dynamic window is one third of the horizontal expansion. Refer to "32.3 Follow Moving Prisms - LOCK" for information on LOCK.

Automation modes

Automation	Description
None	Points are measured with **<Automation: None>**. ATR search and/or ATR measurement are not performed.

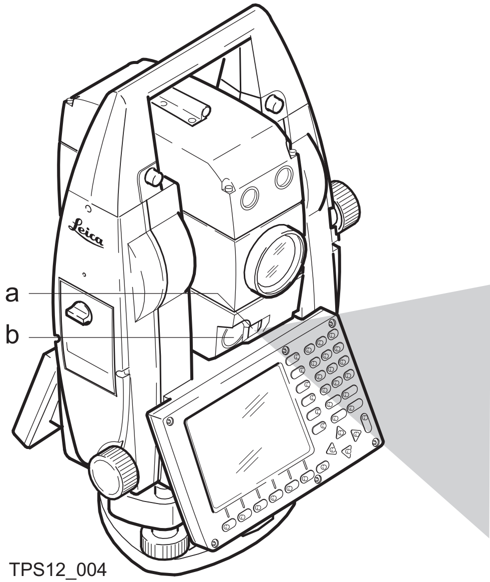
Automation	Description
ATR	**<Automation: ATR>** is set. The ATR sensor is used for measurements to static reflectors. If needed an ATR measurement or ATR search is performed after pressing **ALL (F1)** or **DIST (F2)**. The accuracy of ATR measurements depends on the set **<EDM Mode:>**.
LOCK	**<Automation: LOCK>** is set. The ATR sensor is used to follow moving prisms and to find prisms after loss of lock. Depending on **<EDM Mode:>** single or continuous measurements are performed pressing **ALL (F1)** or **DIST (F2)**. Unavailable for SmartStation.

32.2.2 PowerSearch

Description

The PowerSearch module allows an automatic prism detection within a short period of time. In the **QUICK SET Change Settings to:** screen the PowerSearch function can be started by pressing **PS (F6)**.

Functionality



The PowerSearch sensor consists of a transmitter (a) and a receiver (b). Both are installed in the lower part of the telescope.

When PowerSearch is activated, the instrument starts to rotate around its standing axis.The transmitter emits a vertical laser swath. If the laser swath detects a prism, the rotation of the instrument is stopped. Afterwards a ATR measurement in vertical direction is performed.

a) Transmitter
b) Receiver

☞ If a PS window is defined and active, PowerSearch is executed within the defined limits.

360° search

For **<PS Window: Off>** and **PS (F6)** the prism is searched for with PowerSearch in the 360° window. The default search with PowerSearch consists of a short swing in anti-clockwise direction followed by a complete 360° turn in clockwise direction. If a prism is detected the movement is stopped and an ATR search is performed.

PS window

The PS window can be defined individually. It is specified by absolute angles and does not change its position. The PS window can be set in the **CONFIGURE Search Windows, PS Window** page by aiming at two opposite points of the PS window. For **<PS Window: On>** and **PS (F6)** a prism is searched for with PowerSearch in the PS window. Refer to "17.2 Search Windows" for more information on setting the PS window.

Dynamic PS window

For **<PS Window: Off>**, **<Search with: PowerSearch>**, loss of lock and after prediction the prism is searched for in a dynamic PS window. This window covers a region at the position after prediction of horizontal 100 gon by vertical 40 gon. Refer to "32.3 Follow Moving Prisms - LOCK" for information on LOCK.

32.3 Follow Moving Prisms - LOCK

Description

LOCK enables instruments equipped with ATR to follow a moving prism. The ATR sensor is active. When **<Automation: LOCK>** and a distance measurement is initiated with **DIST (F2)** or **L.GO (F5)** is pressed, an ATR search is executed. The instrument locks onto the prism and follows its movements. ATR offsets are continuously applied to the angle measurements. When the instrument loses lock to the reflector, a search is executed with either PS or ATR depending on settings.

LOCK is unavailable for SmartStation.

Refer to "17 Config...\Instrument Settings..." and to "3 Quick Settings - SHIFT USER" for more information.

☞ If the speed of the reflector is too fast, the target may be lost. Make sure that the speed does not exceed the figure given in the technical data.

Enable lock

<Automation: LOCK>. The instrument is not yet locked onto the reflector and the ATR sensor is not active. Pressing **ALL (F1)**, **DIST (F2)**, **L.GO (F5)** or **CONT (F1)** in **QUICK SET Orientation With Compass**, **QUICK SET Positioning Hz/V**, **QUICK SET Move by Joystick** or **QUICK SET Check Recorded Pt/Backsight Pt** the ATR is used to find the reflector. Pressing **PS (F6)** PowerSearch is used to find the prism. When the reflector is found, the instrument locks onto the reflector. The instrument follows the moving reflector. The ATR sensor is active.

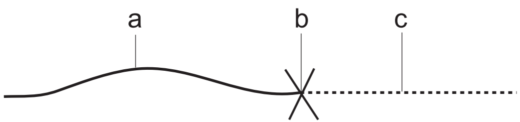
As long as the instrument is locked on, ATR offsets are continuously applied to the angle measurements. If the instrument loses lock to the prism the instrument may search for the prism with ATR or PS.

Loss of lock

When the instrument is locked onto a reflector, lock may be lost if the movement of the reflector is too fast for the instrument to follow or the reflector is hidden behind an object. After lock is lost, the prediction is used to find the prism again. Refer to paragraph "Prediction" for more information.
The ATR sensor is still active.

☞ Whenever the prism is moved in the field of view of the telescope the instrument locks automatically to the prism.

Prediction



TPS12_079

c) Moving reflector locked onto by the instrument
d) Loss of lock
e) Prediction

As long as the prism is being tracked by the instrument a mathematical filter continuously calculates the average speed and direction of the prism. If the line of sight between instrument and prism is disturbed, the instrument keeps on moving using these calculated values.This behaviour is called prediction. The prediction time can be configured.
During prediction the LOCK icon is displayed. If the prism comes into the field of view of the ATR it automatically locks on again.

Prism search after prediction

After prediction, the prism is searched for depending on the settings in the **CONFIGURE Automatic Prism Search** and **CONFIGURE Search Windows, PS Window** screens.

- **<Search with: No Search>**. If prism moved in field of view, prism is not searched for until **ALL (F1)**, **DIST (F2)**, **L.GO (F5)**, **CONT (F1)** or **PS (F6)** is pressed.
- **<Search with: ATR>**. prism is searched for in the dynamic ATR window with ATR.

- **<Search with: PowerSearch>** and **<PS Window: On>**: prism is searched for in the PS window with PowerSearch.
- **<Search with: PowerSearch>** and **<PS Window: Off>**: prism is searched for in the dynamic PowerSearch window.

Relock

Independent of **<Search with:>** the instrument can relock onto the prism. Refer to paragraph "Enable lock" for information on how to enable lock.

32.4 RCS

Description

When **<Use Interface: Yes>** in **CONFIGURE RCS Mode** the instrument can be controlled by RX1200 via radio. The ATR sensor does not necessarily have to be active when working in RCS mode. The RX1200 is used to remote control the instrument. No data can be stored on the RX1200. The screen and content displayed on the RX1200 are a copy of the remote controlled instrument. Refer to "20.3 RCS Mode" for information on configuration of interfaces.

The keyboard design of the RX1200 is different from the TPS1200 keyboard. The functionality of the keys is the same. All functions and programs of the TPS1200 are available on the RX1200.

The communication between the TPS1200 and the RX1200 is established via radio modems. One radio modem has to be connected to the TPS1200 serial port. The RX1250T/RX1250Tc has an integrated radio, no additional connections are needed.

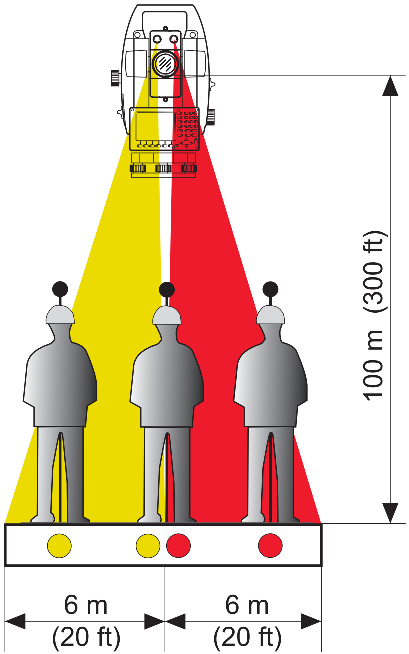
Refer to "RX1200 User Manual" for further information on the RX1200 and refer to "3 Quick Settings - SHIFT USER" for additional information.

32.5 EGL

Description

The **E**mitting **G**uide **L**ight, EGL, consists of two differently coloured flashing lights in the telescope housing of the TPS1200. The EGL is used for guidance into the line of sight. If the left light is seen, the prism should be moved right and vice versa. If both flashing lights can be seen, the prism is in the line of sight of the instrument.

Functionality



TPS12_006

The EGL can be used

- to help guiding the reflector into the telescope line of sight when the instrument is remotely controlled and **<Automation: LOCK>**.
- to stake out points

The instrument emits two differently colored flashing cones of light. At a target distance of 100 m the cones have a width of 6 m. Between the two cones of light a sector with a width of 30 mm is created where both guide lights are visible simultaneously. In this position the prism is in the line of sight of the instrument.

Using the EGL step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Set **<Automation: LOCK>** and press **COMPS (F1)** or **Hz/V (F2)** or **JSTCK (F3)** on the **QUICK SET Change Settings to:** screen OR Set **<EGL: On>** on the **CONFIGURE Lights, Display, Beeps, Text, Lights** page.	3.2 18.5
2.	Align instrument line of sight and prism, where both flashing EGL lights can be seen simultaneously.	
3.	**CONT (F1)** to lock onto the prism.	
4.	If the instrument has locked onto the prism the EGL is turned off automatically.	
	If the EGL was turned on in the **CONFIGURE Lights, Display, Beeps, Text, Lights** page, it has to be turned off by setting **<EGL: Off>**.	

The EGL is turned off automatically once the instrument has locked onto a prism.

32.6 Illumination

Description

There are several different illumination types built into the instrument that all fulfill different functions. Some are to support measurements, for example the visible red laser pointer. Others, such as the screen illumination, are for more convenient work with the instrument. These different types of illumination are described below.

Laser plummet

The laser plummet allows setting up the instrument over a marked point. The laser beam is emitted from the bottom of the instrument, pointing to the ground. When the instrument is levelled and the laser beam points exactly at the ground point, the instrument is set up correctly.

The laser plummet can be turned on and off. It is turned on automatically when opening the **STATUS Level and Laser Plummet** screen and turned off when leaving the screen.

Visible red laser pointer

The visible red laser pointer is used for reflectorless measurements. The visible red laser pointer is arranged coaxially with the line of sight of the telescope and emitted through the objective. If the instrument is well adjusted, the visible red laser beam coincides with the line of sight.

☞ The direction of the beam should be inspected before precise distance measurements are executed, since an excessive deviation of the laser beam from the line of sight can cause inaccurate results.

GUS74 Laser Guide

The GUS74 Laser Guide is an option for TPS1200 instruments. It is built into a special telescope compartment and emits a visible red laser beam to visualise the line of sight over long ranges. The GUS74 Laser Guide is used for special applications such as tunneling. Refer to "GUS74 Laser Guide Manual" for detailed information.

Screen/key illumination

The screen and key illumination allows a more convenient working with the instrument when the lighting conditions are not ideal. They can be turned on in the **CONFIGURE Lights, Displays, Beeps, Text, Lights** page. To access this screen press **SHIFT F11** in any application program. Changes to the setting become effective instantly. Refer to "18.5 Lights, Display, Beeps, Text" for more information on screen and key illumination settings.

33 NTRIP via Internet

33.1 Overview

Description

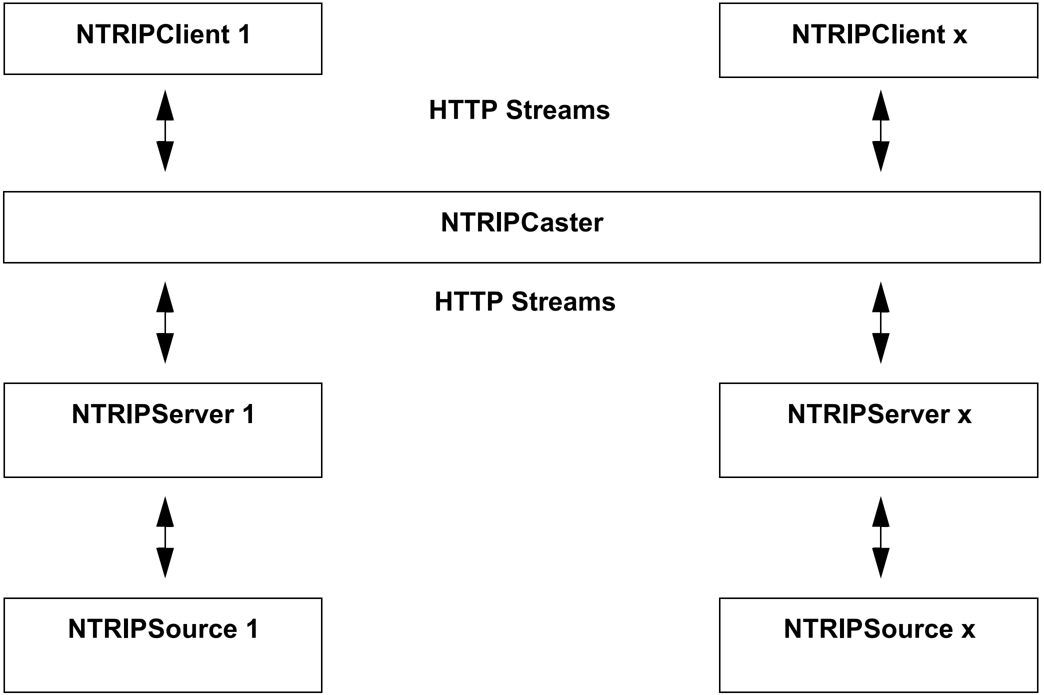
Networked **T**ransport of **R**TCM via **I**nternet **P**rotocol

- is a protocol streaming real-time corrections over the Internet.
- is a generic protocol based on the Hypertext Transfer Protocol HTTP/1.1.
- is used to send differential correction data or other kinds of streaming data to stationary or mobile users over the Internet, allowing simultaneous PC, laptop, PDA, or receiver connections to a broadcasting host.
- supports wireless Internet access through mobile IP networks like digital cellular phones or modems.

System components

NTRIP consists of three system components:

- NTRIPClients
- NTRIPServers
- NTRIPCaster

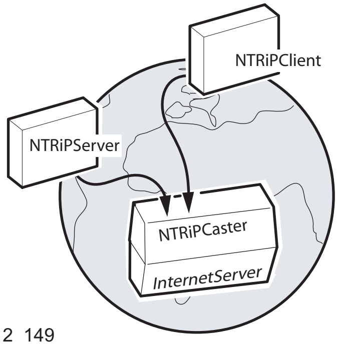


NTRIPClient	The NTRIPClient receives data streams. This could be, for example a real-time rover receiving real-time corrections. In order to receive real-time corrections, the NTRIPClient must first send • a user ID • a password • an identification name, the so-called MountPoint, from which real-time corrections are to be received to the NTRIPCaster.
NTRIPServer	The NTRIPServer transfers data streams. In order to send real-time corrections, the NTRIPServer must first send • a password • an identification name, the so-called MountPoint, where the real-time corrections come from to the NTRIPCaster. Before sending real-time corrections to the NTRIPCaster for the first time, a registration form must be completed. This is available from the NTRIPCaster administration centre. Refer to the Internet.
NTRIPSource	The NTRIPSource generates data streams. This could be, for example a GRX1200 Pro configured as reference sending out real-time corrections.

NTRIPCaster

The NTRIPCaster
- is an Internet server handling various data streams to and from the NTRIPServers and NTRIPClients.
- checks the requests from NTRIPClients and NTRIPServers to see if they are registered to receive or provide real-time corrections.
- decides whether there is streaming data to be sent or to be received.

Graphic



GPS12_149

NTRIP and it’s role in the Internet

33.2 Configuring SmartStation for Using NTRIP Service

33.2.1 Configuring an Access to the Internet

Requirements

- SmartStation must be used.
- Firmware v2 or higher must be loaded on the TPS1200 instrument.
- Firmware v1.42 or higher must be loaded on the RX1200.

☞ To access to the Internet with SmartStation, **G**eneral **P**acked **R**adio **S**ystem devices will normally be used. GPRS is a telecommunication standard for transmitting data packages using the Internet Protocol (IP).

Configure access to Internet step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to "19.2.2 Accessing CONFIGURE Interfaces" to access **CONFIGURE Interfaces**.	
2.	In **CONFIGURE Interfaces** highlight **Internet**.	
3.	**EDIT (F3)** to access **CONFIGURE Internet Interface**.	
4.	**CONFIGURE Internet Interface** **<Internet: Yes:>** **<IP Address: Dynamic>**	20.6

Step	Description	Refer to chapter
	<User ID:> Some providers ask for a user ID to allow connecting to the Internet via GPRS. Contact your provider if a user ID needs to be used. **<Password:>** Some providers ask for a password to allow connecting to the Internet via GPRS. Contact your provider if a password needs to be used.	
5.	**DEVCE (F5)** to access **CONFIGURE GPRS Internet Device**.	
6.	**CONFIGURE GSM/Modem Devices** Highlight the GPRS device to be used.	
	NEW (F2) to create a new device.	19.4.3
7.	**CONT (F1)** to return to **CONFIGURE Internet Interface**.	
8.	**CONT (F1)** to return to **CONFIGURE Interfaces**.	
9.	**CTRL (F4)** to access **CONFIGURE XX Connection**.	
10.	**CONFIGURE XX Connection** Type in relevant information.	21.6
	CODES (F3) Available for digital cellular phones of GSM technology. To enter the **P**ersonal **I**dentification **N**umber of the SIM card. If the PIN is locked for any reason, for example the wrong PIN was entered, input the **P**ersonal **U**nbloc**K**ing code for access to the PIN.	
11.	**CONT (F1)** to return to **TPS1200 Main Menu**.	

Step	Description	Refer to chapter
	The instrument is now online to the Internet. The Internet online status icon is displayed. But because GPRS is being used, no charges are yet made since no data transfer from the Internet has yet taken place.	
12.	**USER**	
13.	**STAT (F3)** to access **STATUS Status Menu**.	
14.	Highlight **Interfaces....**	
15.	**ENTER** to access **STATUS Interfaces**.	
16.	**STATUS Interfaces** Highlight **Internet**.	
17.	**IFACE (F3)** to access **STATUS Internet**.	
18.	**STATUS Internet** This screen shows • if the receiver is online on the Internet. • for how long the receiver is online. • the technology of data transfer. • the amount of data received or sent since the receiver is online.	
19.	**CONT (F1)** to return to **STATUS Interfaces**.	
20.	**CONT (F1)** to return to **TPS1200 Main Menu**.	

33.2.2 Configuring to Connect to a Server

Requirements

The configurations from the previous chapter must have been completed. Refer to "33.2.1 Configuring an Access to the Internet".

Configure connect to a server step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Select **Main Menu: Config...\Interfaces....**	
2.	**CONFIGURE Interfaces** Highlight **GPS RTK**.	
3.	**EDIT (F3)** to access **CONFIGURE Real-Time Mode**.	
4.	**CONFIGURE Real-Time Mode** **<R-Time Mode: Rover>** **<R-Time Data:>** Select the type of data to be received from the Internet. **<Port: NETx>**	22.1
5.	**CONT (F1)** to return to **CONFIGURE Interfaces**.	
6.	Highlight **GPS RTK**.	
7.	**CTRL (F4)** to access **CONFIGURE Set NET Port**.	
8.	**CONFIGURE Set NET Port** **<User: Client>**	

Step	Description	Refer to chapter
	<Server:> The server to be accessed in the Internet. Opening the choicelist accesses **CONFIGURE Server to Connect** where new servers can be created and existing servers can be selected or edited. **<IP Address:>** The stored IP address of the selected **<Server:>** to be accessed in the Internet. **<TCP/IP Port:>** The stored port of the selected Internet **<Server:>** through which the data is provided. Each server has several ports for various services. **<Auto CONEC: Yes>** Allows for automatic connection between the SmartStation and the Internet when a point is occupied during a survey. Ending the point occupation also ends the Internet connection.	21.10
9.	**CONT (F1)** to return to **CONFIGURE Interfaces**.	
	Once SmartStation is connected to the server a message is displayed in the message line.	
10.	**CONT (F1)** to return to **TPS1200 Main Menu**.	
11.	**USER**	
12.	**STAT (F3)** to access **STATUS Status Menu**.	
13.	Highlight **Interfaces....**	
14.	**ENTER** to access **STATUS Interfaces**.	
15.	**STATUS Interfaces**	

Step	Description	Refer to chapter
	Highlight **GPS RTK**.	
16.	**DEVCE (F5)** to access **STATUS Device: Ethernet**.	
17.	**STATUS Device: Ethernet** Check the Internet online status.	
18.	**CONT (F1)** to return to **STATUS Interfaces**.	
19.	**CONT (F1)** to return to **TPS1200 Main Menu**.	

33.2.3 Using the NTRIP Service with SmartStation

Requirements

The configurations from the previous chapter must have been completed. Refer to "33.2.2 Configuring to Connect to a Server".

Use NTRIP service step-by-step

Step	Description
1.	Select **Main Menu: Config...\Interfaces...**.
2.	In **CONFIGURE Interfaces** highlight **GPS RTK**.
3.	**EDIT (F3)** to access **CONFIGURE Real-Time Mode**.
4.	**CONFIGURE Real-Time Mode** **<Port: NETx>** must be selected.
5.	**ROVER (F2)** to access **CONFIGURE Additional Rover Options**.
6.	**PAGE (F6)** to access **CONFIGURE Additional Rover Options**, **NTRIP** page.
7.	**CONFIGURE Additional Rover Options**, **NTRIP** page
8.	**<Use NTRIP: Yes>** **<User ID:>** A user ID is required to receive data from to the NTRIPCaster. Contact the NTRIP administrator for information. **<Password:>** A password is required to receive data from the NTRIPCaster. Contact the NTRIP administrator for information.
9.	**SRCE (F5)** to access **CONFIGURE NTRIP Source-Table**.
10.	**CONFIGURE NTRIP Source-Table** All MountPoints are listed. MountPoints are the NTRIP servers sending out real-time data. This screen consists of two columns:

Step	Description
	• First column **MountPoint**: The abbreviations for the MountPoints. • Second column **Identifier**: The city where the MountPoint is located.
11.	Highlight a MountPoint about which more information is required. This information helps to configure the receiver to use the selected MountPoint as a reference.
12.	**INFO (F3)** to access **CONFIGURE MountPoint: XX**.
13.	**CONFIGURE MountPoint: XX**, **General** page **<Format:>** The real-time data format sent out by the MountPoint. **<FormatDet:>** Details about **<Format:>**, for example the RTCM message types including update rates in seconds displayed in brackets. **<Authentic:>** The type of password protection required for the authorisation to the NTRIPServer. **<Authentic: None>** if no password is required. **<Authentic: Basic>** if the password need not be encrypted. **<Authentic: Digest>** if the password must be encrypted. **<NMEA:>** Indicates if the MountPoint must receive GGA NMEA data from the rover in order to compute VRS information. **<Charges:>** Indicates if charges are currently made for the connection. **<Carrier:>** The type of carrier message sent out. **<System:>** The type of satellite system supported by the MountPoint.
14.	**PAGE (F6)** to access **CONFIGURE MountPoint: XX**, **Location** page.
15.	**CONFIGURE MountPoint: XX**, **Location** page

Step	Description
	Detailed information about the location of the MountPoint is displayed.
16.	**PAGE (F6)** to access **CONFIGURE MountPoint: XX**, **Miscell** page.
17.	**CONFIGURE MountPoint: XX**, **Miscell** page **<Generator:>** The hard- or software generating the data stream. **<Compress:>** The name of the compression / encryption algorithm. **<Info:>** Miscellaneous information if available.
	PREV (F2) to display information about the previous MountPoint in the list.
	NEXT (F3) to display information about the next MountPoint in the list.
18.	**CONT (F1)** to return to **CONFIGURE NTRIP Source-Table**.
19.	**CONT (F1)** to return to **CONFIGURE Additional Rover Options**.
	SHIFT CONEC (F3) and **SHIFT DISCO (F3)** are now available in GPS mode to connect to and disconnect from the NTRIPServer.

34 MapView Interactive Display Feature

34.1 Overview

Description

MapView is an interactive display feature embedded in the firmware but used by all application programs as well as data management. MapView provides a graphical display of the survey elements which allows for a better overall understanding of how the data being used and measured relates to each other.

Depending on the application program and where in the application program MapView is accessed from, different modes, and their associated functionality, are available.

The displayed data in all modes of MapView can be shifted by using both the arrow keys and the touchscreen.

MapView modes

MapView is available in three modes:

Map mode:
- Part of data management.
- Is also available within some application programs, for example, the Reference Line application program.
- Can be used to view, select and edit points, lines and areas.
- Available as the **Map** page in data management and some application programs.

Plot mode:
- Is available to view results in various application programs. For example, COGO application program.
- Available as the **Plot** page in some application programs.

Survey mode:
- Part of the Survey application program.
- Is available within some application programs, for example, Stakeout application program.

- Can be used to select lines and areas.
- Same as Map mode but also shows the positions of the instrument and the reflector.
- Provides special functionality when staking out points.
- Available as the Map page in Survey and some application programs.

Modes within application programs

It is possible to access different MapView modes from the same application program. For example, **REFLINE Choose Task & Reference Line**, **Map** page accesses MapView in map mode, whereas, **REFLINE XX Stakeout**, **Map** page accesses MapView in survey mode.

Displayable data

The data displayed in MapView is defined by the application program through which it was accessed, filters set in **MANAGE Sorts & Filters**, and the selections made in **XX MapView Configuration**.

34.2 Accessing MapView

Description

The MapView interactive display feature is provided as a page within all application programs and data management. It is accessed through the application program itself. Depending on the application program and from where in the application program MapView is accessed, different MapView modes are available.

Access step-by-step

Example access for map mode:

Step	Description
1.	Select **Main Menu: Manage...\Data**. OR Press a hot key configured to access the screen **MANAGE Data: Job Name**. Refer to "2.1 Hot Keys" for information on hot keys. OR Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key. OR From a choicelist in some screens for example in application programs.
2.	**PAGE (F6)** until **MANAGE Data: Job Name**, **Map** page is active.

Example access for plot mode:

Step	Description
1.	Press **PROG**. Highlight **COGO**. **CONT (F1)**. Refer to "35.2 Accessing the Programs Menu" for information on the **PROG** key.

Step	Description
	OR Press a hot key configured to access the screen **COGO COGO Begin**. Refer to "2.1 Hot Keys" for information on hot keys. OR Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.
2.	**CONT (F1)** to access **COGO COGO Menu**.
3.	**COGO COGO Menu** Highlight **Intersections**.
4.	**CONT (F1)** to access **COGO Intersection Input**.
5.	**COGO Intersection Input** Choose a method and enter appropriate data.
6.	**CALC (F1)** to access **COGO XX Results**.
7.	**PAGE (F6)** until **COGO XX Results**, **Plot** page is active.

Example access for survey mode:

Step	Description
1.	Select **Main Menu: Survey**. OR Press a hot key configured to access the screen **SURVEY Survey Begin**. Refer to "2.1 Hot Keys" for information on hot keys.

Step	Description
	OR Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key. OR Press **PROG**. Highlight **Survey**. **CONT (F1).** Refer to "35.2 Accessing the Programs Menu" for information on the **PROG** key.
2.	**CONT (F1)** to access **SURVEY Survey: Job Name**.
3.	**PAGE (F6)** until **SURVEY Survey: Job Name**, **Map** page is active.

☞ MapView can be open multiple times, for example as **SURVEY Survey: Job Name**, **Map** page accessed from **TPS1200 Main Menu** and as **MANAGE Data: Job Name**, **Map** page accessed using the **USER** key.

34.3 Configuring MapView

Description

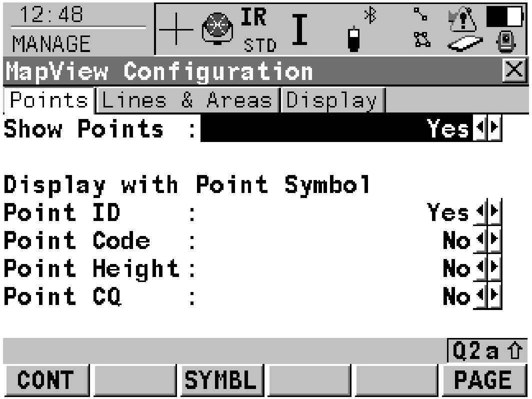
Allows options to be set which are used as default options within MapView. These settings are stored within the configuration set and apply to all **Map** and **Plot** pages, regardless of how MapView is accessed.

Any changes made in **XX MapView Configuration** affect the appearance of MapView in all application programs, not just the active application program.

Access step-by-step

Step	Description
1.	Refer to "34.2 Accessing MapView" to access MapView in map, plot or survey mode.
2.	**SHIFT CONF (F2)** to access **XX MapView Configuration**.

XX
MapView Configuration,
Points page



CONT (F1)
To confirm the selections and to return to the screen from where this screen was accessed.

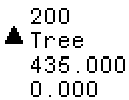
SYMBL (F3)
To view all point symbols and their descriptions.

PAGE (F6)
To change to another page on this screen.

Description of fields

Field	Option	Description
<Show Points:>	**Yes** or **No**	Determines if points are displayed in MapView.
<Point ID:>	**Yes** or **No**	Available for **<Show Points: Yes>**. Determines if the ID of a point is displayed.
<Point Code:>	**Yes** or **No**	Available for **<Show Points: Yes>**. Determines if the code of a point is displayed.
<Point Height:>	**Yes** or **No**	Available for **<Show Points: Yes>**. Determines if the height of a point is displayed.
<Point CQ:>	**Yes** or **No**	Available for **<Show Points: Yes>**. Determines if the coordinate quality of a point is displayed.

Displayable point information



a) **<Point ID:>**
b) **<Point Code:>**
c) **<Point Height:>**
d) **<Point CQ:>**

Next step

PAGE (F6) changes to the **Lines&Areas** page. Refer to paragraph "XX MapView Configuration, Lines&Areas page".

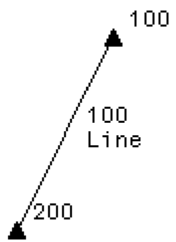
XX MapView Configuration, Lines&Areas page

Description of fields

Field	Option	Description
<Show Lines:>	**Yes** or **No**	Determines if lines are displayed in MapView.
<Show Line ID:>	**Yes** or **No**	Available for **<Show Lines: Yes>**. Determines if the ID of a line is displayed.
<Show Line Code:>	**Yes** or **No**	Available for **<Show Lines: Yes>**. Determines if the code of a line is displayed.
<Show Areas:>	**Yes** or **No**	Determines if areas are displayed in MapView.
<Show Area ID:>	**Yes** or **No**	Available for **<Show Areas: Yes>**. Determines if the ID of an area is displayed.
<Show Area Code:>	**Yes** or **No**	Available for **<Show Areas: Yes>**. Determines if the code of an area is displayed.

Displayable line/area information

A line is shown as example.



a) **<Show Line ID:>**
b) **<Show Line Code:>**

Next step

PAGE (F6) changes to the **Display** page. Refer to paragraph "XX MapView Configuration, Display page".

XX MapView Configuration, Display page

Description of fields

Field	Option	Description
<Show Pt Info:>	**When <200 Pts** or **As Configured**	Determines if point information is shown or not. For **<Show Pt Info: When <200 Pts>** point information is not shown when more than 200 points are displayed. For **<Show Pt Info: As Configured>** the point information, as configured in **XX MapView Configuration, Points** page, is shown regardless of the number of points being displayed.
<Datum View:>	**WGS 1984** or **Local**	Determines the datum in which the points are viewed. When both GPS and TPS data is being used, it is possible that some data will not be displayed.
<Rotate 180°:>	**Yes or No**	Available for **<Datum View: Local>**. To rotate the map by 180°. The north arrow is not rotated and still orientated towards the top of the screen.
<Toolbar:>	**On or Off**	Determines if the toolbar of touch icons are displayed. Refer to "34.4.3 Toolbar".
<Curr Pos Info:>		Determines if a certain information related to the current position is displayed in the lower left corner of the map (only visible in survey mode).

Field	Option	Description
	<None>	No information is displayed in the map.
	Point ID	Point ID of the current position.
	Code	Code of the current position.
	Attrib 01	User defined attribute.
	Attrib 02	User defined attribute.
	Attrib 03	User defined attribute.
	Attrib 04	User defined attribute.
	Attrib 05	User defined attribute.
	Quality 3D	Current 3D coordinate quality of the computed position.
The following fields are relevant for Survey Mode:		
<Show Path:>	**Yes** or **No**	Displays the path of the reflector as a dashed line.
<Center To:>	Choicelist	To centre the map on the reflector or the instrument.
	Reflector	To centre the map on the reflector. For EDM mode standard, fast or average, the map will centre onto the last measured point. For EDM mode tracking or synchrotrack, the map will centre onto the current reflector position. These behaviours are true for all automation settings
	Total Station	To centre the map on the instrument.

Next step

CONT (F1) confirms the selections and returns to where XX MapView Configuration was accessed.

34.4 MapView Components

34.4.1 Softkeys

Description

Standard functionality is provided by a number of softkeys within MapView. These softkeys are available regardless of the mode in which MapView was accessed and always perform the same functions.

Standard softkeys

The softkeys described below are standard on all MapView screens. For descriptions of mode specific softkeys see appropriate chapters.

Softkey	Description
ZOOM+ (F4)	To zoom into the map. ☞ Pressing **ESC** stops the zooming process. All keys become active again.
ZOOM- (F5)	To zoom out of the map. ☞ Pressing **ESC** stops the zooming process. All keys become active again.
PAGE (F6)	To change to another page on this screen.
SHIFT CONF (F2)	To configure MapView. Accesses **XX MapView Configuration**. Refer to "34.3 Configuring MapView".
SHIFT FIT (F3)	To fit all displayable data into the screen area. Refer to "34.4.3 Toolbar" for more information.

Touch screen functions

Some softkey functionality can be replaced by touch screen functions.

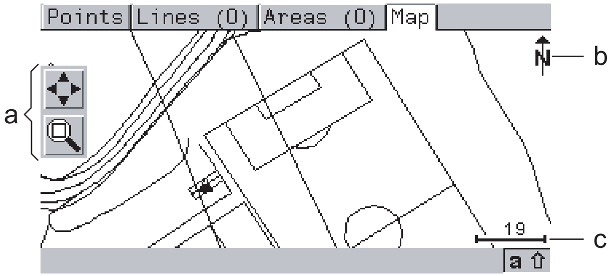
Softkey	Touch equivalent
PAGE (F6)	Tap on a page tab.
SHIFT FIT (F3)	Tap on fit touch icon. Refer to "34.4.3 Toolbar".

34.4.2 Screen Area

Description

The MapView screen area is very similar in all cases. The positions of the scale bar, the North arrow and the toolbar, if visible, do not change.

Standard screen



GPS12_142

a) Toolbar
b) North arrow
c) Scale bar

Reflector

Reflectors are displayed on the **Map** page. The reflector path is shown as dashed line.

Symbol	Description
	Measured position.

Instrument station

Symbol	Description
	Position of the instrument station.

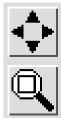
Scale bar

Symbol	Description
	Scale of the current screen. The minimum is 0.5 m. There is no maximum for the zoom but the scale cannot display values greater than 99000 m. In this case the value displayed will be >99000 m.

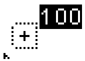
North arrow

Symbol	Description
	North arrow. North is always orientated towards the top of the screen.

Toolbar

Symbol	Description
	Touch icon toolbar. Refer to "34.4.3 Toolbar" for more information about the functionality of the touch icons in the toolbar.

Point with focus

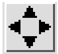
Symbol	Description
	The point that has the focus.

34.4.3 Toolbar

Description

Touch icons are available in a toolbar, if **<Toolbar: On>** in **XX MapView Configuration**, **Display** page. The toolbar is always located on the left hand side of the screen. Some of the functions performed by the touch icons can also be replicated using a softkey in the same mode as when the touch icon appears. The softkey equivalent to each touch icon, if one exists, are indicated below.

Touch icons in the toolbar

Touch icon	Softkey	Description
	**SHIFT FIT (F3)**	Available as a touch icon in map mode. The fit touch icon fits all displayable data, according to filters and the map configuration, into the screen area, using the largest possible scale.
	-	The windowing touch icon zooms to a specified area window. An area window can be drawn by tapping on the top left and the bottom right corner of the area. This causes the screen to zoom to the selected area.
	-	Available in survey mode. Positions the instrument to the selected point. If **<Automation: ATR>** the instrument does an ATR search. If **<Automation: LOCK>** the instrument tries to lock on to a reflector.

34.4.4 Point Symbols

Points

When **<Show Points: Yes>** in **XX MapView Configuration**, points are displayed, in all modes, according to their class.

Symbol	Description
	3D control point is a point of class **CTRL** with horizontal and vertical coordinate components.
	2D control point is a point of class **CTRL** with horizontal coordinate components.
	Adjusted point is a point of class **ADJ**.
	Reference point is a point of class **REF**.
	Average point is a point of class **AVGE**.
	Measured point is a point of class **MEAS**.
	**S**ingle **P**oint **P**osition uploaded from LGO.
	Navigated point is a point of class **NAV**.
	Estimated point is a point of class **EST**.
	Calculated COGO point is a point of class **MEAS** or **CTRL** depending on the COGO calculation method.

Points of class **NONE** or points of class **CTRL/MEAS** with a height only component cannot be displayed in MapView.

☞ A list of the point types available, and their description, is available by pressing **SYMBL (F3)** in **XX MapView Configuration**, **Points** page. Refer to "34.3 Configuring MapView".

34.5 Map Mode

34.5.1 MapView in Map Mode

Description

The map mode of MapView is available as the **Map** page in data management and some application programs. It can be used to display, select and edit points, lines and areas.

Access

Refer to "34.2 Accessing MapView" paragraph "Example access for map mode:".

OR

From a choicelist in some screens, for example, in application programs, which access data management.

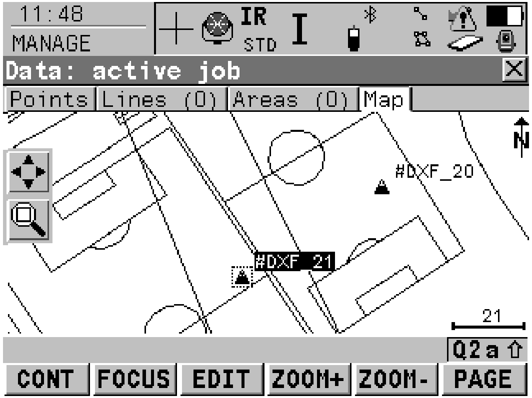
OR

As a part of an application program, for example, COGO.

The **MANAGE Data: Job Name**, **Map** page is used as the example below. The functions described are the same for all **Map** pages in map mode.

MANAGE Data: Job Name, Map page

The softkeys described below are specific to MapView in map mode. Refer to "34.4.1 Softkeys" for descriptions of the standard softkeys.



FOCUS (F2) or **DONE (F2)**
To activate the focus tool and select a point without using the touch screen. Refer to "34.5.2 Selecting Points, Lines and Areas".

EDIT (F3)
To edit the highlighted point's parameters. Accesses **MANAGE Edit Point: Point ID**.

SHIFT CENTR (F4)
To centre the screen around the point with the current focus, or the focus tool if **DONE (F2)** is visible.

SHIFT FILTR (F5)
Available for **FOCUS (F2)**. To change the filter settings. Accesses **MANAGE Sorts & Filters**.

Touch screen functions

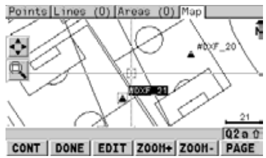
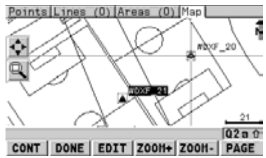
Key	Touch equivalent
FOCUS (F2)	Tap on a point.

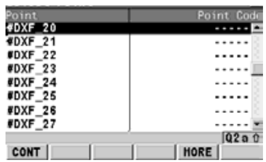
34.5.2 Selecting Points, Lines and Areas

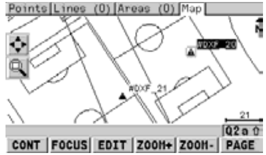
Description

Selecting a point, line or area in the map mode of MapView is possible using both the softkeys and the touch screen. The functionality of all screens and field are similar for the selecting of a point, line or area. The step-by-step instructions for selecting a point using the softkeys can be applied for lines and areas.

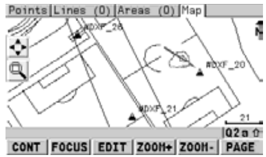
Select a point using the softkeys step-by-step

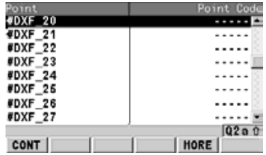
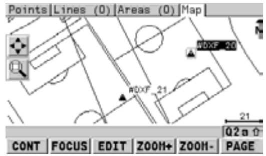
Step	Description	Display
1.	Refer to "34.5.1 MapView in Map Mode" to access **MANAGE Data: Job Name**, **Map** page.	
☞	If no point field is highlighted on the previous page when the **Map** page is accessed, then any point that is selected will be assigned to the first point field on the previous page, the second point to the second point field, etc. If a point field is highlighted when the **Map** page is accessed then the point selected will be assigned to that field.	
2.	**FOCUS (F2)** to activate the focus tool. The focus tool is made up of a square placed at the centre of dashed cross-hairs. The focus tool always starts at the centre of the screen area.	
3.	Use the arrow keys to navigate the focus tool to the point to select. A point is available for selection when the square is centred around the point symbol.	

Step	Description	Display
	When there are multiple points within the same area and the precise selection is unclear, pressing **ENTER** will access **XX Select Point**.	
4.	Press **ENTER** to select the point. The point parameter text, as defined in **XX Map View Configuration, Points** page, is highlighted.	
5.	Have multiple points been selected? • If **yes**, continue with step 6. • If **no**, continue with step 8.	
6.	**XX Select Point** **Point ID** The ID of the points within range of the point selection. **Point Code** The code of the points within range of the point selection. Select the desired point.	
	MORE (F5) to display information about the point code, the 3D coordinate quality and class, the time the point was stored and the date the point was stored.	
7.	**CONT (F1)** returns to **MANAGE Data: Job Name**, **Map** page with the focus on the selected point.	

Step	Description	Display
8.	**DONE (F2)** exits the focus tool.	

Selecting a point using the touch screen step-by-step

Step	Description	Display
1.	Refer to "34.5.1 MapView in Map Mode" to access **MANAGE Data: Job Name**, **Map** page.	
	If no point field is highlighted on the previous page when the **Map** page is accessed, then any point that is selected will be assigned to the first point field on the previous page, the second point to the second point field, etc. If a point field is highlighted when the **Map** page is accessed then the point selected will be assigned to that field.	
2.	Tap on the point to be selected.	
	When there are multiple points within the same area and the precise selection is unclear, tapping on the point will access **XX Select Point**.	

Step	Description	Display
3.	Have multiple points been selected? • If **yes**, continue with step 4. • If **no**, continue with step 6.	
4.	**XX Select Point** **Point ID** The ID of the points within range of the point selection. **Point Code** The code of the points within range of the point selection. Select the desired point.	
	MORE (F5) to display information about the point code, the 3D coordinate quality and class, the time the point was stored and the date the point was stored.	
5.	**CONT (F1)** returns to **MANAGE Data: Job Name**, **Map** page with the focus on the selected point.	
6.	A square is centred on the selected point and the point parameter text, as defined in **XX MapView Configuration**, **Points** page, is highlighted.	

34.6 Plot Mode - MapView Screen Area

Description

The plot mode of MapView is available as the **Plot** page in an application program and can be used to view the results of the application program. Results are shown in black, all other information, that is displayable, is shown in grey.

Access

Refer to "34.2 Accessing MapView" paragraph "Example access for plot mode:".

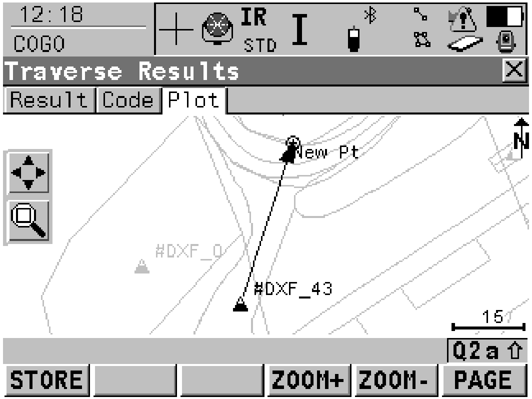
OR

As a part of an application program, for example, COGO.

☞ The **COGO XX Results**, **Plot** page is used as the example below. The functions described are the same for all **Plot** pages.

COGO XX Results, Plot page

The softkeys described below are specific to MapView in plot mode. Refer to "34.4.1 Softkeys" for descriptions of the standard softkeys.



SHIFT FACE (F1) and **SHIFT PLAN (F1)**
Available in **REFPLANE XX Reference Plane**, **Plot** page. To change between the face and the plane view of the plane.

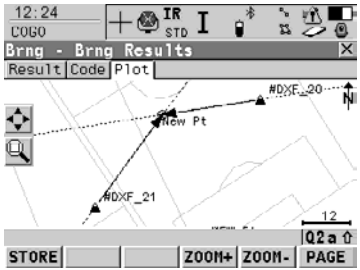
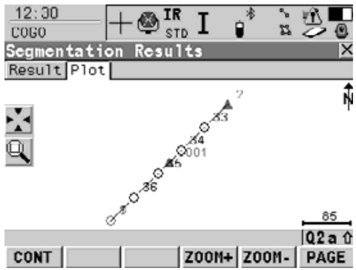
SHIFT FIT R (F4)
To fit the results in the screen area.

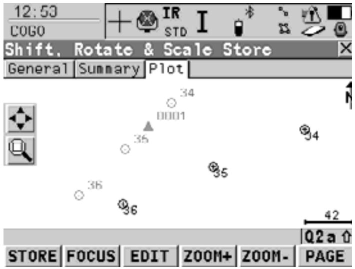
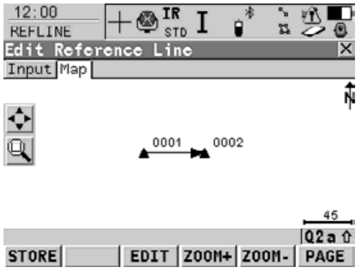
SHIFT RFRSH (F5)
To refresh the screen.

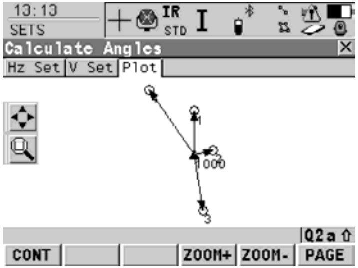
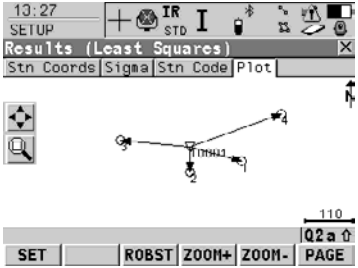
Touch screen functions

Key	Touch Equivalent
SHIFT FIT R (F4)	Tap on fit results touch icon. Refer to "34.4.3 Toolbar".

Example of results displayed in MapView on Plot page

Application	Display	Description
COGO Intersection, Bearing - Bearing		Intersecting lines with known bearings from known points.
COGO line calculation, Segmentation		Points defining the line and those created on the line

Application	Display	Description
COGO Shift, Rotate & Scale		Original points in grey, calculated COGO points in black
Reference Line, Edit Reference Line		Reference line or arc
Reference Plane, Edit Reference Plane		A dashed rectangle indicates the face view of the plane.

Application	Display	Description
Sets of Angles, Calculating Angles		Directions from station to sets of angle points
Setup		Directions to resection points.

34.7 Survey Mode

34.7.1 MapView in Survey Mode

Description

The survey mode of MapView is available as the Map page in Survey and is used to display the position of the instrument station during a survey. It can also be used to select lines and areas. It is also used by the Stakeout, Reference Line and Reference Plane application programs to assist in the staking out/measuring of points.

Refer to "34.7.2 MapView in Staking Out Survey Mode" for more information about using MapView when staking out points.

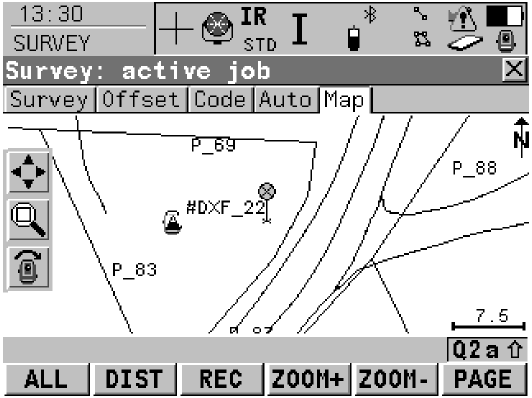
Access

Refer to "34.2 Accessing MapView" paragraph "Example access for survey mode:".

☞ The **SURVEY Survey: Job Name**, **Map** page is used as the example below. The functions described are the same for all **Map** pages in survey mode.

SURVEY
Survey: Job Name, Map page

The softkeys described below are specific to MapView in survey mode. Refer to "34.4.1 Softkeys" for descriptions of the standard softkeys.



SHIFT FACE (F1) and **SHIFT PLAN (F1)**
Available in **REFPLANE Measure Point on Plane**, **Map** page. To change between the face and the plane view of the plane.

SHIFT CENTR (F4)
To centre the screen around the point with the current focus or the focus tool, if **FOCUS (F2)** is active.

SHIFT RFRSH (F5)
To refresh the screen.

Touch screen functions

Key	Touch equivalent
SHIFT CENTR (F4)	Tap on centre touch icon. Refer to "34.4.3 Toolbar".

34.7.2 MapView in Staking Out Survey Mode

Description

When staking out a point in Stakeout or Reference Line application programs, the **Map** page is available. The MapView survey mode is provided for this operation, with some differences.

- With the RX1200 active points can be selected, using the touch screen, as points to be staked.
- An arrow indicating the direction from the current position to the point to be staked is provided.
- A box provides information such as the distance to the stakeout point and the CUT/FILL value so the point to be staked can be found.

Data displayed

For Stakeout application program.

- From **<Job:>**, all points and displayable lines and areas are shown in grey.
- From **<Stakeout Job:>**, all points, according to filter settings, are displayed in black; lines and areas are not displayed.
- If the survey is to be orientated to a reference line, the line is displayed in black.

For Reference Line application program.

- From **<Job:>**, all points and displayable lines and areas are shown in grey.
- The point to be staked is displayed in black.
- The reference line/arc is displayed in black.

☞ The **STAKEOUT XX Stakeout**, **Map** page is used as the example below. The functions described are the same for all **Map** pages available when staking out.

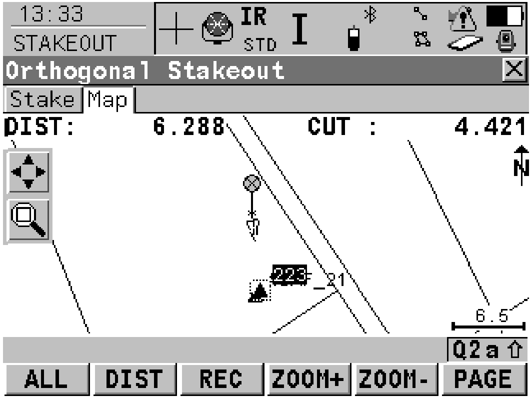
Access step-by-step

Example access for MapView in survey mode, Stakeout

Step	Description
1.	Select **Main Menu: Programs...\Stakeout**. OR Press **PROG**. Highlight **Stakeout**. **CONT (F1)**. OR Press a hot key configured to access the screen **STAKEOUT Stakeout Begin**. Refer to "2.1 Hot Keys" for information on hot keys. OR Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key. OR Press **STAKE (F5)** from another application program, for example COGO.
2.	**CONT (F1)** to access **STAKEOUT XX Stakeout**.
3.	**PAGE (F6)** until **STAKEOUT XX Stakeout**, **Map** page is active.

STAKEOUT
XX Stakeout,
Map page

The softkeys described below are specific to MapView in survey mode, staking out. Refer to "34.4.1 Softkeys" for descriptions of the standard softkeys.



SHIFT CENTR (F4)
To centre the screen around the reflector.

Description of fields

Field	Option	Description
<DIST:>	Output	Horizontal distance from the current position to the point to be staked.
<CUT:>	Output	The negative height difference from the height of the current position to the height of the point to be staked.
<FILL:>	Output	The positive height difference from the height of the current position to the height of the point to be staked.

34.7.3 Selecting Lines and Areas

Description

Selecting a line or area in the survey mode of MapView is possible using the touch screen. The functionality of all screens and field are similar for the selecting of a line or area. The step-by-step instructions for selecting a line using the touchscreen can be applied for areas.

Selecting a line step-by-step

Step	Description
1.	Select Main Menu: Survey. OR Select Main Menu: Programs...\Survey. OR Press a hot key configured to access the screen SURVEY Survey Begin. Refer to "2.1 Hot Keys" for information on hot keys. OR Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key. OR Press **PROG**. Highlight Survey. **CONT (F1)**. Refer to "35.2 Accessing the Programs Menu" for information on the **PROG** key.
2.	**PAGE (F6)** until **SURVEY XX Survey**, **Map** page is active.
3.	Tap on the line to be selected. When there are multiple lines within the same area and the precise selection is unclear, tapping on the line will access **XX Select Line**.
4.	Have multiple lines been selected ?

Step	Description
	• If **yes**, continue with step 5. • If **no**, continue with step 7.
5.	**XX Select Line** **Point ID** The ID of the lines within range of the line selection. **Point Code** The code of the lines within range of the point selection. Select the desired line.
	MORE (F5) to display information about the line code, the start time, the end time, the length and the Open status of the line.
6.	**CONT (F1)** returns to **SURVEY Data: Job Name**, **Map** page.
7.	A message appears in the message line. • Line Line Name was opened (If the line was close before). • Line Line Name was closed (If the line was open before).

35 Application Programs - General

35.1 Overview

Description

Application programs are software packages supporting specific tasks. Available are:

- Survey (integrated into the instrument firmware and cannot be deleted)
- Setup (integrated into the instrument firmware and cannot be deleted)

- Alignment Tool Kit - refer to the separate manual
- COGO
- Determine Coordinate System
- DTM Stakeout
- DXF Export, DXF Import
- GPS Survey
- Hidden Point
- MGuide - refer to the separate manual
- Reference Line
- Reference Plane
- RoadRunner - this program could contain the following:
  - RoadRunner - refer to the separate manual
  - RoadRunner Tunnel - refer to the separate manual
  - RoadRunner Rail - refer to the separate manual

- Sets of Angles - this program could contain the following:
  - Sets of Angles
  - Monitoring
- Stakeout
- Survey Cross Section
- Traverse
- Volume Calculations

For an explanation of the application programs refer to the relevant chapters.

Loadable and non-loadable application programs

Loadable application programs:	• Can be loaded onto the instrument. • Can be deleted from the instrument.
Non-loadable application programs:	• Are always available on the instrument. • Survey and Setup are non-loadable application programs. To get updates for these programs, the system software has to be reloaded.

Licence key

Some loadable application programs are protected. They are activated through a specific licence key. This can either be typed in **Main Menu: Tools...\Licence Keys** or the first time the application program is started. Refer to "28 Tools...\Licence Keys" for information on how to type in or upload a licence key. A licence key is required for:

- DTM Stakeout
- DXF Export
- Reference Line
- Reference Plane
- RoadRunner
- Sets of Angles (includes Monitoring, which requires a separate licence key)
- Stakeout
- Volume Calculations

Customised application programs

Customised application programs can be developed locally using the GeoC++ development environment. Information on the GeoC++ development environment is available on request from the Leica Geosystems representative.
Customised application programs always run in the language they were developed in.

35.2 Accessing the Programs Menu

Description

The application programs menu contains all loaded application programs including Survey and Setup. They are listed in the order in which they were loaded. Selecting an option in the menu starts the application program assigned to the option. Configurations and measurements that can be performed depend on the application program.

The screen of the application programs menu is called **TPS1200 Programs**.

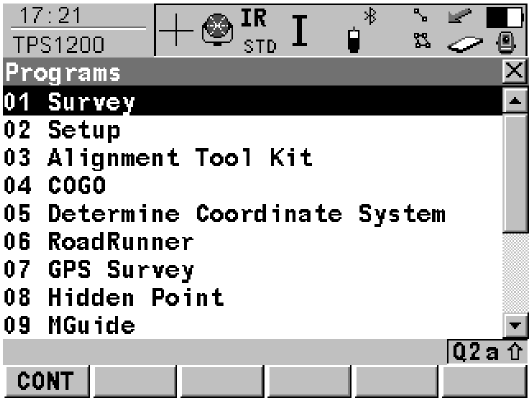
Access to the application programs menu

Select **Main Menu: Programs....**

OR

Press **PROG**.

TPS1200 Programs



CONT (F1)

To start the highlighted application program.

Next step

Select an option in the menu to open the application. Refer to the chapter on the individual application programs.

☞ Four application programs can be open at one time. **XX Begin** is shown for the application program opened first, but not for the following application programs.

36 COGO

36.1 Overview

Description

COGO is an application program to perform **co**ordinate **geo**metry calculations such as

- coordinates of points.
- bearings between points.
- distances between points.

The calculations can be made from

- existing point data in the job, known distances or known azimuths.
- measured points.
- entered coordinates.

In contrast to remote point measurements within the Survey application program, COGO is more of a calculation program than a measuring program.

☞ Changing coordinates of a point which has been previously used in COGO does not result in the point being recomputed.

COGO calculation methods

The COGO calculation methods are:

- Inverse.
- Traverse.
- Intersections.
- Line calculations.
- Arc calculations.
- Shift, Rotate & Scale (Manual)
- Shift, Rotate & Scale (Match Pts)
- Area Division

Distances and azimuths	Type of distances:	The choices are • Ground • Grid • Ellipsoidal
	Type of azimuths:	The azimuths are grid azimuths relative to the local grid.

Coding of COGO points

- Thematical coding is available in **COGO XX Results** after the COGO calculation. Thematical coding of COGO points is identical to coding measured points. Refer to "8 Coding" for information on coding.
- For the COGO calculation shift, rotate & scale, the codes from the original points are taken over for the calculated COGO points.

Properties of COGO points

The properties stored with COGO points are:

- Class: Either **MEAS** or **CTRL** depending on the COGO calculation method.
- Sub class: **COGO**
- Source: **Arc Base Pt**, **Arc Centre Pt**, **Arc Offset Pt**, **Arc Segmt Pt**, **COGO Area Divsn.**, **COGO Shift/Rtn**, **COGO Traverse**, **Intsct (Brg Brg)**, **Intsct (Brg Dst)**, **Intsct (Dst Dst)**, **Intsct (4 Pts)**, **Line Base Pt**, **Line Offset Pt** or **Line Segmt Pt** depending on the COGO calculation method used
- Instrument source: **TPS**

36.2 Accessing COGO

Access

Select **Main Menu: Programs...\COGO**.

OR

Press **PROG**. Highlight **COGO**. **CONT (F1).** Refer to "35.2 Accessing the Programs Menu" for information on the **PROG** key.

OR

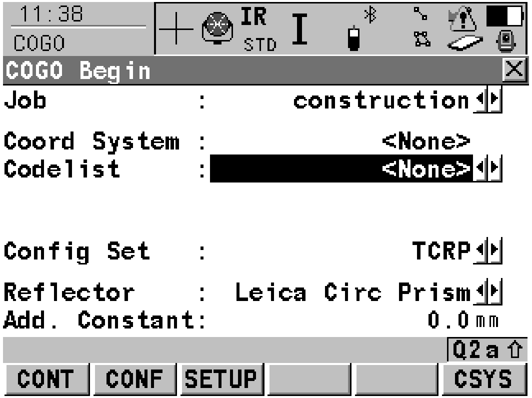
Press a hot key configured to access the screen **COGO COGO Begin**. Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

☞ The screens for each COGO calculation method can be accessed directly by pressing a configured hot key or **USER** where **COGO COGO Begin** is not accessed. The currently active configuration set and job are used.

COGO
COGO Begin



CONT (F1)
To accept changes and access the subsequent screen. The chosen settings become active.

CONF (F2)
To configure the COGO application program. Accesses **COGO Configuration**. Refer to "36.3 Configuring COGO".

SETUP (F3)
To set up station. Accesses **SETUP Station Setup**.

CSYS (F6)
To select a different coordinate system.

Description of fields

Field	Option	Description
<Job:>	Choicelist	The active job. All jobs from **Main Menu: Manage...\Jobs** can be selected.
<Coord System:>	Output	The coordinate system currently attached to the selected **<Job:>**.
<Codelist:>	Choicelist	No codes are stored in the selected **<Job:>**. All codelists from **Main Menu: Manage...\Codelists** can be selected.

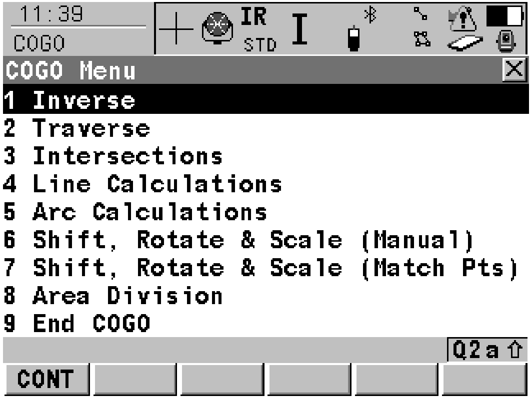
Field	Option	Description
	Output	Codes have already been stored in the selected **<Job:>**. If codes had been copied from a System RAM codelist, then the name of the codelist is displayed. If codes have not been copied from a System RAM codelist but typed in, then the name of the active job is displayed.
<Config Set:>	Choicelist	The active configuration set. All configuration sets from **Main Menu: Manage...\Configuration Sets** can be selected.
<Reflector:>	Choicelist	The active reflector. All reflectors from **Main Menu: Manage...\Reflectors** can be selected.
<Add. Constant:>	Output	The additive constant stored with the chosen reflector.

Next step

CONT (F1) accepts changes and accesses **COGO COGO Menu**.

COGO
COGO Menu

The COGO menu lists all COGO calculation methods and the option to end COGO.



CONT (F1)
To select the highlighted option and to continue with the subsequent screen.

SHIFT CONF (F2)
To configure the COGO application program. Accesses **COGO Configuration**. Refer to "36.3 Configuring COGO".

Description of the COGO menu options

COGO menu options	Description	Refer to chapter
Inverse	To calculate the direction, the distance and the 3D coordinate differences between: • two known points, • a known point and a given line, • a known point and a given arc. Points with full coordinate triplets, position only points and height only points can be used.	36.4
Traverse	To calculate the position of new points using	36.5

COGO menu options	Description	Refer to chapter
	• the azimuth/bearing and the distance from a known point. Offset optional. • the angle and the distance from a known point. Offset optional. Points with full coordinate triplets and position only points can be used.	
Intersections	To calculate the position of an intersection point using • bearings from two known points. • a bearing and a distance from two known points. • distances from two known points. • four points. • two lines Points with full coordinate triplets and position only points can be used.	36.6
Line Calculations	To calculate the base point of the line using • two known points and an offset point. • a bearing and a distance from a known point and an offset point. To calculate the offset point of the line using	36.7

COGO menu options	Description	Refer to chapter
	• two known points that define the line, a distance along the line and an offset. • a distance along a bearing from a known point and and offset. To calculate new points on a line using • two known points that define the line and either the segment length or the number of segments. • a bearing and distance from a known point that define the line and either the segment length or the number of segments.	
Arc Calculations	To calculate: • the arc centre. • the base point of the arc. • the offset point of the arc. • new points on an arc. The arc can be defined using • three points. • a radius to two known points. • a radius and two tangents, each of it defined by a point and the intersection point of the tangents.	36.8

COGO menu options	Description	Refer to chapter
	• the length of an arc and two tangents, each of it defined by a point and the intersection point of the tangents. • the length of a chord and two tangents, each of it defined by a point and the intersection point of the tangents. Known must be also, depending on the arc calculation method • an offset point. • either the segment length or the number of segments.	
Shift, Rotate & Scale (Manual)	To calculate the position of new points using • coordinates of known points • shifts. • rotation. • scale. Heights are not scaled. The values for shifts, rotation and/or scale are entered manually. Points with full coordinate triplets, position only points and height only points can be used.	36.9

COGO menu options	Description	Refer to chapter
Shift, Rotate & Scale (Match Pts)	To calculate the coordinates of new points using the shifts, rotation and scale computed from selected points. Points with full coordinate triplets, position only points and height only points can be used.	36.10
Area Division	To divide an area by a • defined line • percentage • size of a sub area.	36.11
End COGO	To end COGO and return to the screen from where COGO was accessed.	

Next step

IF	THEN
a COGO calculation method is to be started	highlight the relevant option and press **CONT (F1)**. Refer to the chapters stated above.
COGO is to be configured	**SHIFT CONF (F2)**. Refer to "36.3 Configuring COGO".
COGO is to be ended	highlight **End COGO** and **CONT (F1)**.

36.3 Configuring COGO

Access

Select **Main Menu: Programs...\COGO**. In **COGO COGO Begin** press **CONF (F2)** to access **COGO Configuration**.

OR

Press **PROG**. Highlight **COGO**. **CONT (F1)**. In **COGO COGO Begin** press **CONF (F2)** to access **COGO Configuration**.

OR

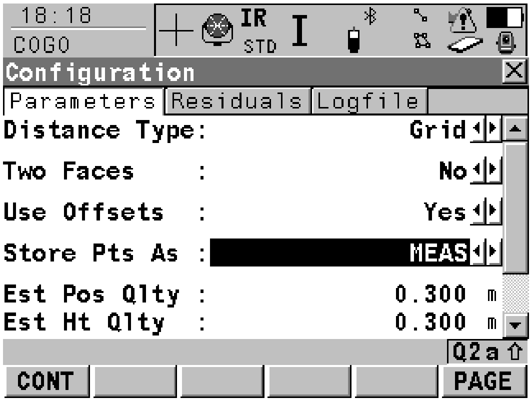
Press **SHIFT CONF (F2)** in **COGO COGO Menu**. Refer to "36.2 Accessing COGO".

OR

Press **SHIFT CONF (F2)** in **COGO XX**.

COGO Configuration, Parameters page

This screen consists of the **Parameters** page, **Residuals** page and the **Logfile** page. The explanations for the softkeys given below are valid for all pages.



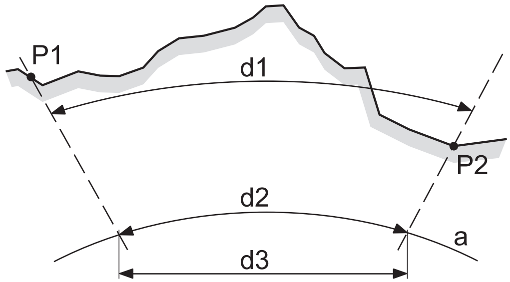
CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

PAGE (F6)
To change to another page on this screen.

SHIFT ABOUT (F5)
To display information about the program name, the version number, the date of the version, the copyright and the article number.

Description of fields

Field	Option	Description
<Distance Type:>		The type of distances and offsets to be accepted as input, shown as output and used in the calculation.
	Grid	Distances are calculated as the trigonometric distance between the position of two points. The distance field is **<HDist-Grid:>**.
	Ground	Distances are horizontal distances between two points at the mean elevation parallel to the ellipsoid of the active coordinate system. The distance field is **<HDist-Grnd:>**.
	Ellipsoid	The distances are reduced to the ellipsoid. They are calculated as the shortest distance between the two points on the ellipsoid. A scale factor is applied. The distance field is **<HDist-Ell:>**. ☞ In the attached coordinate system, a projection, an ellipsoid and a transformation have to be defined to calculate grid, ground and ellipsoid coordinates.

<table>
<tr><th>Field</th><th>Option</th><th>Description</th></tr>
<tr><td colspan="3">

a Ellipsoid
Known
P1 First known point
P2 Second known point
Unknown
d1 Ground distance
d2 Ellipsoid distance
d3 Grid distance
TPS12_170</td></tr>
<tr><td>**<Two Faces:>**</td><td></td><td>Defines if the instrument measures the second face automatically after storing the first.</td></tr>
<tr><td></td><td>**Yes**</td><td>After storing a measurement with **ALL (F1)** or **REC (F3)** motorised instruments change face automatically, non-motorised instruments access **COGO Telescope Positioning**. The measurements of face I and face II are averaged on the base of face I. The averaged value is stored.</td></tr>
<tr><td></td><td>**No**</td><td>No automatic measurement in two faces.</td></tr>
<tr><td>**<Use Offsets:>**</td><td>**Yes** or **No**</td><td>Activates the use of offsets in the COGO calculations. Input fields for the offsets are available in **COGO XX**.</td></tr>
<tr><td>**<Store Pts As:>**</td><td>**MEAS** or **CTRL**</td><td>To store the cogo point with point class MEAS or with point class CTRL.</td></tr>
</table>

Field	Option	Description
		Points stored with point class MEAS can be stored with the same point ID. The averaging functionality (configured under job management) can then be used to calculate an average for these points. Points stored with point class CTRL can only be stored with a unique point ID. A message is always displayed when a point is about to be stored with an already existing point ID. The user can then decide to either keep the existing point or overwrite the existing point.
<Est Pos Qlty:>	User input	The estimated value for the position quality assigned to all calculated COGO points which is used for the averaging calculation.
<Est Ht Qlty:>	User input	The estimated value for the height quality assigned to all calculated heights which is used for the averaging calculation.
When the Intersections method=TPS Obs-TPS Obs, the following fields apply:		
<Compute Ht:>	Output text	Defines the height being used.
	Using Average	Using an average of the two observations.
	Use Upper Height	Using the upper height.
	Use Lower Height	Using the lower height.

Next step

PAGE (F6) changes to the **Residuals** page. Refer to paragraph "COGO Configuration, Residuals page".

COGO Configuration, Residuals page

This page applies to COGO Shift, Rotate & Scale (Match Pts).

Description of fields

Field	Option	Description
<Easting:>	User input	The limit above which Easting residuals will be flagged as possible outliers.
<Northing:>	User input	The limit above which Northing residuals will be flagged as possible outliers.
<Height:>	User input	The limit above which Height residuals will be flagged as possible outliers.
<Residual Distbtn:>		The method by which the residuals of the control points will be distributed throughout the transformation area.
	None	No distribution is made. Residuals remain with their associated points.
	1/Distance^{XX}	Distributes the residuals according to the distance between each control point and the newly transformed point.
	Multiquadratic	Distributes the residuals using a multiquadratic interpolation approach.

Next step

PAGE (F6) changes to the **Logfile** page. Refer to paragraph "COGO Configuration, Logfile page".

COGO Configuration, Logfile page

Description of fields

Field	Option	Description
<Write Logfile:>	**Yes** or **No**	To generate a logfile when the application program is exited. A logfile is a file to which data from an application program is written to. It is generated using the selected **<Format File:>**.
<File Name:>	Choicelist	Available for **<Write Logfile: Yes>**. The name of the file to which the data should be written. A logfile is stored in the \DATA directory of the active memory device. The data is always appended to the file. Opening the choicelist accesses **XX Logfiles** where a name for a new logfile can be created and an existing logfile can be selected or deleted.
<Format File:>	Choicelist	Available for **<Write Logfile: Yes>**. A format file defines which and how data is written to a logfile. Format files are created using LGO. A format file must first be transferred from the CompactFlash card to the System RAM before it can be selected. Refer to "24 Tools...\Transfer Objects..." for information on how to transfer a format file.

Field	Option	Description
		Opening the choicelist accesses **XX Format Files** where an existing format file can be selected or deleted.

Next step

PAGE (F6) changes to the first page on this screen.

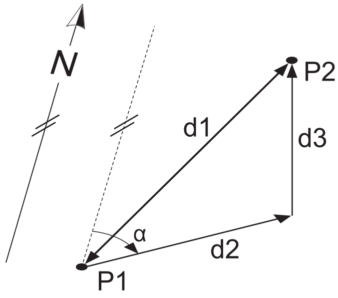
<Azimuth:> is used throughout this chapter. This should always be considered to also mean **<Bearing:>**.

36.4 COGO Calculation - Inverse Method

36.4.1 Overview

Description

It is possible to compute an inverse result between point, line and arc elements:



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Option 1: inverse between point - point

To compute an inverse between two known points.

Known elements:

P1 First known point (From)

P2 Second known point (To)

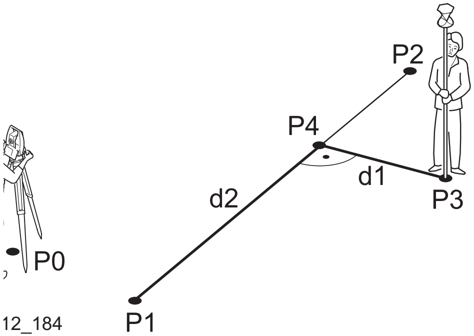
Unknown elements:

α Direction from P1 to P2

d1 Slope distance between P1 and P2

d2 Horizontal distance between P1 and P2

d3 Height difference between P1 and P2



12_184

Option 2: inverse between point - line

To compute an inverse between a known point and a given line (the inverse is computed as the perpendicular between the known point and the given line).

Known elements:

P0 Instrument station

P1 Starting point

P2 End point or the direction from P1 to P2

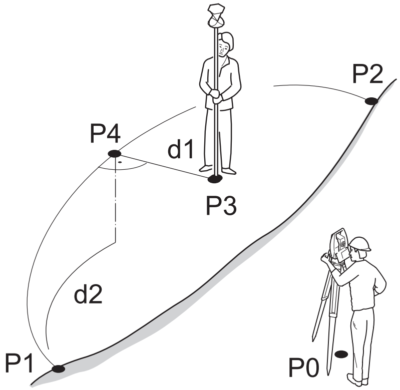
P3 Offset point

Unknown elements:

P4 Base point

d1 The perpendicular offset to the base point

d2 The distance along the line



TPS12_186

Option 3: inverse between point - arc

To compute an inverse between a known point and a given arc (the inverse is computed as the perpendicular between the known point and the given arc).

Known elements:

P0 Instrument station
P1 Starting point
P2 End point
P3 Offset point
P4 Second point or arc radius or arc/chord length

Unknown elements:

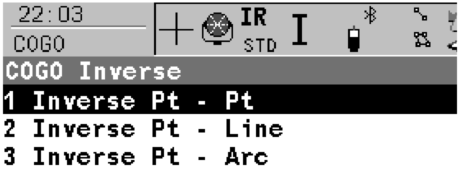
P4 Base point
d1 The perpendicular offset to the base point
d2 The distance along the arc

The coordinates of the points must be known. The points:

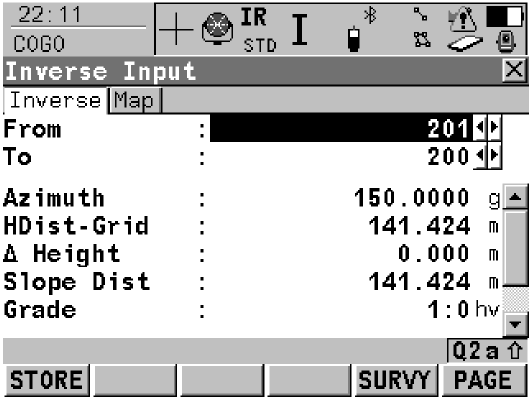
- may be taken from the active job.
- may be measured during the COGO calculation.
- may be entered manually.

36.4.2 Inverse Between Two Known Points (Pt - Pt)

Starting step-by-step

Step	Description
1.	
2.	

Calculating



STORE (F1)
To store the result.

SURVY (F5)
To measure a known point for the calculation.

SHIFT CONF (F2)
To configure the program.

PAGE (F6)
To change to another page on the screen.

Description of fields

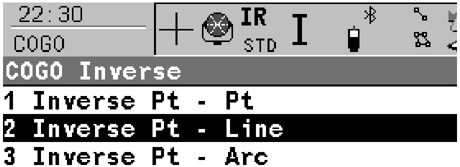
Field	Option	Description
<From:> or **<To:>**	Choicelist	The point ID of the two known points. To type in coordinates for a known point open the choicelist. Press **NEW (F2)** to create a new point.
<Azimuth:>	Output	The direction from the first point to the second point.
<HDist-XX:>	Output	The horizontal distance between the two points.
<ΔHeight:>	Output	The height difference between the two points.
<Slope Dist:>	Output	The slope distance between the two points.
<Grade:>	Output	The grade between the two points.
<ΔEasting:>	Output	The difference in Easting between the two points.
<ΔNorthing:>	Output	The difference in Northing between the two points.

Storing the results step-by-step

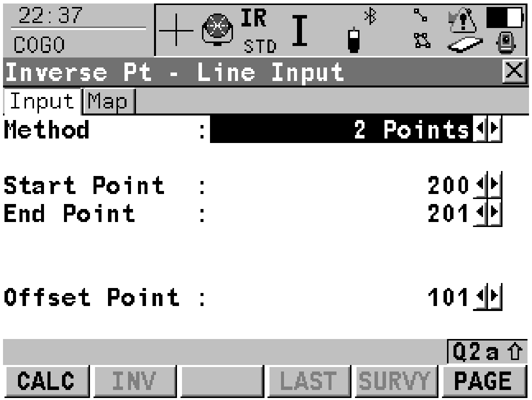
Step	Description
1.	Press **STORE (F1)** to store the inverse result to the active job. There are no points stored to the database, only the inverse result.
2.	Inverse results can be exported from the job using a format file. The format file is created with Format Manager in LEICA Geo Office.

36.4.3 Inverse Between a Known Point and a Line (Pt - Line)

Starting step-by-step

<table>
<tr><th>Step</th><th>Description</th></tr>
<tr><td>1.</td><td>
</td></tr>
<tr><td>2.</td><td>
</td></tr>
</table>

Calculating



CALC (F1)
To calculate the result.

INV (F2)
To calculate the inverse between two points.

LAST (F4)
To select the values for distance and offset from previous COGO inverse calculations.

SURVY (F5)
To measure a known point for the calculation.

SHIFT CONF (F2)
To configure the program.

SHIFT MODIF (F4)
To modify the original azimuth, distance or offset value.
PAGE (F6)
To change to another page on the screen.

Description of fields

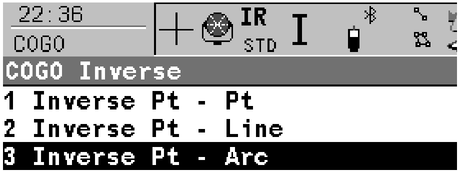
Field	Option	Description
<Method:>		**2 Points** or **Pt/Brg/Dist**. The method for calculating the inverse result.
<Start Point:>	Choicelist	The point ID defining the start of the line.
<End Point:>	Choicelist	The point ID defining the end of the line.
<Azimuth:>	Output	The direction from the first point to the second point.
<HDist-XX:>	Output	The horizontal distance between the two points.
<Offset Point:>	Choicelist	The point ID defining an offset to the line.

Storing the results step-by-step

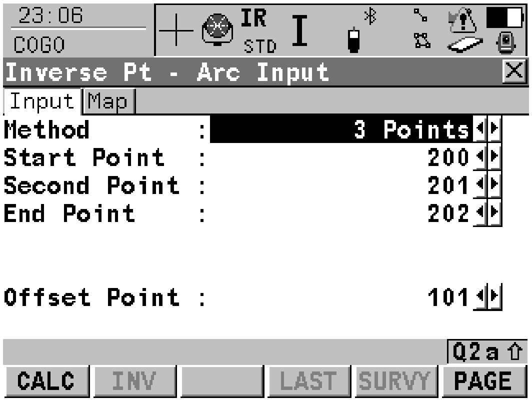
Step	Description
1.	Press **CALC (F1)** to calculate the inverse result and move to the results screen.
2.	Press **STORE (F1)** to store the inverse result to the active job. There are no points stored to the database, only the inverse result.
3.	Inverse results can be exported from the job using a format file. The format file is created with Format Manager in LEICA Geo Office.

36.4.4 Inverse Between a Known Point and an Arc (Pt - Arc)

Starting step-by-step

Step	Description
1.	
2.	

Calculating



CALC (F1)
To calculate the result.

INV (F2)
To calculate the inverse between two points.

LAST (F4)
To select the values for distance and offset from previous COGO Inverse calculations.

SURVY (F5)
To measure a known point for the calculation.

SHIFT CONF (F2)
To configure the program.

SHIFT MODIF (F4)
To modify the original azimuth, distance or offset value.
PAGE (F6)
To change to another page on the screen.

Description of fields

Field	Option	Description
<Method:>		**3 Points** or **2 Points/Radius** or **2 Tgnts/Radius** or **2 Tgnts/Arc Lngt** or **2 Tgnts/Chrd Lngt**. The method for calculating the inverse result.
<Start Point:>	Choicelist	The point ID defining the start of the arc.
<Second Point:>	Choicelist	The point ID defining a second point on the arc.
<End Point:>	Choicelist	The point ID defining the end of the arc.
<Arc Length:>	User Input	The arc length.
<Azimuth:>	Output	The direction from the first point to the second point.
<Chord length:>	User Input	The chord length of the arc.
<HDist-XX:>	Output	The horizontal distance between the two points.
<Offset Point:>	Choicelist	The point ID defining an offset to the arc.
<PI Point:>	Choicelist	The point ID defining the intersection of the tangents.
<Point 1:>	Choicelist	The point ID (with PI Point) defining the 1st tangent.
<Point 2:>	Choicelist	The point ID (with PI Point) defining the 2nd tangent.
<Radius:>	User Input	The radius of the arc.

Storing the results step-by-step

Step	Description
1.	Press **CALC (F1)** to calculate the inverse result and move to the results screen.
2.	Press **STORE (F1)** to store the inverse result to the active job. There are no points stored to the database, only the inverse result.
3.	Inverse results can be exported from the job using a format file. The format file is created with Format Manager in LEICA Geo Office.

36.5 COGO Calculation - Traverse Method

36.5.1 Overview

Description

Elements that must be known are

- the coordinates of one point.
- the direction from the known point to the COGO point.
- the distance from the known point to the COGO point.
- offsets, if required and configured.

The coordinates of the known point

- may be taken from the active job.
- may be measured during the COGO calculation.
- may be entered.

The direction from the known point to the COGO point can be an azimuth or an angle.

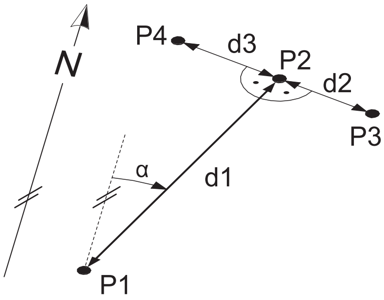
Points with full coordinate triplets and position only points can be used. Position only is calculated, height can be typed in.

A COGO traverse calculation can be calculated for

- a single point.
- multiple points. Several single points are calculated in one sequence.
- sideshots.

Diagram

COGO traverse calculation with offset for a single point



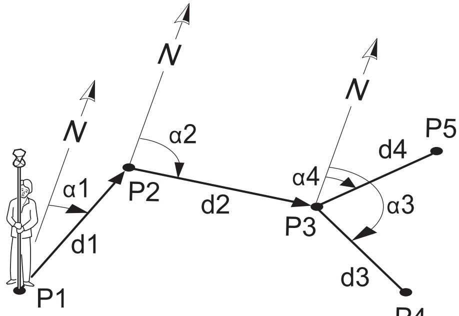
Known

P1	Known point
α	Direction from P1 to P2
d1	Distance between P1 and P2
d2	Positive offset to the right
d3	Negative offset to the left

Unknown

P2	COGO point without offset
P3	COGO point with positive offset
P4	COGO point with negative offset

COGO traverse calculation without offset for multiple points



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Known

P1	Known point
α1	Direction from P1 to P2
α2	Direction from P2 to P3
α3	Direction from P3 to P4
α4	Direction from P3 to P5
d1	Distance between P1 and P2
d2	Distance between P2 and P3
d3	Distance between P3 and P4
d4	Distance between P3 and P5

Unknown

P2	First COGO point
P3	Second COGO point
P4	Third COGO point - sideshot
P5	Fourth COGO point

36.5.2 Traverse with Azimuth/Bearing

COGO traverse calculation with azimuth/bearing step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to "36.2 Accessing COGO" to access **COGO Traverse Input**.	
☞	**COGO Traverse Input**, **Input** page **SHIFT CONF (F2)** to configure the COGO application program.	36.3
2.	**COGO Traverse Input**, **Input** page **<Method: Azimuth>** **<From:>** The point ID of the known point for the COGO calculation. Select a point to be used.	
☞	**SURVY (F5)** when **<From:>** is highlighted. To measure a known point for the COGO calculation.	47.2
☞	For all point fields, the MapView interactive display on the **Map** page can be used to select the desired point.	34.5
☞	To type in coordinates for a known point open the choicelist when **<From:>** is highlighted. Press **NEW (F2)** to create a new point.	6.3.2
3.	**COGO Traverse Input**, **Input** page **<Azimuth:>** The direction from the known point to the COGO point. **<HDist-XX:>** The horizontal distance between the known point and the COGO point.	

Step	Description	Refer to chapter
	<Offset:> Available for **<Use Offsets: Yes>** in **COGO Configuration**, **Parameters** page. The offset of the COGO point from the line of direction. A positive offset is to the right, a negative offset is to the left. Type in the azimuth, the distance and the offset, if required.	
	The values for the azimuth, the distance and the offset can be calculated from two existing points. **INV (F2)** when **<Azimuth:>**, **<HDist-XX:>** or **<Offset:>** is highlighted. To perform a COGO inverse calculation. Upon pressing **STORE (F1)** in **COGO Inverse**, the result from the COGO inverse calculation is copied to the field which was highlighted when **INV (F2)** was pressed. For **<Write Logfile: Yes>** in **COGO Configuration**, **Logfile** page the result of the COGO inverse calculation is written to the logfile.	36.4
	The values for the azimuth, the distance and the offset can be selected from previous COGO inverse calculations. **LAST (F4)** when **<Azimuth:>**, **<HDist-XX:>** or **<Offset:>** is highlighted. To recall previous results from COGO inverse calculations. Upon pressing **CONT (F1)** in **COGO Last Inverse Calculations**, the selected result is copied to the field which was highlighted when **LAST (F4)** was pressed.	36.12

Step	Description	Refer to chapter
	The values for the azimuth, the distance and the offset can be mathematically modified. **SHIFT MODIF (F4)** when **<Azimuth:>**, **<HDist-XX:>** or **<Offset:>** is highlighted. To add, subtract, multiply and divide values.	36.13
4.	Is the COGO point a foresight? • If **yes**, **CALC (F1)**. The result is calculated and displayed in **COGO Traverse Results**. After storing the result and returning to **COGO Traverse Input**, **Input** page, the point displayed in **<From:>** is the newly calculated COGO point. The next COGO calculation can be continued from this new point. • If **no**, **SSHOT (F3)**. The result is calculated and displayed in **COGO Traverse Results**. After storing the result and returning to **COGO Traverse Input**, **Input** page, the point originally selected in **<From:>** is still displayed. The next COGO calculation can be continued from that same point.	
5.	**COGO Traverse Results**, **Result** page **<Point ID:>** The identifier for the COGO point depending on the point ID template configured for **<Survey Pts:>** in **CONFIGURE ID Templates**. The point ID can be changed.	16.1

Step	Description	Refer to chapter
	<Ortho Ht:> or **<Local Ell Ht:>** are input fields. They display ----- when entering the **Result** page. A height value to be stored with the calculated point can be typed in. The calculated coordinates are displayed. Type in a point ID.	
☞	**COORD (F2)** views other coordinate types unless **<Coord System: None>**.	
☞	**STAKE (F5)** to access the Stakeout application program and stake out the calculated COGO point. After staking and storing the COGO point, **COGO Traverse Results**, **Result** page is displayed.	46.4
☞	**SHIFT ELL H (F2)** and **SHIFT ORTH (F2)**. Available unless **<Coord System: None>.** Changes between the ellipsoidal and the orthometric height.	
☞	**SHIFT INDIV (F5)** for an individual point ID independent of the ID template. **SHIFT RUN (F5)** changes back to the next ID from the configured ID template.	16.1
6.	**PAGE (F6)** changes to the **Code** page.	
7.	**COGO Traverse Results**, **Code** page **<Code:>/<Point Code:>** The thematical code. All codes of the job can be selected. Type in a code if required.	8 and 6.3.2

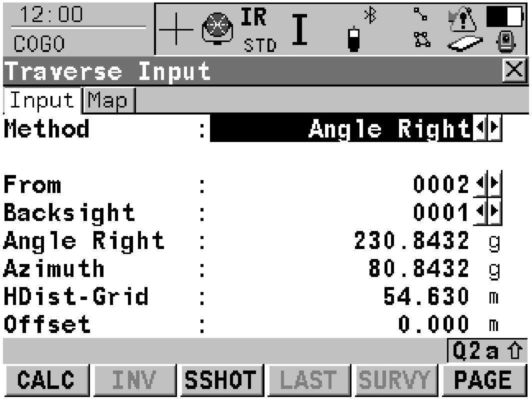
Step	Description	Refer to chapter
8.	**PAGE (F6)** changes to the **Plot** page.	
9.	**COGO Traverse Results**, **Plot** page An arrow points from the known point to the calculated COGO point.	34.6
	SHIFT QUIT (F6) does not store the COGO point and exits COGO calculations.	
10.	**STORE (F1)** to store the result and return to **COGO Traverse Input**, **Input** page.	
	For **<Write Logfile: Yes>** in **COGO Configuration**, **Logfile** page the result is written to the logfile.	
11.	Are more COGO traverse calculations to be made? • If **yes**, repeat steps 2. to 11. • If **no**, continue with step 12.	
12.	**SHIFT QUIT (F6)** to exit COGO calculation.	

36.5.3 Traverse with Angle Right

Access

Refer to "36.2 Accessing COGO" to access **COGO Traverse Input**.

COGO Traverse Input, Input page



CALC (F1)
To calculate the COGO point.

INV (F2)
To calculate the values for the distance and the offset from two existing points. Available if **<HDist-XX:>** or **<Offset:>** is highlighted.

SSHOT (F3)
To calculate the point as a sideshot.

LAST (F4)
To select the values for the distance and the offset from previous COGO inverse calculations. Available if **<HDist-XX:>** or **<Offset:>** is highlighted.

SURVY (F5)
To measure a point for the COGO calculation. Available if **<From:>** or **<Backsight:>** is highlighted.

SHIFT CONF (F2)
To configure the COGO application program.

SHIFT MODIF (F4)
To mathematically modify the values for the angle right, the distance and the offset. Available if **<Angle Right:>, <HDist-XX:>** or **<Offset:>** is highlighted.

Description of fields

Field	Option	Description
<Method:>	**Angle Right**	The direction from the known point to the COGO point is an angle.
<From:>	Choicelist	The point ID of the known point for the COGO calculation.
<Backsight:>	Choicelist	The point ID of a point used as backsight.
<Angle Right:>	User input	The angle between **<Backsight:>** and the new COGO point to be calculated from the point selected as **<From:>**. A positive value is for clockwise angles. A negative value is for counterclockwise angles.
<Azimuth:>	Output	The direction from the known point to the COGO point calculated from **<Angle Right:>**.
<HDist-XX:>	User input	The horizontal distance between the known point and the COGO point.
<Offset:>	User input	The offset of the COGO point from the line of direction. A positive offset is to the right, a negative offset is to the left.

Next step

The work flow is very similar to a COGO traverse calculation with azimuth/bearing. Refer to "36.5.2 Traverse with Azimuth/Bearing".

36.6 COGO Calculation - Intersections Method

36.6.1 Intersection with Bearing - Bearing

Description

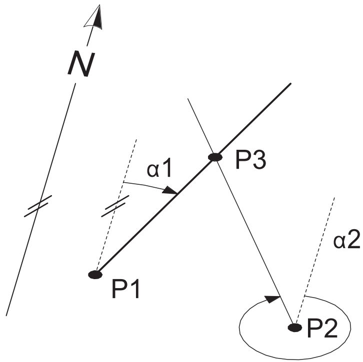
The COGO intersection calculation bearing - bearing calculates the intersection point of two lines. A line is defined by a point and a direction.

Elements that must be known are
- the coordinates of two points.
- the direction from these known points to the COGO point.
- offsets if required and configured.

The coordinates of the known points
- may be taken from the active job.
- may be measured during the COGO calculation.
- may be entered.

Points with full coordinate triplets and position only points can be used. Position only is calculated, height can be typed in.

Diagram



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Known
P1 First known point
P2 Second known point
α1 Direction from P1 to P3
α2 Direction from P2 to P3
Unknown
P3 COGO point

COGO intersection calculation with bearing - bearing step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to "36.2 Accessing COGO" to access **COGO Intersection Input**.	
	COGO Intersection Input, **Input** page **SHIFT CONF (F2)** to configure the COGO application program.	36.3
2.	**COGO Intersection Input**, **Input** page **<Method: Brng - Brng>** **<1st Point:>** The point ID of the first known point for the COGO calculation.	

Step	Description	Refer to chapter
	Select the point stored in the job.	
☞	**SURVY (F5)** when **<1st Point:>** is highlighted. To measure a point for the COGO calculation.	47.2
☞	For all point fields, the MapView interactive display on the **Map** page can be used to select the desired point.	34.5
☞	To type in coordinates for a known point open the choicelist when **<1st Point:>** is highlighted. Press **NEW (F2)** to create a new point.	6.3.2
3.	**COGO Intersection Input**, **Input** page **<Azimuth:>** The direction from the first known point to the COGO point. **<Offset:>** Available for **<Use Offsets: Yes>** in **COGO Configuration**, **Parameters** page. The offset of the COGO point from the line of direction. A positive offset is to the right, a negative offset is to the left. Type in the azimuth and the offset, if required.	
☞	The values for the azimuth and the offset can be calculated from two existing points. **INV (F2)** when **<Azimuth:>** or **<Offset:>** is highlighted. To perform a COGO inverse calculation. ☞ Upon pressing **STORE (F1)** in **COGO Inverse**, the result from the COGO inverse calculation is copied to the field which was highlighted when **INV (F2)** was pressed.	36.4

Step	Description	Refer to chapter
	For **<Write Logfile: Yes>** in **COGO Configuration**, **Logfile** page the result of the COGO inverse calculation is written to the logfile.	
	The values for the azimuth and the offset can be selected from previous COGO inverse calculations. **LAST (F4)** when **<Azimuth:>** or **<Offset:>** is highlighted. To recall previous results from COGO inverse calculations. Upon pressing **CONT (F1)** in **COGO Last Inverse Calculations**, the selected result is copied to the field which was highlighted when **LAST (F4)** was pressed.	36.12
	The values for the azimuth and the offset can be mathematically modified. **SHIFT MODIF (F4)** when **<Azimuth:>** or **<Offset:>** is highlighted. To add, subtract, multiply and divide values.	36.13
4.	**COGO Intersection Input**, **Input** page The procedure to input the second known point and the azimuth is identical to the procedure for the first known point. Repeat steps 2. and 3.	
5.	**CALC (F1)** to calculate the result.	
6.	**COGO Brng - Brng Results**, **Result** page	

Step	Description	Refer to chapter
	<Point ID:> The identifier for the COGO point depending on the point ID template configured for **<Survey Pts:>** in **CONFIGURE ID Templates**. The point ID can be changed. **<Ortho Ht:>** or **<Local Ell Ht:>** are input fields. They display ----- when entering the **Result** page. A height value to be stored with the calculated point can be typed in. The calculated coordinates are displayed. Type in a point ID.	16.1
☞	**COORD (F2)** views other coordinate types unless **<Coord System: None>**.	
☞	**STAKE (F5)** to access the Stakeout application program and stake out the calculated COGO point. After staking and storing the COGO point **COGO Brng - Brng Results**, **Result** page is displayed.	46.4
☞	**SHIFT ELL H (F2)** and **SHIFT ORTH (F2)**. Available unless **<Coord System: None>.** Changes between the ellipsoidal and the ortho-metric height.	
☞	**SHIFT INDIV (F5)** for an individual point ID independent of the ID template. **SHIFT RUN (F5)** changes back to the next ID from the configured ID template.	16.1
7.	**PAGE (F6)** changes to the **Code** page.	
8.	**COGO Brng - Brng Results**, **Code** page	8 and 6.3.2

Step	Description	Refer to chapter
	<Code:>/**<Point Code:>** The thematical code. All codes of the job can be selected. Type in a code if required.	
9.	**PAGE (F6)** changes to the **Plot** page.	
10.	**COGO Brng - Brng Results**, **Plot** page Arrows point from the known points to the calculated COGO point.	34.6
	SHIFT QUIT (F6) does not store the COGO point and exits COGO calculation.	
11.	**STORE (F1)** to store the result and return to **COGO Intersection Input**, **Input** page.	
	For **<Write Logfile: Yes>** in **COGO Configuration**, **Logfile** page the result is written to the logfile.	
12.	Are more COGO intersection calculations to be made? • If **yes**, repeat steps 2. to 12. **<Method:>** in **COGO Intersection Input**, **Input** page can be changed. Refer to the relevant chapters for the other COGO intersection calculation methods. • If **no**, continue with step 13.	36.6.2, 36.6.3 or 36.6.4.
13.	**SHIFT QUIT (F6)** to exit COGO calculation.	

36.6.2 Intersection with Bearing - Distance

Description

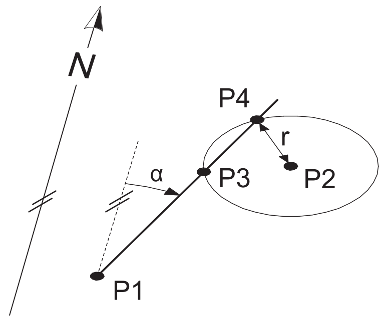
The COGO intersection calculation bearing - distance calculates the intersection point of a line and a circle. The line is defined by a point and a direction. The circle is defined by the centre point and the radius.

Elements that must be known are
- the coordinates of two points.
- the direction from one known point to the COGO point.
- the distance from the second known point to the COGO point.
- offsets if required and configured.

The coordinates of the known points
- may be taken from the active job.
- may be measured during the COGO calculation.
- may be entered.

Points with full coordinate triplets and position only points can be used.

Diagram



TPS12_149

Known

P1	First known point
P2	Second known point
α	Direction from P1 to P3 and P4
r	Radius, as defined by the distance from P2 to P4 and P3

Unknown

P3	First COGO point
P4	Second COGO point

COGO intersection calculation with bearing - distance step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	The procedure of a COGO intersection calculation with bearing - distance is similar to a COGO intersection calculation with bearing - bearing. Follow the steps 1. to 5. in paragraph "COGO intersection calculation with bearing - bearing step-by-step". The differences are: • **<Method: Brng - Dist>** is to be selected in **COGO Intersection Input**, **Input** page. • For the second known point **<HDist-XX:>** is used instead of **<Azimuth:>**. The keys and advice mentioned are still valid.	36.6.1

Step	Description	Refer to chapter
2.	**CALC (F1)** to calculate the COGO points.	
☞	Two results are calculated.	
3.	**COGO Brng - Dist Results**, **Result1** page **<Point ID:>** The identifier for the first result of the COGO point depending on the point ID template configured for <**Survey Pts:>** in **CONFIGURE ID Templates**. The point ID can be changed. **<Ortho Ht:>** or **<Local Ell Ht:>** are input fields. They display ----- when entering the **Result1** page. A height value to be stored with the calculated point can be typed in. The calculated coordinates are displayed. Type in a point ID.	16.1
☞	**COORD (F2)** views other coordinate types unless **<Coord System: None>**.	
☞	**STAKE (F5)** to access the Stakeout application program and stake out the calculated COGO point. After staking and storing the COGO point **COGO Brng - Brng Results**, **Result1** page is displayed.	46.4
☞	**SHIFT ELL H (F2)** and **SHIFT ORTH (F2)**. Available unless **<Coord System: None>.** Changes between the ellipsoidal and the orthometric height.	

Step	Description	Refer to chapter
☞	**SHIFT INDIV (F5)** for an individual point ID independent of the ID template. **SHIFT RUN (F5)** changes back to the next ID from the configured ID template.	16.1
☞	**PAGE (F6)** changes to the **Code** page where a code and attributes can be selected.	8
☞	Pressing **PAGE (F6)** twice changes to the **Plot** page. Both COGO points and known points are displayed.	34.6
☞	**SHIFT QUIT (F6)** does not store the COGO points and exits COGO calculations.	
☞	**RSLT1 (F3)** or **RSLT2 (F3)** to view the first and second result.	
4.	**COGO Brng - Dist Results**, **Result1** page s the first result to be stored? • If **yes**, **STORE (F1)** to store the result and activate the **Result2** page. For **<Write Logfile: Yes>** in **COGO Configuration**, **Logfile** page the result is written to the logfile. • If **no**, **RSLT2 (F3)** to activate the **Result2** page.	
5.	**COGO Brng - Dist Results**, **Result2** page Repeat step 3.	
6.	**COGO Brng - Dist Results**, **Result2** page Is the second result to be stored?	

Step	Description	Refer to chapter
	• If **yes**, **STORE (F1)** to store the result and return to **COGO Intersection Input**, **Input** page. For **<Write Logfile: Yes>** in **COGO Configuration**, **Logfile** page the result is written to the logfile. • If **no**, **ESC** does not store the COGO point and returns to **COGO Intersection Input**, **Input** page.	
7.	Are more COGO intersection calculations to be done? • If **yes**, repeat steps 1. to 7. **<Method:>** in **COGO Intersection Input**, **Input** page can be changed. Refer to the relevant chapters for other COGO intersection calculation method than **<Method: Brng - Dist>**. • If **no**, continue with step 8.	36.6.1, 36.6.3 or 36.6.4
8.	**SHIFT QUIT (F6)** exit COGO calculation.	

36.6.3 Intersection with Distance - Distance

Description

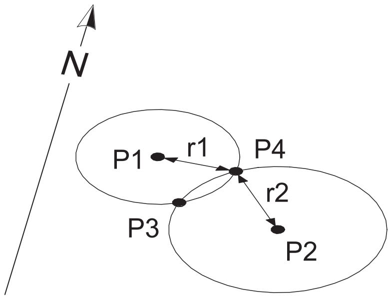
The COGO intersection calculation distance - distance calculates the intersection point of two circles. The circles are defined by the known point as the centre point and the distance from the known point to the COGO point as the radius.

Elements that must be known are
- the coordinates of two points.
- the distance from the known points to the COGO point.

The coordinates of the known points
- may be taken from the active job.
- may be manually occupied during the COGO calculation.
- may be entered.

Points with full coordinate triplets and position only points can be used.

Diagram



TPS12_150

Known

P1	First known point
P2	Second known point
r1	Radius, as defined by the distance from P1 to P3 or P4
r2	Radius, as defined by the distance from P2 to P3 or P4

Unknown

P3	First COGO point
P4	Second COGO point

COGO intersection calculation with distance - distance step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	The procedure for a COGO intersection calculation with distance - distance is very similar to a COGO intersection calculation with bearing - bearing. Follow the steps 1. to 5. in paragraph "COGO intersection calculation with bearing - bearing step-by-step". The differences are: • **<Method: Dist - Dist>** is to be selected in **COGO Intersection Input**, **Input** page. • For both known points **<HDist-XX:>** is used instead of **<Azimuth:>**. The keys mentioned are still valid. • **<Offset:>** is unavailable.	36.6.1

Step	Description	Refer to chapter
2.	The remaining procedure is identical to a COGO intersection calculation with bearing - distance. The screen is called **COGO Dist - Dist Results**. Follow the steps 2. to 8. in paragraph "COGO intersection calculation with bearing - distance step-by-step".	 36.6.2

36.6.4 Intersection with By Points

Description

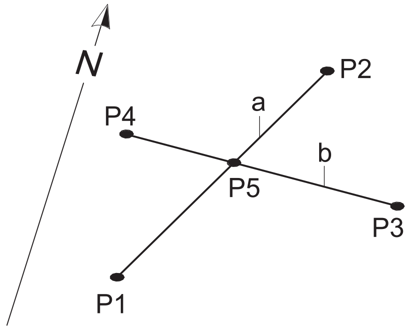
The COGO intersection calculation by points calculates the intersection point of two lines. A line is defined by two points.

Elements that must be known are
- the coordinates of four points.
- offsets of the lines if required and configured.

The coordinates of the known points
- may be taken from the active job.
- may be measured during the COGO calculation.
- may be entered.

Points with full coordinate triplets and position only points can be used.

Diagram



TPS12_151

Known

P1 First known point
P2 Second known point
P3 Third known point
P4 Fourth known point
a Line from P1 to P2
b Line from P3 to P4

Unknown

P5 COGO point

COGO intersection calculation with by points step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to "36.2 Accessing COGO" to access **COGO Intersection Input**.	
	COGO Intersection Input, **Input** page **SHIFT CONF (F2)** to configure the COGO application program.	36.3.
2.	**COGO Intersection Input**, **Input** page **<Method: By Points>** **<1st Point:>** The point ID of the known start point of the first line for the COGO calculation.	

Step	Description	Refer to chapter
	<2nd Point:> The point ID of the known end point of the first line for the COGO calculation. Select the points stored in the job.	
	SURVY (F5) when **<1st Point:>** or **<2nd Point:>** is highlighted. To measure a known point for the COGO calculation.	47.2
	For all point fields, the MapView interactive display on the **Map** page can be used to select the desired point.	34.5
	To type in coordinates for a known point open the choicelist when **<1st Point:>** or **<2nd Point:>** is highlighted. Press **NEW (F2)** to create a new point.	6.3.2
3.	**COGO Intersection Input**, **Input** page **<Offset:>** Available for **<Use Offsets: Yes>** in **COGO Configuration**, **Parameters** page. The offset of the line in the direction **<1st Point:>** to **<2nd Point:>**. A positive offset is to the right, a negative offset is to the left. Type in the offset if required.	
	The value for the offset can be calculated from two existing points. **INV (F2)** when **<Offset:>** is highlighted. To perform a COGO inverse calculation. Upon pressing **STORE (F1)** in **COGO Inverse**, the result from the COGO inverse calculation is copied to the field which was highlighted when **INV (F2)** was pressed.	36.4

Step	Description	Refer to chapter
	For **<Write Logfile: Yes>** in **COGO Configuration**, **Logfile** page the result of the COGO inverse calculation is written to the logfile.	
	The value for the offset can be selected from previous COGO inverse calculations. **LAST (F4)** when **<Offset:>** is highlighted. To recall previous results from COGO inverse calculations. Upon pressing **CONT (F1)** in **COGO Last Inverse Calculations**, the selected result is copied to the field.	36.12
	The value for the offset can be mathematically modified. **SHIFT MODIF (F4)** when **<Offset:>** is highlighted. To add, subtract, multiply and divide values.	36.13
4.	**COGO Intersection Input**, **Input** page The procedure for the third and fourth known point and the offset is identical to the procedure for the first and second known point. Repeat steps 2. and 3.	
5.	The remaining procedure is identical to a COGO intersection calculation with bearing - bearing. The screen is called **COGO By Points Results**. On the **Plot** page two solid lines are displayed. Follow the steps 5. to 13. in paragraph "COGO intersection calculation with bearing - bearing step-by-step".	 36.6.1

36.6.5 Intersection with TPS Observation - TPS Observation

Description

The COGO intersection calculation TPS observation - TPS observation calculates the intersection point of two lines. A line is defined by a TPS station and a TPS measurement from this station.

Elements that must be known are

- the coordinates of two points.
- azimuths of the lines.

The coordinates of the known points

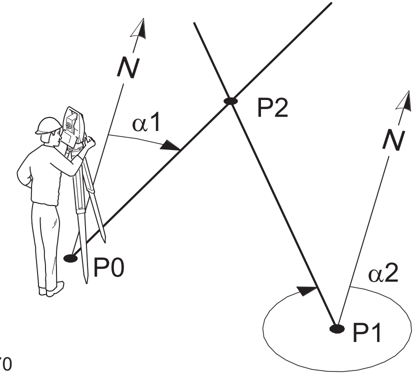
- must be taken from the active job.
- must be TPS station points.

The azimuths of the lines

- must be TPS measurements angle measurements from the known points.
- can be two angle measurements or an angle measurement and a distance measurement.

Points with full coordinate triplets and position only points can be used.

Diagram



GPS12_170

Known
P0 First known point (TPS station)
P1 Second known point (TPS station)
á1 Direction from P0 to P2
á2 Direction from P1 to P2
Unknown
P2 COGO point

COGO intersection calculation with TPS Obs - TPS Obs step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to "36.2 Accessing COGO" to access **COGO Intersection Input**.	
	**COGO Intersection Input**, **Input** page **SHIFT CONF (F2)** to configure the COGO application program.	36.3
2.	**COGO Intersection Input**, **Input** page <Method: TPS Obs-TPS Obs> **<1st TPS Stn:>** The point ID of the first TPS station which is the known start point of the first line for the COGO calculation.	

Step	Description	Refer to chapter
	<TPS Measmnt:> The point ID of the TPS measurement which is the known end point of the first line for the COGO calculation. **<Azimuth:>** The azimuth related to the known end point of the first line for the COGO calculation. **<2nd TPS Stn:>** The point ID of the second TPS station which is the known start point of the second line for the COGO calculation. **<TPS Measmnt:>** The point ID of the TPS measurement which is the known end point of the second line for the COGO calculation. **<Azimuth:>** The azimuth related to the known end point of the second line for the COGO calculation. Points can only be selected from the active job. Points for the **<2nd TPS Stn:>** and the **<TPS Measmnt:>** from that station can also be directly measured when using this method.	
	The value for the azimuth can be calculated from two existing points. **INV (F2)** when **<Azimuth:>** is highlighted. To perform a COGO inverse calculation. Upon pressing **STORE (F1)** in **COGO Inverse**, the result from the COGO inverse calculation is copied to the field which was highlighted when **INV (F2)** was pressed. For **<Write Logfile: Yes>** in **COGO Configuration**, **Logfile** page the result of the COGO inverse calculation is written to the logfile.	36.4

Step	Description	Refer to chapter
	The value for the azimuth can be selected from previous COGO inverse calculations. **LAST (F4)** when **<Azimuth:>** is highlighted. To recall previous results from COGO inverse calculations. Upon pressing **CONT (F1)** in **COGO Last Inverse Calculations**, the selected result is copied to the field.	36.12

36.7 COGO Calculation - Line Calculations Method

36.7.1 Line Calculation - Base Point

Description

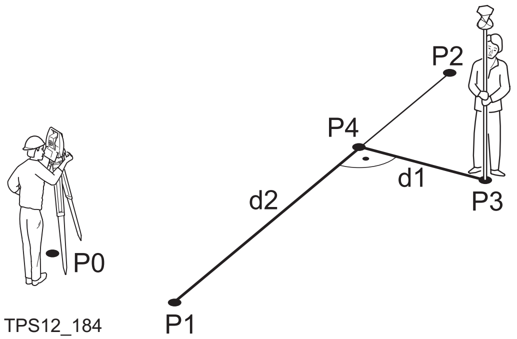
The COGO line calculation base point calculates the base point, station and offset of a point in relation to a line.

Elements that must be known are
- coordinates of two points and an offset point.

OR
- coordinates of one point and an offset point
- bearing and distance from one point

The coordinates of the known points
- may be taken from the active job.
- may be measured during the COGO calculation.
- may be entered.

Diagram



TPS12_184

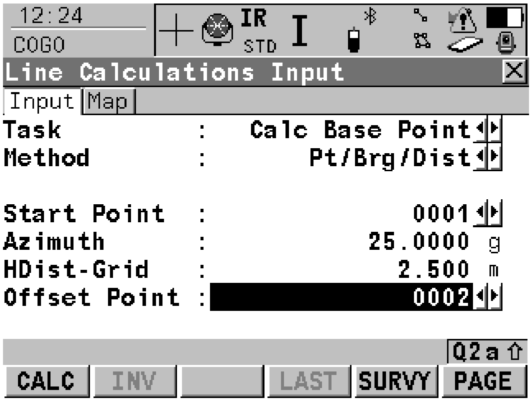
P0	Instrument station
P1	**<Start Point:>**
P2	**<End Point:>**
P3	**<Offset Point:>**
P4	Base point
d1	**<Offset-XX:>**
d2	**<ΔLine-XX:>**

☞ Line management is not available for COGO line calculations.

Access

Refer to "36.2 Accessing COGO" to access **COGO Line Calculations Input**.

COGO Line Calculations Input, Input page



CALC (F1)
To calculate COGO point.

INV (F2)
To calculate the values for the distance and the offset from two existing points. Available if **<Azimuth:>** or **<HDist-XX:>** is highlighted.

LAST (F4)
To select the values for the distance and the offset from previous COGO inverse calculations. Available if **<Azimuth:>** or **<HDist-XX:>** is highlighted.

SURVY (F5)
To measure a point for the COGO calculation. Available if **<Start Point:>** or **<End Point:>** is highlighted.

SHIFT CONF (F2)
To configure the COGO application program.

SHIFT MODIF (F4)
To mathematically modify the values. Available if **<Azimuth:>**, **<ΔLine-XX:>** or **<HDist-XX:>** is highlighted.

Description of fields

Field	Option	Description
<Task:>	Calc Base Point	Calculates the base point, the station and offset of a point in relation to a line.
	Calc Offset Point	Calculates the coordinates of a new point after input of station and offset values in relation to a line.
	Segmentation	Calculates the coordinates of new points on a line either equally spaced or with defined segments.
<Method:>		The method by which the line will be defined.
	2 Points	Uses two known points to define the line.
	Pt/Brg/Dist	Defines the line using a known point, a distance and an azimuth of the line.
<Start Point:>	Choicelist	The start point of the line. All points from **COGO Data: Job Name** can be selected.

Field	Option	Description
<End Point:>	Choicelist	Available for **<Method: 2 Points>**. The end point of the line. All points from **COGO Data: Job Name** can be selected.
<Azimuth:>	User input	Available for **<Method: Pt/Brg/Dist>**. The azimuth of the line.
<HDist-XX:>	User input	Available for **<Method: Pt/Brg/Dist>**. The horizontal distance from the start point to the end point of the line.
<ΔLine-XX:>	User input	Available for **<Task: Calc Offset Point>**. Horizontal distance from start point to base point.
<Offset Point:>	Choicelist	Available for **<Task: Calc Offset Point>**. The offset point.
<Offset-XX:>	User input	Available for **<Task: Calc Offset Point>**. Offset from base point to offset point. Positive to the right and negative to the left of the line.

Next step

PAGE (F6) accesses **Map** page. Refer to paragraph "COGO Line Calculations Input, Map page".

COGO Line Calculations Input, Map page

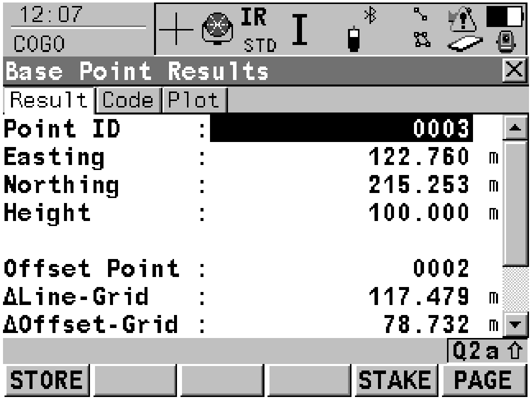
The **Map** page provides an interactive display of the data. Refer to "34 MapView Interactive Display Feature" for information on the functionality and softkeys available.

Next step

IF	THEN
<Task: Calc Base Point>	**CALC (F1)** accesses **COGO Base Point Results**. Refer to paragraph "COGO XX Point Results, Result page".
<Task: Calc Offset Point>	**CALC (F1)** accesses **COGO Offset Point Results**. Refer to paragrahp "COGO XX Point Results, Result page".
<Task: Segmentation>	**CALC (F1)** accesses **COGO Define Segmentation**. Refer to paragraph "36.7.3 Line Calculation - Segmentation".

COGO XX Point Results, Result page

The result screens for base point and offset point are very similar. The explanations given for the softkeys below are valid for the **Result** page.



STORE (F1)
To store result and to return to **COGO Line Calculations Input**.

STAKE (F5)
To access the Stakeout application program and stake out the calculated COGO point.

PAGE (F6)
To change to another page on this screen.

SHIFT ELL H (F2) and **SHIFT ORTH (F2)**
To change between the ellipsoidal and the orthometric height. Available unless **<Coord System: None>**.

SHIFT INDIV (F5) and **SHIFT RUN (F5)**
To change between entering an individual point ID different to the defined ID template and the running point ID according to the ID template. Refer to "16.1 ID Templates".

Description of fields

Field	Option	Description
<Point ID:>	User input	The identifier for the COGO point depending on the point ID template configured for **<Survey Pts:>** in **CONFIGURE ID Templates**.
<Ortho Ht:> or **<Local Ell Ht:>**	User input	A height value to be stored with the calculated point can be typed in.
<Offset Point:>	Output	Point ID of offset point. Available for **<Task: Calc Base Point>**.
<ΔLine-XX:>	Output	Horizontal distance from start point to base point. Available for **<Task: Calc Base Point>**.
<ΔOffset-XX:>	Output	Offset from base point to offset point. Positive to the right and negative to the left of the line. Available for **<Task: Calc Base Point>**.
<Line Length:>	Output	Length of line from start point to end point.

Field	Option	Description
<Line Brng:>	Output	Bearing of line from start point to end point.
<Offs Pt Brng:>	Output	Bearing of offset point from base point to offset point.

Next step
PAGE (F6) changes to the **Code** page.

COGO XX Point Results, Code page

The functionality of the **Code** page is similar to **COGO Traverse Result, Code** page.

Next step
PAGE (F6) changes to the **Plot** page.

COGO XX Point Results, Plot page

The functionality of the **Plot** page is similar to **COGO Traverse Results, Plot** page.

Next step
STORE (F1) stores the result and accesses **COGO Line Calculations Input, Input** page.

36.7.2 Line Calculation - Offset Point

Description

The COGO line calculation offset point calculates the coordinates of a new point after input of station and offset values in relation to a line.

Elements that must be known are
- coordinates of two points.
- offsets.

OR
- coordinates of one point.
- bearing and distance from one point.
- offsets.

The coordinates of the known points
- may be taken from the active job.
- may be measured during the COGO calculation.
- may be entered.

☞ Line management is not available for COGO line calculations.

COGO line calculation offset point step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to "36.2 Accessing COGO" to access **COGO Line Calculations Input**.	

Step	Description	Refer to chapter
	COGO Line Calculations Input, Input page. **SHIFT CONF (F2)** to configure the COGO application program.	 36.3
2.	**COGO Line Calculations Input, Input** page. **<Task: Calc Offset Point>**	36.7.1
3.	**CALC (F1)** calculates the results.	
4.	**COGO Offset Point Results, Result** page **STORE (F1)** stores the results.	36.7.1

36.7.3 Line Calculation - Segmentation

Description

The COGO line calculation segmentation calculates the coordinates of new points on a line.

Elements that must be known are

- coordinates of the start and the end point of the line

OR

- a bearing and distance from a known point that define the line

AND EITHER

- the number of segments dividing the line

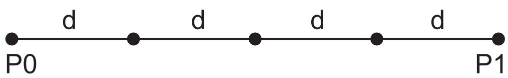
OR

- a segment length for the line.

The coordinates of the known points

- may be taken from the active job.
- may be measured during the COGO calculation.
- may be entered.

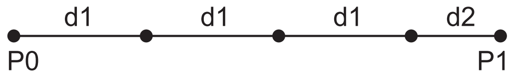
Diagram



GPS12_144

Line divided by **<Method: No. of Segments>**

P0	**<Start Point:>**
P1	**<End Point:>**
d	Equally spaced segments result from dividing a line by a certain number of points.



GPS12_145

Line divided by **<Method: Segment Length>**

P0 **<Start Point:>**
P1 **<End Point:>**
d1 **<Seg Length:>**
d2 Remaining segment

COGO line calculation segmentation step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to "36.2 Accessing COGO" to access **COGO Line Calculation Input**.	
	COGO Line Calculation Input, **Input** page **SHIFT CONF (F2)** to configure the COGO application program.	36.3
2.	**COGO Line Calculations Input**, **Input** page **<Task: Segmentation>**	36.7.1
3.	**CALC (F1)** to access **COGO Define Segmentation**.	
4.	**COGO Define Segmentation** **<Method:>** How the line is to be divided. Refer to paragraph "Diagram". Depending on the selection, the following fields are user input or output fields. **<Line Length:>** Calculated line length between the selected **<Start Point:>** and **<End Point:>**.	

Step	Description	Refer to chapter
	<No. of Segs:> For **<Method: No. of Segments>** type in the number of segments for the line. For **<Method: Segment Length>** type in the segment length for the line. A remaining segment may result from this method. **<Seg Length:>** For **<Method: No. of Segments>** this is the calculated length of each segment. For **<Method: Segment Length>** type in the required segment length. **<Last Seg Lgth:>** Available for **<Method: Segment Length>**. The length of the remaining segment. **<Start PtID:>** The point ID to be assigned to the first new point on the line. The selected point ID templates from **CONFIGURE ID Templates** are not applied. **<PtID Inc:>** **<Start PtID:>** is incremented numerically for the second, third, etc. point on the line.	
5.	**CALC (F1)** to access **COGO Segmentation Results**.	
☞	The coordinates of the new points are calculated. The heights are computed along the line assuming a linear slope between **<Start Point:>** and **<End Point:>**.	
6.	**COGO Segmentation Results**, **Result** page **<Number of Segments:>** Describes the number of resulting segments for the line including the remaining segment, if it applies.	

Step	Description	Refer to chapter
	<Last Segment Lgth:> Available for **<Method: Segment Length>**. The length of the remaining segment.	
	STAKE (F5) to access the Stakeout application program and stake out the calculated COGO point. **SHIFT QUIT (F6)** or **ESC** return to **COGO Segmentation Results**, **Result** page.	
7.	**PAGE (F1)** to access **COGO Segmentation Results**, **Plot** page The known points defining the line and those created on the line are shown in black.	34.6
8.	**CONT (F1)** returns to **COGO Line Calculations Input**.	

36.8 COGO Calculation - Arc Calculations Method

36.8.1 Arc Calculation - Arc Center

Description

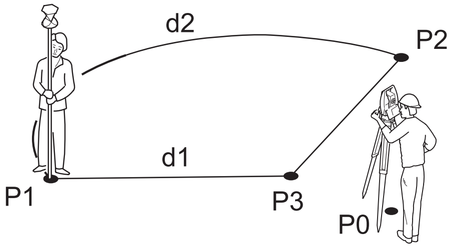
The COGO arc calculation arc center calculates the coordinates of the centre of the arc.

Elements that must be known are
- coordinates of three points

OR
- coordinates of two points
- radius to the two points

The coordinates of the known points
- may be taken from the active job.
- may be measured during the COGO calculation.
- may be entered.

Diagram



TPS12_217

P0	Instrument station
P1	**<Start Point:>**
P2	**<End Point:>**
P3	Arc Center
d1	**<Arc Radius:>**
d2	**<Arc Length:>**

☞ Arc management is not available for COGO arc calculations.

Access

Refer to "36.2 Accessing COGO" to access **COGO Arc Calculations Input**.

COGO
Arc Calculations Input
Input page

The softkeys are similar to line calculation. Refer to "36.7.1 Line Calculation - Base Point" for information on softkeys.

Description of fields

Field	Option	Description
<Task:>	Calc Arc Center	Calculates the coordinates of the centre of the arc.
	Calc Offset Point	Calculates the coordinates of a new point after input of station and offset values in relation to an arc.
	Calc Base Point	Calculates the base point, the station and offset of a point in relation to an arc.
	Segmentation	Calculates the coordinates of new points on an arc either equally spaced, in a defined interval or in a defined angle.
<Method:>		The method by which the arc will be defined.
	3 Points	Uses three known points to define the arc.
	2 Points/Radius	Defines the arc using two known points and a radius of the arc.
	2 Tgnts/Radius	Defines the arc using two tangents and a radius of the arc.

Field	Option	Description
	2 Tgnts/Chrd Lngt	Defines the arc using two tangents and the chord of the arc.
<Start Point:>	Choicelist	The start point of the arc. All points from **COGO Data: Job Name** can be selected. Available for **<Method: 3 Points>** and **<Method: 2 Points/Radius>**.
<Second Point:>	Choicelist	All points from **COGO Data: Job Name** can be selected. Available for **<Method: 3 Points>**. The second point of the arc.
<End Point:>	Choicelist	The end point of the arc. All points from **COGO Data: Job Name** can be selected. Available for **<Method: 3 Points>** and **<Method: 2 Points/Radius>**.
<Point 1:>	Choicelist	A point on the first tangent. Available for **<Method: 2 Tgnts/Radius>**, **<Method: 2 Tgnts/Arc Lngt>** and **<Method: 2 Tgnts/Chrd Lngt>**.
<PI Point:>	Choicelist	The point of intersection of the two tangents. Available for **<Method: 2 Tgnts/Radius>**, **<Method: 2 Tgnts/Arc Lngt>** and **<Method: 2 Tgnts/Chrd Lngt>**.
<Point 2:>	Choicelist	A point on the second tangent. Available for **<Method: 2 Tgnts/Radius>**, **<Method: 2 Tgnts/Arc Lngt>** and **<Method: 2 Tgnts/Chrd Lngt>**.
<Radius:>	User input	The radius of the arc. Available for **<Method: 2 Points/Radius>** and **<Method: 2 Tgnts/Radius>**.

Field	Option	Description
<Arc Length:>	User input	The length of the arc. Available for **<Method: 2 Tgnts/Arc Lngt>**.
<Chord Length:>	User input	The length of the chord. Available for **<Method: 2 Tgnts/Chrd Lngt>**.
<ΔArcDist-XX:>	User input	Horizontal distance along the arc from start point to base point. Available for **<Task: Calc Offset Point>**.
<ΔOffset-XX:>	User input	Offset from base point to offset point. Positive to the right and negative to the left of the arc. Available for **<Task: Calc Offset Point>**.
<Offset Point:>	Choicelist	The offset point. Available for **<Task: Calc Base Point>**.

Next step

IF	THEN
<Task: Calc Arc Center>	**CALC (F1)** accesses **COGO Center of Arc Results**. Refer to paragraph "COGO XX Results, Result page".
<Task: Calc Offset Point>	**CALC (F1)** accesses **COGO Offset Point Results**. Refer to paragraph "COGO XX Results, Result page".
<Task: Calc Base Point>	**CALC (F1)** accesses **COGO Base Point Results**. Refer to paragraph "COGO XX Results, Result page".
<Task: Segmentation>	**CALC (F1)** accesses **COGO Define Segmentation**. Refer to "36.8.4 Arc Calculation - Segmentation".

COGO XX Results, Result page

Refer to paragraph "36.7.1 Line Calculation - Base Point" for information on softkeys.

Description of fields

Field	Option	Description
<Point ID:>	User input	The identifier for the COGO point depending on the point ID template configured for **<Survey Pts:>** in **CONFIGURE ID Templates**.
<Ortho Ht:> or **<Local Ell Ht:>**	User input	The height of the start point of the arc is suggested. A height value to be stored with the calculated point can be typed in.
<Arc Radius:>	Output	Computed radius of arc.
<Arc Length:>	Output	Computed length of arc.
<Offs Pt Brng:>	Output	Available for **<Task: Calc Offset Point>**. Bearing of offset point from base point to offset point.
<Offset Point:>	Output	Available for **<Task: Calc Base Point>**. Point ID of offset point.
<ΔArcDist-XX:>	Output	Available for **<Task: Calc Base Point>**. Horizontal distance along the arc from start point to base point.
<ΔOffset-XX:>	Output	Available for **<Task: Calc Base Point>**. Offset from base point to offset point. Positive to the right and negative to the left of the line.

Next step

PAGE (F6) changes to the **Code** page.

COGO XX Results, Code page

The functionality of the **Code** page is similar to **COGO Traverse Results, Code** page.

Next step

PAGE (F6) changes to the **Plot** page.

COGO XX Results, Plot page

The functionality of the **Plot** page is similar to **COGO Traverse Results, Plot** page.

Next step

STORE (F1) stores the result and accesses **COGO Arc Calculations Input, Input** page.

36.8.2 Arc Calculation - Base Point

Description

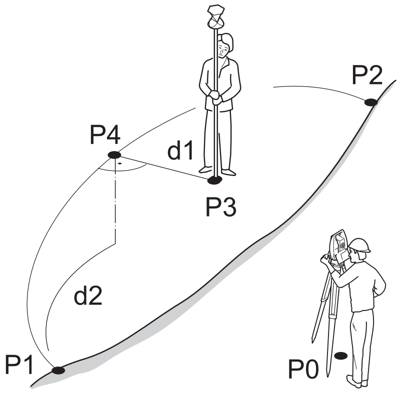
The COGO arc calculation base point calculates the coordinates of the base point, station and offset of a point in relation to an arc.

Elements that must be known are
- coordinates of three points
- coordinates of an offset point

OR
- coordinates of two points
- radius to the two points
- coordinates of an offset point

The coordinates of the known points
- may be taken from the active job.
- may be measured during the COGO calculation.
- may be entered.

Diagram



TPS12_186

P0	Instrument station
P1	**<Start Point:>**
P2	**<End Point:>**
P3	**<Offset Point:>**
P4	Base point
d1	**<ΔOffset-XX:>**
d2	**<ΔArcDist-XX:>**

☞ Arc management is not available for COGO arc calculations.

COGO arc calculation base point step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to "36.2 Accessing COGO" to access **COGO Arc Calculations Input, Input** page.	
☞	**COGO Arc Calculations Input, Input** page. **SHIFT CONF (F2)** to configure the COGO application program.	 36.3
2.	**COGO Arc Calculations Input, Input** page. **<Task: Calc Base Point>**	36.8.1

Step	Description	Refer to chapter
3.	**CALC (F1)** calculates the results.	
4.	**COGO Base Point Results, Result** page **STORE (F1)** stores the results.	36.8.1

36.8.3 Arc Calculation - Offset Point

Description

The COGO arc calculation offset point calculates the coordinates of a new point after input of arc and offset values in relation to an arc.

Elements that must be known are
- coordinates of three points.
- offsets.

OR
- coordinates of two points.
- radius to the two points.
- offsets.

The coordinates of the known points
- may be taken from the active job.
- may be measured during the COGO calculation.
- may be entered.

☞ Arc management is not available for COGO arc calculations.

COGO arc calculation offset point step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to "36.2 Accessing COGO" to access **COGO Arc Calculations Input**.	

Step	Description	Refer to chapter
☞	**COGO Arc Calculations Input, Input** page. **SHIFT CONF (F2)** to configure the COGO application program.	 36.3
2.	**COGO Arc Calculations Input, Input** page. **<Task: Calc Offset Point>**	36.8.1
3.	**CALC (F1)** calculates the results.	
4.	**COGO Offset Point Results, Result** page **STORE (F1)** stores the results.	36.8.1

36.8.4 Arc Calculation - Segmentation

☞ The COGO arc calculation segmentation and the functionality of all screens and fields are similar to those for COGO line calculation segmentation. Refer to "36.7.3 Line Calculation - Segmentation".

Exceptions to line calculation segmentation

New field and option in COGO Define Segmentation

Field	Option	Description
<Method:>	**Delta Angle**	To divide the arc by an angular value.
<Delta Angle:>	User input	The angular value by which new points will be defined on the arc.

36.9 COGO Calculation - Shift, Rotate & Scale (Manual) Method

Description

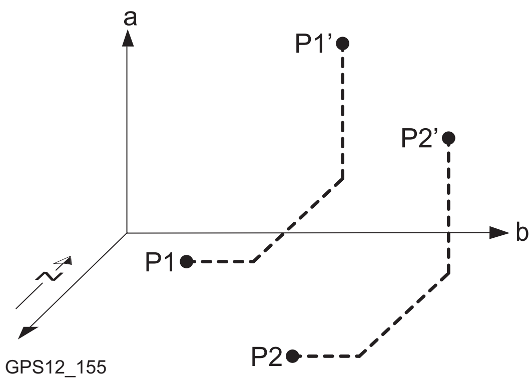
The COGO calculation shift, rotate & scale (manual) applies shifts and/or rotation and/or scale to one or several known points. The values for shifts and/or rotation and/or scale are typed in manually.

Elements that must be known are

- the coordinates of the points to be shifted, rotated and/or scaled. They must be stored in the active job.
- the shift values. They can be defined as the direction of Easting, Northing and Height or as an azimuth and a grid distance or as shift from one point to another.
- the rotation value. It can be defined by a point as rotation center plus a rotation or by an existing and new azimuth.
- the scale. It is only applied to the position.

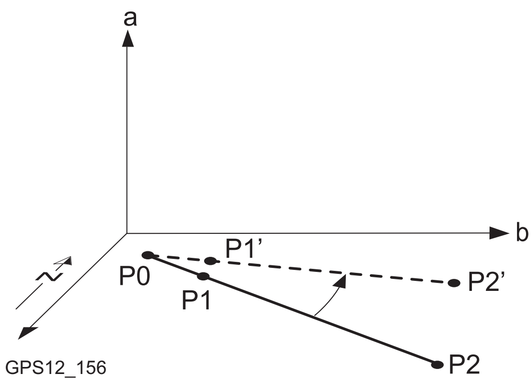
Points with full coordinate triplets, position only points and height only points can be used.

Diagram



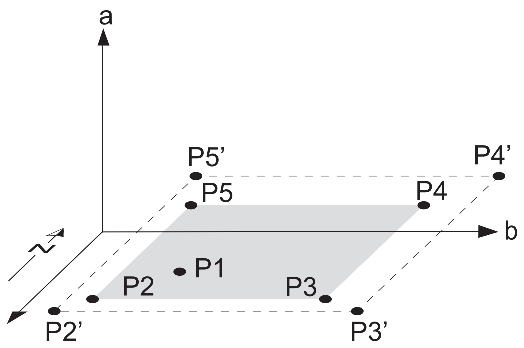
Shift

a	Height
b	Easting
P1	Known point
P1'	Shifted point
P2	Known point
P2'	Shifted point



Rotation

a	Height
b	Easting
P0	**<Rotation Pt:>**
P1	Known point
P1'	Rotated point
P2	Known point
P2'	Rotated point



GPS12_157

Scale

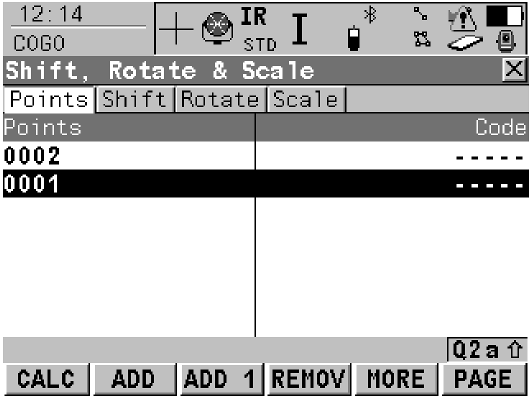
a	Height
b	Easting
P1	**<Rotation Pt:>**, can be held fixed, all other points are then scaled from here
P2	Known point
P2'	Scaled point
P3	Known point
P3'	Scaled point
P4	Known point
P4'	Scaled point
P5	Known point
P5'	Scaled point

Access

Refer to "36.2 Accessing COGO" to access **COGO Shift, Rotate & Scale**.

COGO Shift, Rotate & Scale, Points page

Listed are points which have been selected for shifting, rotating and/or scaling.



CALC (F1)
To perform the shift, rotation and scale calculation and to continue with the subsequent screen. Calculated COGO points are not yet stored.

ADD (F2)
To add several points from the active job to the list. Accesses **COGO Data: Job Name**. Selected sort and filter settings apply. **CONT (F1)** adds all displayed points to the list in **COGO Shift, Rotate & Scale** and returns to that screen.

ADD 1 (F3)
To add one point from the active job to the list. Accesses **COGO Data: Job Name**. Selected sort and filter settings apply. **CONT (F1)** adds the currently highlighted point to the list in **COGO Shift, Rotate & Scale** and returns to that screen.

REMOV (F4)
To remove the highlighted point from the list. The point itself is not deleted.

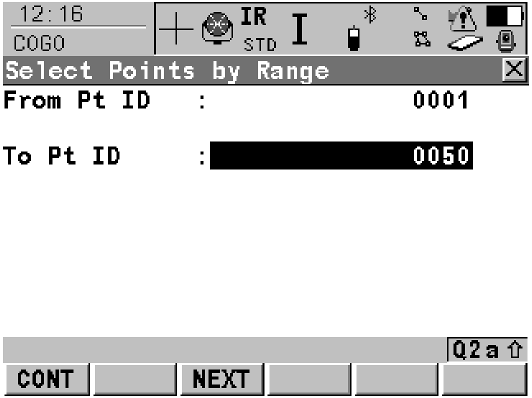
MORE (F5)
To display information about the codes if stored with any point, the time and the date of when the point was stored and the 3D coordinate quality and the class.

PAGE (F6)
To change to another page on this screen.
SHIFT REM A (F4)
To remove all points from the list. The points itself are not deleted.
SHIFT RANGE (F5)
To define a range of points from the active job to be added to the list. Refer to paragraph "COGO Select Points by Range".

Next step

IF	THEN
all points from **COGO Data: Job Name** are to be added	**ADD (F2)**.
one point from **COGO Data: Job Name** is to be added	**ADD 1 (F3)**.
a range of points from **COGO Data: Job Name** is to be added	**SHIFT RANGE (F5)** accesses **COGO Select Points by Range**. Refer to paragraph "COGO Select Points by Range".
all points are added	**PAGE (F1)** accesses **COGO Shift, Rotate & Scale**, **Shift** page. Refer to paragraph "COGO Shift, Rotate & Scale, Shift page".

COGO
Select Points by Range



CONT (F1)
To add the points within the selected range to the list in **COGO Shift, Rotate & Scale**, **Points** page and to return to the screen from where this screen was accessed.

NEXT (F3)
To add the points within the selected range to the list in **COGO Shift, Rotate & Scale**, **Points** page without quitting this screen. Another range of point ID's can be selected.

Description of fields

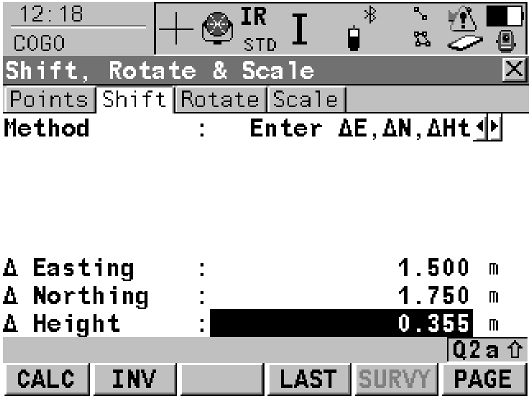
Field	Option	Description
<From Pt ID:> and **<To Pt ID:>**	User input	• Numeric point ID's in both fields: Points with numeric point ID's falling within the range are selected. Example: **<From Pt ID: 1>**, **<To Pt ID: 50>** Selected are point ID's 1, 2, 3, 4, 5, 6, 7, 8, 9, 10…. 49, 50 as well as 001, 01, 0000045, ... Not selected are point ID's 100,200,300, ...

Field	Option	Description
		• Alphanumeric point ID’s in both fields: The left most character of both entries is used as the basis for the range. The standard ASCII numerical range is used. Points with alphanumeric point ID’s falling within the range are selected. Example: **<From Pt ID: a9>**, **<To Pt ID: c200>** Selected are point ID’s a, b, c, aa, bb, cc, a1, b2, c3, c4, c5, a610, ... Not selected are point ID’s d100, e, 200, 300, tzz ...

Next step

Step	Description
1.	**CONT (F1)** adds all points within the range to the list in **COGO Shift, Rotate & Scale** and returns to the screen from where this screen was accessed.
2.	**PAGE (F6)** accesses **COGO Shift, Rotate & Scale**, **Shift** page. Refer to "COGO Shift, Rotate & Scale, Shift page".

COGO
Shift, Rotate & Scale, Shift page



CALC (F1)
To perform the shift, rotation and scale calculation and to continue with the subsequent screen. Calculated COGO points are not yet stored.

INV (F2)
To calculate the amout of shift in Easting, Northing and height from two existing points. Available if **<Δ Easting:>**, **<Δ Northing:>** or **<Δ Height:>** is highlighted.

LAST (F4)
To select the value for the shift from previous COGO inverse calculations. Available if **<Δ Easting:>**, **<Δ Northing:>** or **<Δ Height:>** is highlighted.

SURVY (F5)
To measure a point for the COGO calculation. Available for **<Method: Use 2 Points>** if **<From:>** or **<To:>** is highlighted.

PAGE (F6)
To change to another page on this screen.

SHIFT CONF (F2)
To configure the COGO application program. Accesses **COGO Configuration**. Refer to "36.3 Configuring COGO".

SHIFT MODIF (F4)

To mathematically modify the values. Available if **<Δ Easting:>**, **<Δ Northing:>** or **<Δ Height:>** is highlighted.

Description of fields

Field	Option	Description
<Method:>		The method by which the shift in Δ Easting, Δ Northing and Δ Height will be determined.
	Enter ΔE,ΔN,ΔHt	Defines the shift using coordinate differences.
	Enter Bng,Dst,Ht	Defines the shift using an azimuth, a distance and a height difference.
	Use 2 Points	Computes the shift from the coordinate differences between two known points.
<From:>	Choicelist	Available for **<Method: Use 2 Points>**. The point ID of the first known point for calculating the shift.
<To:>	Choicelist	Available for **<Method: Use 2 Points>**. The point ID of the second known point for calculating the shift.
<Azimuth:>	User input	Available for **<Method: Enter Bng,Dst,Ht>**. The azimuth defines the direction of the shift.
<HDist-XX:>	User input	Available for **<Method: Enter Bng,Dst,Ht>**. The amount of shift from the original point to the calculated COGO points.

Field	Option	Description
<Δ Easting:>	User input or output	The amount of shift in East direction.
<Δ Northing:>	User input or output	The amount of shift in North direction.
<Δ Height:>	User input or output	The amount of shift in height.

Next step

PAGE (F6) accesses **COGO Shift, Rotate & Scale**, **Rotate** page. Refer to "COGO Shift, Rotate & Scale, Rotate page".

COGO Shift, Rotate & Scale, Rotate page

The softkeys are the same as on the Shift page. Refer to paragraph "COGO Shift, Rotate & Scale, Shift page" for information on the keys.

Description of fields

Field	Option	Description
<Method:>		The method by which the rotation angle will be determined.
	User Entered	The rotation can be manually typed in.
	Computed	The rotation will be calculated as **<New Azimuth:>** minus **<Existing Az:>**.
<Rotation Pt:>	Choicelist	The point around which all points will be rotated.

Field	Option	Description
<Existing Az:>	User input	Available for **<Method: Computed>**. A known direction before rotating.
<New Azimuth:>	User input	Available for **<Method: Computed>**. A known direction after rotating.
<Rotation:>	User input or output	The amount by which the points will be rotated.

Next step

PAGE (F6) accesses **COGO Shift, Rotate & Scale**, **Scale** page. Refer to "COGO Shift, Rotate & Scale, Scale page".

COGO Shift, Rotate & Scale, Scale page

The softkeys are the same as on the Shift page. Refer to paragraph "COGO Shift, Rotate & Scale, Shift page" for information on the keys.

Description of fields

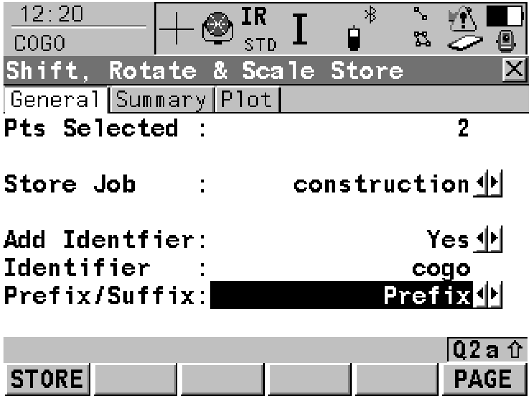
Field	Option	Description
<Method:>		The method by which the scale factor will be determined.
	User Entered	The scale factor can be manually typed in.
	Computed	The scale factor will be calculated as **<New Dist:>** divided by **<Existing Dist:>**.

Field	Option	Description
<Existing Dist:>	User input	Available for **<Method: Computed>**. A known distance before scaling. This value is used for calculating the scale factor.
<New Dist:>	User input	Available for **<Method: Computed>**. A known distance after scaling. This value is used for calculating the scale factor.
<Scale:>	User input or output	The scale factor used in the calculation.
<Scale From Pt:>	**No**	Scaling is performed by multiplying the original coordinates of all points by **<Scale:>**.
	Yes	**<Scale:>** is applied to the coordinate difference of all points relative to **<Rotation Pt:>** selected on the **Rotation** page. The coordinates of **<Rotation Pt:>** will not change.

Next step

CALC (F1) performs the shift, rotation and scale calculation and accesses **COGO Shift, Rotate & Scale Store**.

COGO
Shift, Rotate & Scale Store, General page



STORE (F1)
To to store the results and continue with the next subsequent screen.

PAGE (F6)
To change to another page on this screen.

Description of fields

Field	Option	Description
<Pts Selected:>	Output	The number of selected points having been shifted, rotated and/or scaled.
<Store Job:>	Choicelist	The calculated COGO points will be stored in this job. All jobs from **Main Menu: Manage...\Jobs** can be selected. The original points are not copied to this job.
<Add Identifier:>	**Yes** or **No**	Activates the use of additional identifiers for the point ID's of the calculated COGO points.

Field	Option	Description
<Identifier:>	User input	The identifier with up to four characters is added in front of or at the end of the ID of the calculated COGO points.
<Prefix/Suffix:>	**Prefix**	Adds the setting for **<Identifier:>** in front of the original point ID's.
	Suffix	Adds the setting for **<Identifier:>** at the end of the original point ID's.

Next step

IF	THEN
the used parameters are to be viewed	**PAGE (F6)** accesses **COGO Shift, Rotate & Scale Store**, **Summary** page.
the calculated COGO points are to be viewed graphically	**PAGE (F6)** accesses **COGO Shift, Rotate & Scale Store**, **Plot** page. Original points are displayed in grey, calculated COGO points are displayed in black.
the calculated COGO points are to be stored	**STORE (F1)** accesses **COGO Shift, Rotate & Scale Results**, **Result** page. Refer to paragraph "COGO Shift, Rotate & Scale Results Result page".

COGO Shift, Rotate & Scale Results Result page

Description of fields

Field	Option	Description
<No. of New Pts:>	Output	Number of new points created.
<No. of Skipped Pts>	Output	Number of points which were skipped either due to not being able to convert coordinates or points with identical point ID's already existed in **<Store Job:>**.

Next step

IF	THEN
the stored COGO points are to be viewed graphically	**PAGE (F6)** accesses **COGO Shift, Rotate & Scale Results**, **Plot** page. Original points are displayed in grey, calculated COGO points are displayed in black.
more points are to be shifted, rotated and/or scaled	**CONT (F1)** returns to **COGO Shift, Rotate & Scale**.
COGO is to be ended	**SHIFT QUIT (F6)**.

36.10 COGO Calculation - Shift, Rotate & Scale (Match Pts) Method

Description

The COGO calculation shift, rotate & scale (match pts) applies shifts and/or rotation and/or scale to one or several known points. The shifts and/or rotation and/or scale are calculated from selected points using a 2D Helmert tranformation.

Elements that must be known are

- the coordinates of at least two matching points for the calculation of the shifts and/or rotation and/or scale.
- the coordinates of the points to be shifted, rotated and/or scaled. They must be stored in the active job.
- the shift values. They can be defined as the direction of Easting, Northing and Height or as an azimuth and a grid distance or as shift from one point to another.
- the rotation value. It can be defined by a point as rotation center plus a rotation or by an existing and new azimuth.
- the scale. It is only applied to the position.

Points with full coordinate triplets, position only points and height only points can be used.

Computation of shift, rotation and scale values

The number of pairs of points matched determines whether the shift, rotation and scale values are computed.

Number of pairs of points matched	Shift East	Shift North	Shift Height	Rotation	Scale
1	x	x	x	-	-

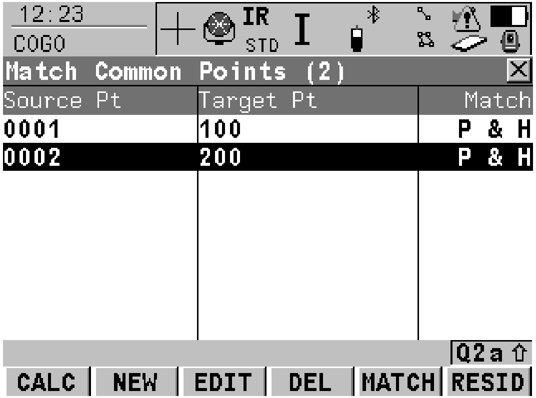
Number of pairs of points matched	Shift East	Shift North	Shift Height	Rotation	Scale
> 1	x	x	x	x	x

Access

Refer to "36.2 Accessing COGO" to access **COGO Match Common Points (n)**.

COGO Match Common Points (n)

This screen provides a list of points chosen from the active job. The points are used for the determination of the 2D Helmert transformation. The number of points matched is indicated in the title, for example **COGO Match Common Points (3)**. Unless there is no pair of matching points in the list all softkeys are available. Refer to paragraph "Match points step-by-step" for information on how to match points.



CALC (F1)
To confirm the selections, compute the transformation and continue with the subsequent screen.

NEW (F2)
To match a new pair of points. This pair is added to the list. A new point can be manually occupied. Refer to paragraph "Match points step-by-step".

EDIT (F3)
To edit the highlighted pair of matched points.

DEL (F4)
To delete the highlighted pair of matched points from the list.

MATCH (F5)
To change the type of match for a highlighted pair of matched points. Refer to "Description of columns".

RESID (F6)
To display a list of the matched points used in the transformation calculation and their associated residuals. Refer to paragraph "Fix parameters".

SHIFT PARAM (F5)
To define the parameters to be used in the 2D transformation.

Description of columns

Column	Description
Source Pt	The point ID of the points of origin for the calculation of the shifts and/or rotation and/or scale.
Target Pt	The point ID of the target points for the calculation of the shifts and/or rotation and/or scale.
Match	The type of match to be made between the points. This information is used in the transformation calculation. **P**osition **&** **H**eight, **P**osition **only**, **H**eight **only** or **None**.

Column	Description
	None removes matched common points from the transformation calculation but does not delete them from the list. This can be used to help improve residuals.

Next step

IF	THEN
the transformation is to be computed	**CALC (F1)**. The calculated shift, rotation and scale values are displayed in **COGO Shift, Rotate & Scale**. They cannot be edited. The remaining functionality of the calculation is very similar to COGO calculation shift, rotate & scale (manual). Refer to "36.9 COGO Calculation - Shift, Rotate & Scale (Manual) Method".
a pair of points is to be matched or edited	**NEW (F2)** or **EDIT (F3)**. Refer to paragraph "Match points step-by-step".
parameters for the transformation are to be fixed	**SHIFT PARAM (F5)**. Refer to paragraph "Fix parameters".

Match points step-by-step

Before calculating a transformation, it must be defined which points are to be matched. Matching new points and editing matched points is very similar.

Step	Description
1.	Refer to "36.2 Accessing COGO" to access **COGO Match Common Points**.
2.	**NEW (F2)** or **EDIT (F3)**

Step	Description
3.	**COGO Choose Matching Points** or **COGO Edit Matching Points** **<Source Pt:>** A point of origin for the calculation of the shifts and/or rotation and/or scale. **<Target Pt:>** A target point for the calculation of the shifts and/or rotation and/or scale. **<Match Type:>** The type of match to be made between the points selected in **<Source Pt:>** and **<Target Pt:>**. **Pos**ition **& Height**, **Pos**ition **Only**, **Height Only** or **None**. Select the points to be matched.
	SURVY (F5). To manually occupy a point and store it in the active job.
4.	**CONT (F1)** returns to **COGO Match Common Points (n)** and adds a new line of matched points to the matched points list.

Fix parameters

The settings on this screen define the parameters to be used in the transformation.

IF the value for a field is	THEN the value for this parameter will be
-----	calculated.
any number	fixed to that value.

Description of fields

Field	Option	Description
<Δ Easting:>	User input	Shift in Easting direction.
<Δ Northing:>	User input	Shift in Northing direction.
<Δ Height:>	User input	Shift in Height direction.
<Rotation:>	User input	Rotation around the X axis.
<Scale:>	User input	Scale factor.

Next step

IF	AND	THEN
a field displays -----	the parameter needs to be fixed to a value	highlight the field. Enter the value of the parameter. **FIX (F4)**.
a field displays a value	the parameter needs to be calculated	highlight the field. **ADJST (F4)**.
all parameters are configured	-	**CONT (F1)** to return to **COGO Match Common Points (n)**.

36.11 Area Division

36.11.1 Overview

Description

The COGO calculation area division divides an area by a defined line, by percentage or by the size of a subarea.

The area division methods are listed in the table below. Elements that must be known for the calculation depend on the area division method. At least three points are required to form an area.

Divide by	Using		Elements required
Defined line	Parallel line	Through a point	• Two points defining the line • One point on the dividing line
		By a distance	• Two points defining the line • Distance
	Perpendicular line	Through a point	• Two points defining the line • One point on the dividing line
		By a distance	• Two points defining the line • Distance
Percentage	Parallel line	-	• Size of new area in percentage • Two points defining the line
	Perpendicular line	-	• Size of new area in percentage • Two points defining the line

Divide by	Using		Elements required
	Swing line	Rotation point	• Size of new area in percentage • Rotation point of the swing line
Area	Parallel line	-	• Size of new area • Two points defining the line
	Perpendicular line	-	• Size of new area • Two points defining the line
	Swing line	Rotation point	• Size of new area • Rotation point of the swing line

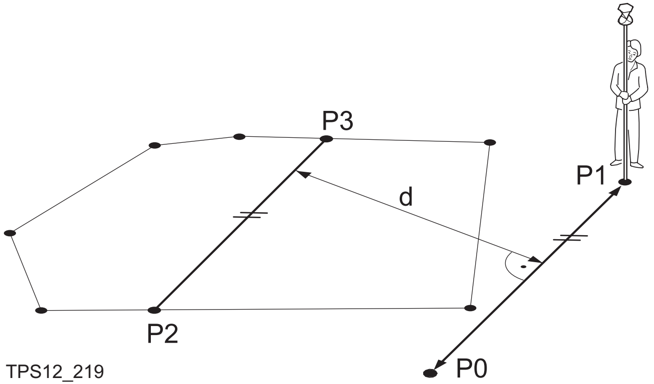
The coordinates of the known points

- may be taken from the active job.
- may be measured during the COGO calculation.
- may be entered.

Diagram

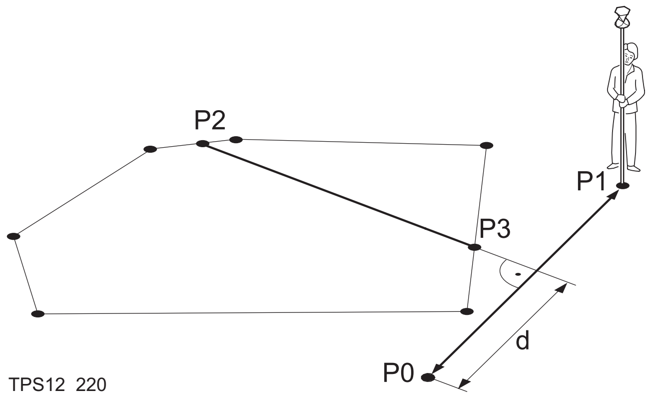
The diagrams show the area division methods. Some diagrams apply to several area division methods.

Area division method	<Divide:>	<Using:>	<Shift:>
1.	**By Defined Line**	**Parallel Line**	**By Distance**
2.	**By Percentage**	**Parallel Line**	-
3.	**By Area**	**Parallel Line**	-



P0 **<Point A:>** of defined line
P1 **<Point B:>** of defined line
P2 First new COGO point
P3 Second new COGO point
d **<HDist-XX:>**

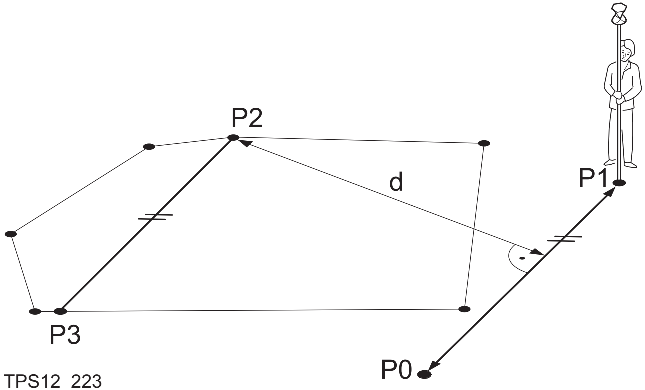
Area division method	<Divide:>	<Using:>	<Shift:>
1.	**By Defined Line**	**Perpendic Line**	**By Distance**
2.	**By Percentage**	**Perpendic Line**	-
3.	**By Area**	**Perpendic Line**	-



TPS12_220

P0 **<Point A:>** of defined line
P1 **<Point B:>** of defined line
P2 First new COGO point
P3 Second new COGO point
d **<HDist-XX:>**

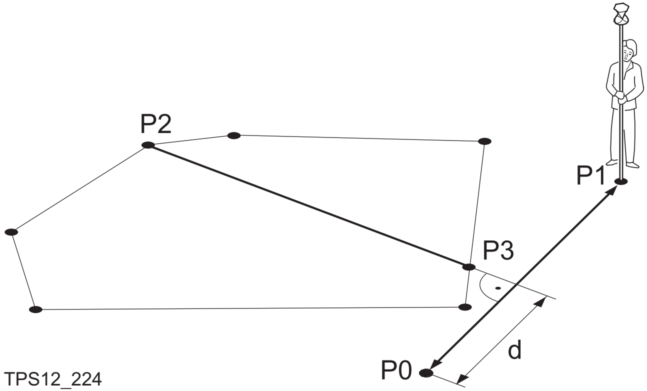
Area division method	<Divide:>	<Using:>	<Shift:>
1.	**By Defined Line**	**Parallel Line**	**Through Point**



TPS12_223

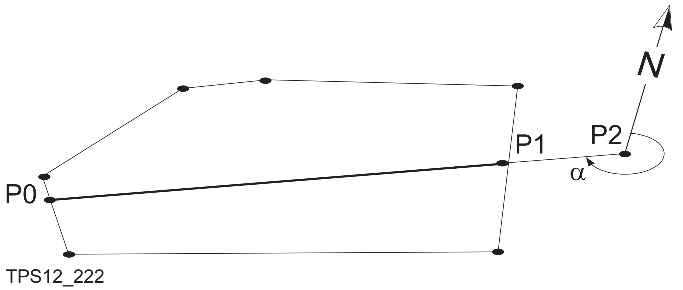
P0 **<Point A:>** of defined line
P1 **<Point B:>** of defined line
P2 **<Through Point:>**; in this case it is a known point of the existing border
P3 New COGO point
d **<HDist-XX:>**

Area division method	<Divide:>	<Using:>	<Shift:>
1.	**By Defined Line**	**Perpendic Line**	**Through Point**



P0 **<Point A:>** of defined line
P1 **<Point B:>** of defined line
P2 **<Through Point:>**; in this case it is a known point of the existing border
P3 New COGO point
d **<HDist-XX:>**

Area division method	<Divide:>	<Using:>	<Shift:>
1.	**By Percentage**	**Swing Line**	-
2.	**By Area**	**Swing Line**	-



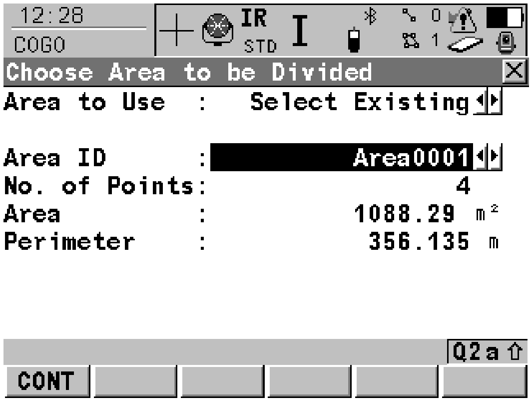
P0 First new COGO point
P1 Second new COGO point
P3 **<Rotation Pnt:>**
α **<Azimuth:>**

36.11.2 Choosing an Area to be Divided

Access

Refer to "36.2 Accessing COGO" to access **COGO Choose Area to be Divided**.

COGO Choose Area to be Divided



CONT (F1)
To accept the changes and access the subsequent screen.

Description of fields

Field	Option	Description
<Area to Use:>		The setting determines the availability of the subsequent fields and screen.
	Select Existing	To use an area from the **<Job:>** selected in **COGO COGO Begin**. The area can be edited and a new area can be created from points existing in the **<Job:>**.

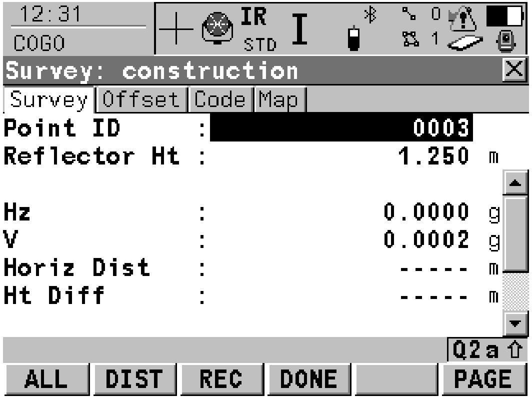
Field	Option	Description
	Survey New Area	To survey points that do not exist in the job yet. The points will be added to a new area.
<Area ID:>	Choicelist	For **<Area to Use: Select Existing>**. To select the area to be divided.
	User input	For **<Area to Use: Survey New Area>**. To enter a name for the new area.
<No. of Points:>	Output	Number of points forming the area.
<Area:>	Output	The size of the selected area.
<Perimeter:>	Output	The perimeter of the area.

Next step

IF	THEN
<Area to Use: Select Existing>	**CONT (F1)** accesses **COGO Define How to Divide Area**. Refer to "36.11.3 Dividing an Area".
<Area to Use: Survey New Area>	**CONT (F1)** accesses **COGO Survey: Job Name**. Refer to "COGO Survey: Job Name, Survey page".

COGO
Survey: Job Name, Survey page

Points to be added to the new area can be surveyed.



ALL (F1)
To measure and store distances and angles.

DIST (F2)
To measure and display distances. Available unless **<EDM Mode: Tracking>** and/or **<Log Auto Pts: Yes>**, after the tracking or logging is started.

REC (F3)
To record data.
If **<EDM Mode: Tracking>** and/or **<Log Auto Pts: Yes>**, records measured point and continues tracking.

DONE (F4)
To end surveying an area and to access **COGO Edit Area: Area ID** where the area can be stored.

PAGE (F6)
To change to another page on this screen.

SHIFT INDIV (F5) and **SHIFT RUN (F5)**
To change between entering an individual point ID different to the defined ID template and the running point ID according to the ID template. Refer to "16.1 ID Templates".

Description of fields

Field	Option	Description
<Point ID:>	User input	The identifier for manually occupied points. The configured point ID template is used. The ID can be changed in the following ways: • To start a new sequence of point ID's type over the point ID. • For an individual point ID independent of the ID template **SHIFT INDIV (F5)**. **SHIFT RUN (F5)** changes back to the next ID from the configured ID template. Refer to "16.1 ID Templates".
<Reflector Ht:>	User input	The last used reflector height is suggested when accessing the Survey application program. An individual reflector height can by typed in.
<Hz:>	Output	The current horizontal angle.
<V:>	Output	The current vertical angle.
<Horiz Dist:>	Output	The horizontal distance after **DIST (F2)** was pressed. No distance is displayed when accessing the screen and after **REC (F3)** or **ALL (F1)**.
<Ht Diff:>	Output	The height difference between station and measured point after **DIST (F2)**. Displays ----- when accessing the screen and after **REC (F3)** or **ALL (F1)**.

Next step

IF the task is to	THEN
change to another page on this screen	**PAGE (F6)**.
stop surveying the area and to store the area	**DONE (F4)** and then **STORE (F1)**. **COGO Define How to Divide Area** is accessed. Refer to "36.11.3 Dividing an Area".
return to **COGO Choose Area to be Divided**	**ESC**.

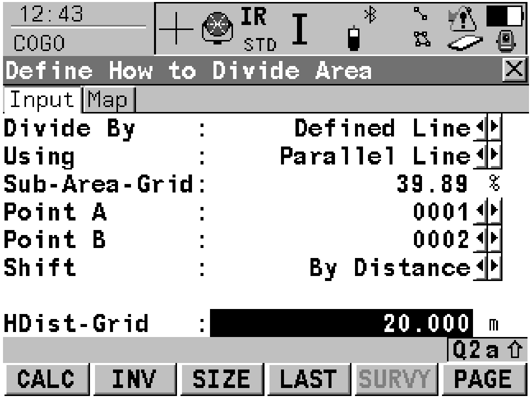
36.11.3 Dividing an Area

Access

Refer to "36.11.2 Choosing an Area to be Divided" to access **COGO Define How to Divide Area**.

COGO
Define How to Divide Area,
Input page

After each change of parameters in this screen, the values in the output fields are recalculated and updated.



CALC (F1)
To perform the area division and to continue with the subsequent screen. Calculated COGO points are not yet stored.

INV (F2)
To calculate the value for the distance from two existing points. Available if **<HDist-XX:>** is highlighted.

SIZE (F3) and **PERC (F3)**
To display the size and the perimeter of the sub-area.

LAST (F4)
To select the value for the distance from previous COGO inverse calculations. Available if **<HDist-XX:>** is highlighted.

SURVY (F5)
To manually occupy a point for the COGO calculation. Available if **<Point A:>**, **<Point B:>** or **<Rotation Pnt:>** is highlighted.

PAGE (F6)
To change to another page on this screen.
SHIFT CONF (F2)
To configure the COGO application program.
SHIFT MODIF (F4)
To mathematically modify the values for the distance or angle. Available if **<HDist-XX:>** or **<Azimuth:>** is highlighted.

Description of fields

Field	Option	Description
<Divide By:>		This field defines how the size of the sub area is defined.
	Percentage	The size of the sub area is given in %.
	Area	The size of the sub area is given in m^2.
	Defined Line	The new border defining the size of the sub area is known.
<Using:>		This field defines how the new border will run.
	Parallel Line	The border will be parallel to a line defined by **<Point A:>** and **<Point B:>**.
	Perpendic Line	The border will be perpendicular to a line defined by **<Point A:>** and **<Point B:>**.
	Swing Line	The border will be a line rotated around **<Rotation Pnt:>** by **<Azimuth:>**.

Field	Option	Description
<Sub-Area-XX:>	User input	For **<Divide By: Percentage>** and **<Divide By: Area>**. The size of the sub area must be typed either in % or in m^2. When dividing the area using a parallel or perpendicular line, a reference line is defined by **<Point A:>** and **<Point B:>**. The direction of the new dividing line is always the same as the direction of the reference line. The sub area is always to the left of the new dividing line. When dividing a line using a swing line, the direction of the new dividing line is defined by the **<Rotation Pnt:>** and the **<Azimuth:>**. The sub area is always to the left of the new dividing line.
	Output	For **<Divide By: Defined Line>**. The size of the sub area is calculated in the background and displayed.
<Point A:>	Choicelist	The first point of the line which is used as the reference for a new parallel or perpendicular border. All points from **COGO Data: Job Name** can be selected.
<Point B:>	Choicelist	The second point of the line which is used as the reference for a new parallel or perpendicular border. All points from **COGO Data: Job Name** can be selected.
<Shift:>		Available for **<Divide By: Defined Line>**.

Field	Option	Description
	By Distance	The new border will run in a certain distance from the line defined by **<Point A:>** and **<Point B:>**.
	Through Point	The new border will run through a point defined in **<Through Point:>**.
<Through Point:>	Choicelist	Available for **<Shift: Through Point>**. The point through which the new border will run.
<Rotation Pnt:>	Choicelist	Available for **<Using: Swing Line>**. The point around which the new border will rotate by **<Azimuth:>**.
<Azimuth:>	Output	Available for **<Using: Swing Line>**. The angle of the new border from **<Rotation Pnt:>** to the new COGO point.
<HDist-XX:>		The distance from the line defined by **<Point A:>** and **<Point B:>** to the new border.
	User Input	For **<Divide By: Defined Line>** and **<Shift: By Distance>**.
	Output	For **<Divide By: Percentage>** or**<Divide By: Area>** with **<Using: Parallel Line>** or **<Using: Perpendic Line>**.

Next step

PAGE (F6) changes to the **Map** page. Refer to paragraph "COGO Define How to Divide Area, Map page".

COGO Define How to Divide Area, Map page

The **Map** page provides an interactive display of the data. Refer to "34 MapView Interactive Display Feature" for information on the functionality and softkeys available.

Next step

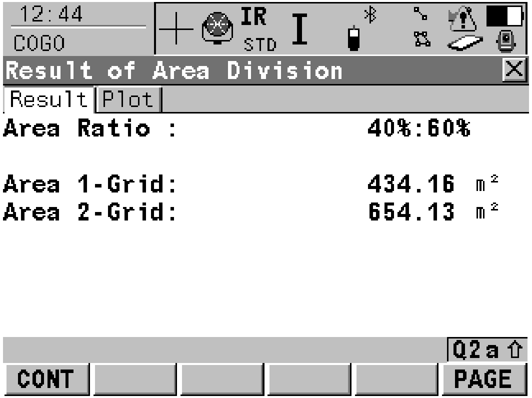
CALC (F1) performs the area division and accesses **COGO Results of Area Division**. Refer to "36.11.4 Results of the Area Division".

36.11.4 Results of the Area Division

Access

CALC (F1) in **COGO Define How to Divide Area**.

COGO
Results of Area Division,
Result page



CONT (F1)
To accept the calculation and to continue with the subsequent screen. Calculated COGO points are not yet stored.

PAGE (F6)
To change to another page on this screen.

SHIFT CONF (F2)
To configure the COGO application program.

Description of fields

Field	Option	Description
<Area Ratio:>	Output	The ratio of the size of the two sub areas in percent.
<Area 1-XX:>	Output	The size of the first sub area in m^2.
<Area 2-XX:>	Output	The size of the second sub area in m^2.

Next step

PAGE (F6) changes to the **Plot** page.

COGO
Results of Area Division, Map page

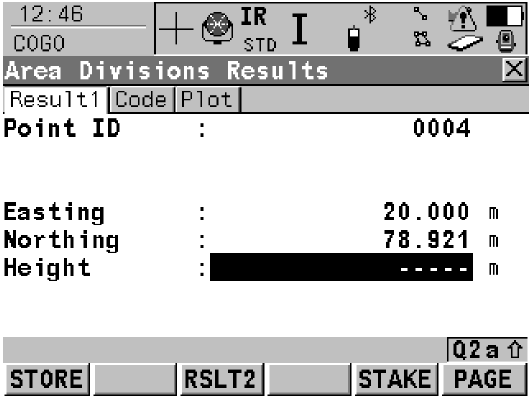
The points defining the area and the calculated COGO points are shown in black.

Next step

CONT (F1) access **COGO Area Division Results.**

COGO
Area Division Results, ResultX page

The coordinates of the intersection points of the new border with the original area are displayed.



STORE (F1)
: To store the two results and to return to **COGO Choose Area to be Divided** once both points are stored

RSLT1 (F3) or **RSLT2 (F3)**
: To view the first and second result.

STAKE (F5)
: To access the Stakeout application program and stake out the calculated COGO point.

PAGE (F6)
: To change to another page on this screen.

SHIFT INDIV (F5) and **SHIFT RUN (F5)**
: To change between entering an individual point ID different to the defined ID template and the running point ID according to the ID template. Refer to "16.1 ID Templates".

Description of fields

Field	Option	Description
<Point ID:>	User input	The identifier for the COGO point depending on the point ID template configured for **<Survey Pts:>** in **CONFIGURE ID Templates**.
<Height:>	User input	A height value to be stored with the calculated point can be typed in.

Next step
PAGE (F6) changes to the **Code** page.

COGO
Area Division Results,
Code page

All codes of the job can be selected. Type in a code if required.

Next step
PAGE (F6) changes to the **Plot** page.

COGO
Area Division Results,
Plot page

The points defining the area and the points of the new border are shown in black.

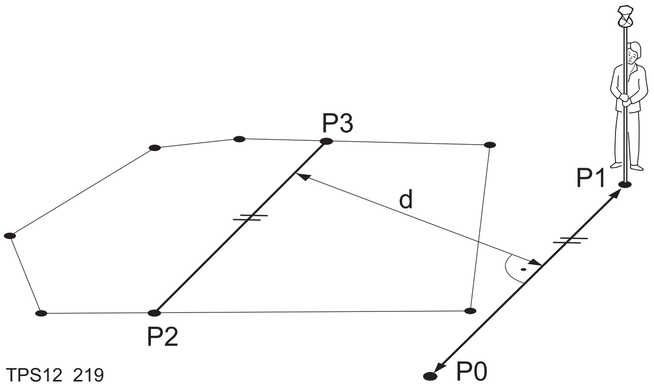
Next step
STORE (F1) stores the results and accesses **COGO Choose Area to be Divided**. For **<Write Logfile: Yes>** in **COGO Configuration**, **Logfile** page the result is written to the logfile.

36.11.5 Working Example

Description

Application:	Divide an area by a defined, parallel line. The new border has to run through a known point with the point ID 100.
Working technique:	Real-time kinematic.
Goal:	The points forming the original area are to be picked. The area division is to be calculated.

Diagram



TPS12_219

P0	**<Point A:>** of defined line
P1	**<Point B:>** of defined line
P2	First new COGO point
P3	Second new COGO point
d	**<HDist-XX:>**

Requirements

- A real-time reference is running.
- For the rover: **<R-Time Mode: Rover>** in **CONFIGURE Real-Time Mode**.

Field procedure step-by-step

Step	Description
1.	**Main Menu: Programs...\COGO**
2.	**COGO COGO Begin** Select a job and a configuration set with the settings mentioned above.
	CONF (F2) to configure the COGO application program.
3.	**CONT (F1)** to access **COGO COGO Menu**.
4.	Highlight **Area Division**.
5.	**CONT (F1)** to access **COGO Choose Area to be Divided**.
6.	**COGO Choose Area to be Divided** **<Area to Use: Survey New Area>** **<Area ID:>** Type in an ID for the new area.
7.	**CONT (F1)** to access **COGO Survey: Job Name**.
8.	**COGO Survey: Job Name** **<Point ID:>** Type in a name for the first point of the area.
9.	**ALL (F1)** to measure and store the first point of the area.
10.	Survey all points belonging to the area. Point 100 must be part of the points.
11.	**DONE (F4)** once all points are surveyed.
12.	**COGO Edit Area: Area ID** Check the points forming the area.
13.	**STORE (F1)** to store the area and to access **COGO Define How to Divide Area**.
14.	**COGO Define How to Divide Area**, **Input** page

Step	Description
	<Divide By: Defined Line> **<Using: Parallel Line>** **<Point A:>** and **<Point B:>** Select the first and the second point of the line which is used as the reference for the new border. The new border will run parallel to this line. **<Shift: Through Point>** **<Through Point: 100>**
15.	**CALC (F1)** to access **COGO Results of Area Division**.
16.	**COGO Results of Area Division**, **Result** page The size of the two new sub areas is displayed,
17.	**CONT (F1)** to access **COGO Area Division Results**.
18.	**COGO Area Division Results**, **Result1** page **<Point ID:>** The identifier for the first COGO point depending on the point ID template configured for **<Survey Pts:>** in **CONFIGURE ID Templates**. The point ID can be changed. **<Ortho Ht:>** or **<Local Ell Ht:>** are input fields. The height of the first point used in the COGO calculation is suggested. A height value to be stored with the calculated point can be typed in. The calculated coordinates are displayed. Type in a point ID.
	COORD (F2) views other coordinate types.
	RSLT1 (F3) and **RSLT2 (F3)** to view the first and second result.

Step	Description
☞	**STAKE (F5)** to access the Stakeout application program and stake out the calculated COGO point.
☞	**SHIFT ELL H (F2)** and **SHIFT ORTH (F2)**. Available for local coordinates. Changes between the ellipsoidal and the orthometric height.
☞	**SHIFT INDIV (F5)** for an individual point ID independent of the ID template. **SHIFT RUN (F5)** changes back to the next ID from the configured ID template.
19.	**STORE (F1)** stores the first COGO point and displays the coordinates of the second COGO point.
20.	**STORE (F1)** stores the second COGO point and returns to **COGO Choose Area to be Divided**.
21.	**SHIFT QUIT (F6)** to exit the COGO application program.

36.12 Selecting a Result from Previous COGO Inverse Calculations

Description

Azimuths, distances and offsets required within the COGO traverse and intersection calculations can be selected from previously calculated inverse results.

Select a result from previous COGO inverse calculations step-by-step

Step	Description
1.	Refer to "36.2 Accessing COGO" to access **COGO Traverse Input** or **COGO Intersection Input**.
2.	**COGO XX Input**, **Input** page Highlight **<Azimuth:>**, **<HDist-XX:>** or **<Offset:>**.
3.	**LAST (F4)** to access **COGO Last Inverse Calculations**.
4.	**COGO Last Inverse Calculations** All previous COGO inverse calculations stored in the active job are displayed, sorted by time with the most recent at the top. This screen consists of three columns. • First column **From**: The point ID of the first known point for the COGO inverse calculation. • Second column **To**: The point ID of the second known point for the COGO inverse calculation. • Third column: The information displayed can vary. ----- is displayed for unavailable information, for example if a height only point is used, **Azimuth** cannot be calculated. **Azimuth**: The direction from the first to the second known point.

Step	Description
	HDist-XX: The horizontal distance between the two known points. **Date** and **Time** when the COGO inverse calculation was stored.
☞	**VIEW (F3)** to view all calculated values for the highlighted COGO inverse calculation. This includes the height difference, the slope distance, the grade and the coordinate differences between the two known points.
☞	**DEL (F4)** to delete the highlighted COGO inverse calculation.
☞	**MORE (F5)** to display other information in the third column.
5.	Highlight the COGO inverse calculation of which a result is to be taken over into **COGO XX Input**, **Input** page.
6.	**CONT (F1)** to return to **COGO XX Input**, **Input** page.
☞	The relevant result of the highlighted COGO inverse calculation is copied into the field which was initially highlighted in **COGO XX Input**, **Input** page.

36.13 Modifying Values for Azimuths, Distances and Offsets

Description

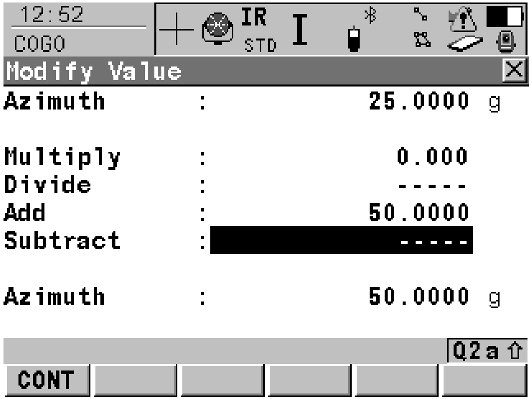
The values for the azimuth, the distance and the offset required within the COGO traverse and intersection calculation can be mathematically modified.

Access step-by-step

Step	Description
1.	Refer to "36.2 Accessing COGO" to access **COGO Traverse Input** or **COGO Intersection Input**.
2.	**COGO XX Input**, **Input** page Highlight **<Azimuth:>**, **<HDist-XX:>** or **<Offset:>**.
3.	**SHIFT MODIF (F4)** to access **COGO Modify Value**.

COGO Modify Value

On this screen numbers can be typed in for the multiplication, division, addition and subtraction with the original azimuth, distance or offset value. The standard rules of mathematical operations apply.



CONT (F1)
To accept the modified value and to return to the screen from where this screen was accessed. The modified value is copied into the field which was initially highlighted in **COGO XX Input**, **Input** page.

Description of fields

Field	Option	Description
<Azimuth:>, **<HDist-XX:>** or **<Offset:>**	Output	The name of the field and the value which was highlighted before accessing **COGO Modify Value**.
<Multiply:>	User input	The number to multiply by. • Minimum: -3000 • Maximum: 3000 • ----- performs a multiplication by 1.
<Divide:>	User input	The number to divide by. • Minimum: -3000

Field	Option	Description
		• Maximum: 3000 • ----- performs a division by 1.
<Add:>	User input	The number to be added. • For azimuths Minimum: 0 Maximum: Full circle • For distances and offsets Minimum: 0 m Maximum: 30000000 m • ----- performs an addition of 0.000.
<Subtract:>	User input	The number to be subtracted. • For azimuths Minimum: 0 Maximum: Full circle • For distances and offsets Minimum: 0 m Maximum: 30000000 m • ----- performs a subtraction of 0.000.
<Azimuth:>, **<HDist-XX:>** or **<Offset:>**	Output	The modified value for the field in the first line. This field is updated with every mathematical operation. Angles greater than the full circle are reduced accordingly.

Next step

CONT (F1) accepts the modified value and returns to the screen from where this screen was accessed.

Example: Calculations for an azimuth

Step	User input	Value as calculated	Value as displayed
☞			**<Azimuth: 250.0000> g**
1.	**<Multiply: 2>**	500	**<Azimuth: 100.0000> g**
2.	**<Divide: 3>**	166.667	**<Azimuth: 166.6670> g**
3.	**<Add: 300>**	466.667	**<Azimuth: 66.6670> g**
4.	**<Subtract: 100>**	366.667	**<Azimuth: 366.6670> g**

Example: Calculations for a distance

The behaviour for an offset is identical.

Step	User input	Value as calculated	Value as displayed
☞			**<HDist-Grid: 250.000> m**
1.	**<Multiply: 2>**	500	**<HDist-Grid: 500.000> m**
2.	**<Divide: 3>**	166.667	**<HDist-Grid: 166.667> m**
3.	**<Add: 300>**	466.667	**<HDist-Grid: 466.667> m**
4.	**<Subtract: 100>**	366.667	**<HDist-Grid: 366.667> m**

37 Determine Coordinate System - General

37.1 Overview

Description

GPS measured points are always stored based on the global geocentric datum known as WGS 1984. Using GPS measured points with the TPS1200 requires coordinates in a local grid system, for example, based on a country's official mapping datum or an arbitrary grid system used in a particular area such as a construction site. To convert the WGS 1984 coordinates into local coordinates a coordinate system needs to be created. Part of the coordinate system is the transformation used to convert coordinates from the WGS 1984 datum to the local datum.

The Determine Coordinate System application program allows:

- the parameters of a new transformation to be determined.
- the parameters of an existing transformation to be recomputed.

Transformations

A transformation is the process of converting coordinates from one geodetic datum to another.

Requirements

- Transformation parameters.
- In some cases a local ellipsoid.
- In some cases a map projection.
- In some cases a geoid model.

Transformation parameters

A transformation consists of a number of shifts, rotations and scale factors, depending on the type of transformation used. Not all of these parameters are always required. These parameters may already be known, or may need to be computed.

Description of transformations

Three different transformations are provided:

- Classic 3D, also called Helmert transformation
- Onestep
- Twostep

Transformation	Characteristic	Description
Classic 3D	Principle	Transforms coordinates from WGS 1984 cartesian to local cartesian coordinates and vice versa. A map projection can then be applied to obtain grid coordinates. As a similarity transformation, it is the most rigorous transformation type and keeps the full geometrical information.
	Positions and heights	Positions and heights are linked. The accuracy is fully maintained and does not distort the measurements.
	Use	When measurements are to be kept totally homogenous.

Transformation	Characteristic	Description
	Requirements	• The positions and heights are known in WGS 1984 and in the local system for at least three points. Four points or more are recommended in order to obtain higher redundancy. • Parameters of the local ellipsoid. • Parameters of the local map projection in order to convert between grid coordinates and geodetic coordinates. • Parameters of the local geoid model in order to convert between orthometric and ellipsoidal heights. This is not compulsory.
	Area	Especially wide networks with large height differences. Local grid coordinates must be accurate.
	Advantage	• Accuracy of the measurements is maintained. • It may be used over any area as long as the local coordinates, including heights, are accurate.
	Disadvantage	• The local ellipsoid and map projection must be known for the local grid coordinates. In order to obtain accurate ellipsoidal heights the geoid separation at the measured points must be known. This may be determined from a geoid model. Refer to "10.2 Terminology".

Transformation	Characteristic	Description
Onestep	Principle	Transforms coordinates directly from WGS 1984 to local grid and vice versa without knowledge about the local ellipsoid or the map projection. Procedure: 1. The WGS 1984 coordinates are projected onto a temporary Transverse Mercator projection. The central meridian of this projection passes through the centre of gravity of the common control points. 2. The results of 1. are preliminary grid coordinates for the WGS 1984 points. 3. These preliminary grid coordinates are matched with the local grid control points in order to compute the Easting and Northing shifts, the rotation and the scale factor between these two sets of points. This is known as a classic 2D transformation. 4. The height transformation is a single dimension height approximation.
	Positions and heights	The position and height transformations are separated.

Transformation	Characteristic	Description
	Use	When measurements are to be forced to tie in with local existing control. For example: A site where the coordinates of the control points are based on a purely local grid. The coordinate values within this grid are totally arbitrary and are in no way connected with any ellipsoid or map projection. Obviously a Classic 3D transformation cannot be used here, as cartesian coordinates cannot be calculated from such a grid.
	Requirements	• The position is known in WGS 1984 and in the local system for at least one point. Three or more points are recommended in order to obtain redundancy. • Additional height information for one point enables the transformation of heights. • Parameters of the local geoid model. This is not compulsory. • No parameters of the local ellipsoid. • No parameters of the local map projection.
	Area	• Limited to about 10 x 10 km because no projection scale factor is applied and a standard Transverse Mercator projection is used to compute the preliminary WGS 1984 grid coordinates. • For areas without large height differences.

Transformation	Characteristic	Description
	Points and transformation parameters	The transformation parameters determined depend on the number of available points with position information. • One point: Classic 2D with shift in X and Y. • Two points: Classic 2D with shift in X and Y, rotation about Z and scale. • More than two points: Classic 2D with shift in X and Y, rotation about Z, scale and residuals.
	Points and height transformation	The type of height transformation performed depends on the number of available points with height information. • No point: No height transformation. • One point: Heights are shifted to fit to the height control point. • Two points: Average height shift between the two height control points. • Three points: Tilted plane through the three height control points to approximate the local heights. • More than three points: Best fitting average plane.

Transformation	Characteristic	Description
	Advantage	• Errors in height do not propagate into errors in position since the height and position transformations are separated. • If local heights have low accuracy or do not exist, a transformation of position can still be calculated and vice versa. • The height points and position points do not have to be the same points. • No parameters of the local ellipsoid and map projection is required. • Parameters may be computed with a minimum of points. Care should be taken when computing parameters using just one or two local points as the parameters calculated are valid in the vicinity of the points used for the transformation.
	Disadvantage	• Restriction in the area over which the transformation can be applied. This is mainly due to the fact that there is no provision for scale factor in the projection. • The accuracy in height depends on the undulation of the geoid. The bigger the geoid variations the less accurate the results are.

Transformation	Characteristic	Description
Twostep	Principle	Combines the advantages of the Onestep and the Classic 3D transformation. It allows treating position and height separately, but is not restricted to smaller areas. Procedure: 1. The WGS 1984 coordinates of the common control points are shifted closely to the local datum using a given Classic 3D pretransformation. This is typically a rough transformation valid for the country of the local datum. 2. The coordinates are projected onto a preliminary grid, but this time using the true map projection of the local points. 3. A 2D transformation is applied, exactly as with the Onestep transformation.
	Positions and heights	The position and height transformations are separated.
	Use	When measurements are to be forced to tie in with local existing control in areas larger than 10 x 10 km.
	Requirements	• The position is known in WGS 1984 and in the local system for at least one point. Four points or more are recommended in order to obtain higher redundancy. • Parameters of the local ellipsoid. • Parameters of the local map projection.

Transformation	Characteristic	Description
		• Parameters of a pretransformation.
	Area	Virtually any area as long as the local coordinates are accurate.
	Points and transformation parameters	Identical with the Onestep transformation.
	Points and height transformation	Identical with the Onestep transformation.
	Advantage	• Errors in height do not propagate into errors in position since the height and position transformations are separated. • If local heights have low accuracy or do not exist, a transformation of position can still be calculated and vice versa. • The height points and position points do not have to be the same points.

Transformation	Characteristic	Description
		• Fits much better over larger areas than a Onestep transformation. Reason: The first step of a Twostep transformation avoids any distortions due to the fact that the preliminary grid coordinates are built on a different ellipsoid than the local points. The second step ensures that the influence of the scale factor of the map projection is equally taken into account before the final 2D transformation is computed.
	Disadvantage	• The local ellipsoid must be known. • The map projection must be known. • A pretransformation must be known. A null transformation can be used. • In order to obtain accurate ellipsoidal heights, the geoid separation at the measured points must be known. This may be determined from a geoid model.

☞ With one common control point, it is still possible to calculate a Classic 3D transformation, as long as the rotations and the scale parameter are fixed. Such a transformation fits perfectly in the vicinity of the common control point, but is degraded by the distance from that point, because neither the orientation of the local reference frame nor any scale factor within the local datum can be taken into account.

Requirements to determine a transformation

To determine a transformation it is necessary to have common control points whose positions are known in both WGS 1984 coordinates and local coordinates. The more points that are common between datums the more accurately the transformation parameters can be calculated. Depending on the type of transformation used, details about the map projection, the local ellipsoid and a local geoidal model may also be needed.

Requirements for control points

- The control points used for the transformation should surround the area for which the transformation is to be applied. It is not good practice to survey or convert coordinates outside of the area covered by the control points as extrapolation errors may be introduced.
- When a geoid field file and/or a CSCS field file is used in the determination of a coordinate system, the control points for the calculation must fall within the areas of the field files.

Coordinate system determination methods

Two different methods for determining a coordinate system are available:

Coordinate system determination method	Characteristic	Description
Normal	Number of control points needed	One or more control points for both the WGS 1984 and the local datum.
	Transformation to use	Onestep, Twostep or Classic 3D, depending on number of control points and available information.
One point localisation	Number of control points needed	One control point for both the WGS 1984 and the local datum.

Coordinate system determination method	Characteristic	Description
	Transformation to use	• Onestep or Twostep when information about the necessary rotations and scale factor is known. • Classic 3D when the rotations are to be set to zero and the scale factor to one.

37.2 Accessing Determine Coordinate System

Access

Select **Main Menu: Programs...\Determine Coordinate System**.

OR

Press **PROG**. Highlight **Determine Coordinate System. CONT (F1)**. Refer to "35.2 Accessing the Programs Menu" for information on the **PROG** key.

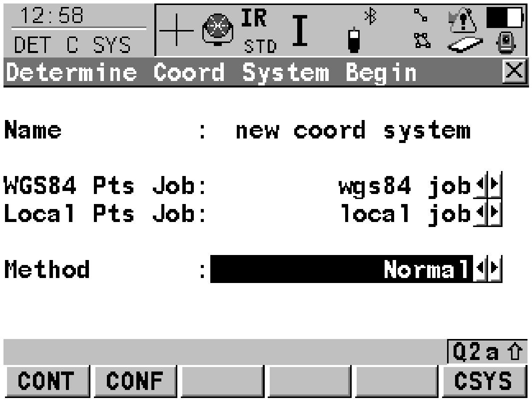
OR

Press a hot key configured to access the screen **DET C SYS Determine Coord System Begin**. Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

DET C SYS Determine Coord System Begin



CONT (F1)
To confirm the selections and to continue with the subsequent screen.

CONF (F2)
To configure the coordinate system determination method selected in **<Method:>**.

CSYS (F6)
Available for **<Method: Normal>**. To access **DET C SYS Coordinate Systems** and choose a coordinate system to edit. Refer to "10.4.2 Editing a Coordinate System".

Description of fields

Field	Option	Description
<Name:>	User input	A unique name for the coordinate system. The name may be up to 16 characters in length and may include spaces. Input is mandatory. ☞ Entering the name of a coordinate system will allow that existing system to be updated. Refer to "10.4.2 Editing a Coordinate System".
<WGS84 Pts Job:>	Choicelist	The job from which the points with WGS84 coordinates will be taken. Opening the choicelist accesses **MANAGE Jobs (Device)**. Refer to "5 Manage...\Jobs".
<Local Pts Job:>	Choicelist	The job from which the points with local coordinates will be taken. Opening the choicelist accesses **MANAGE Jobs (Device)**. Refer to "5 Manage...\Jobs".
<Method:>	**Normal** or **One Pt Localistn**	Method used to determine the coordinate system.

Next step

IF	AND	THEN
<Method: Normal>	the application program needs configuring	**CONF (F2)** to access **DET C SYS Configuration**. Refer to "37.3.1 Configuring Determine Coordinate System - Normal".

IF	AND	THEN
<Method: One Pt Localistn>	the application program needs configuring	**CONF (F2)** to access **DET C SYS Configuration**. Refer to "37.3.2 Configuring Determine Coordinate System - One Point Localisation".
<Method: Normal>	the application program does not need configuring	**CONT (F1)** to access **DET C SYS Step 1: Choose Transform Type**. Refer to "38 Determine Coordinate System - Normal".
<Method: One Pt Localistn>	the application program does not need configuring	**CONT (F1)** to access **DET C SYS Step 1: Choose Transform Type**. Refer to "39 Determine Coordinate System - One Point Localisation".

37.3 Configuring Determine Coordinate System

37.3.1 Configuring Determine Coordinate System - Normal

Description

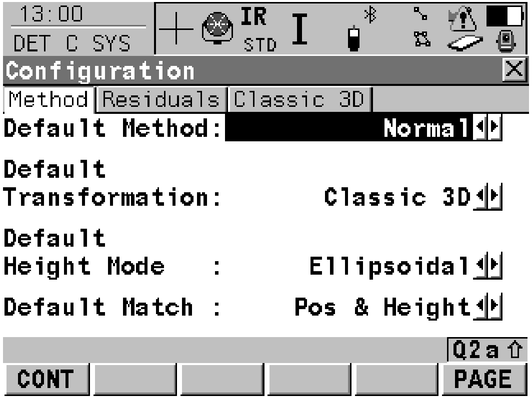
The configuration of **DET C SYS**, normal method, allows options to be set which are used as the default options within the Determine Coordinate System application program when using the normal method. These settings are stored within the active configuration set.

Access step-by-step

Step	Description
1.	Refer to "37.2 Accessing Determine Coordinate System" to access **DET C SYS Determine Coord System Begin**.
2.	**CONF (F2)** to access **DET C SYS Configuration**, **Method** page.
3.	Select **<Default Method: Normal>**.

DET C SYS Configuration, Method page

This screen consists of the **Method** page, the **Residuals** page and the **Classic 3D** page. The explanations for the softkeys given below are valid for all pages, unless otherwise stated.



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

FIX (F4) or **ADJST (F4)**
Available for **Classic 3D** page unless **<Transf Model:>** is highlighted. To define which parameters are computed or fixed in the Classic 3D transformation. Refer to paragraph "DET C SYS Configuration, Classic 3D page".

PAGE (F6)
To change to another page on this screen.

Description of fields

Field	Option	Description
<Default Method:>	**Normal** or **One Pt Localistn**	Method used to determine the coordinate system. ☞ The fields and pages available are different if **<Default Method: One Pt Localistn>** is selected. Refer to "37.3.2 Configuring Determine Coordinate System - One Point Localisation" for information on how to configure **DET C SYS** using the one point localisation method.
<Default Transformation:>	**Onestep**, **Twostep** or **Classic 3D**	The default transformation to be used when determining the coordinate system. Refer to "37.1 Overview".

Field	Option	Description
<Default Height Mode:>	**Orthometric** or **Ellipsoidal**	The default height type to be used when determining the coordinate system.
<Default Match:>	**Pos & Height**, **Pos Only**, **Height Only** or **<None>**	Options available depend on the choice made for **<Default Transformation:>**. Point parameters to be matched between points in both datums.

Next step

PAGE (F6) changes to the **Residuals** page. Refer to paragraph "DET C SYS Configuration, Residuals page".

DET C SYS Configuration, Residuals page

Description of fields

Field	Option	Description
<Easting:>	User input	The limit above which Easting residuals will be flagged as possible outliers.
<Northing:>	User input	The limit above which Northing residuals will be flagged as possible outliers.
<Height:>	User input	The limit above which Height residuals will be flagged as possible outliers.
<Default Residual Distbtn:>		The method by which the residuals of the control points will be distributed throughout the transformation area.

Field	Option	Description
	None	No distribution is made. Residuals remain with their associated points.
	1/Distance^{XX}	Distributes the residuals according to the distance between each control point and the newly transformed point.
	Multiquadratic	Distributes the residuals using a multiquadratic interpolation approach.

Next step

PAGE (F6) changes to the **Classic 3D** page. Refer to paragraph "DET C SYS Configuration, Classic 3D page".

DET C SYS Configuration, Classic 3D page

The settings on this page define the parameters to be used in a Classic 3D transformation. Refer to "10.2 Terminology" for more information about how many transformation parameters are needed, based on the number of points common to both datums.

IF the value for a field is	THEN the value for this parameter will be
-----	calculated.
any number	fixed to that value.

Description of fields

Field	Option	Description
<Transf Model:>	**Bursa Wolf** or **Molodensky-Bad**	The transformation model to be used. Refer to standard surveying literature for details on the models.
<Shift dX:>	User input	Shift in X direction.
<Shift dY:>	User input	Shift in Y direction.
<Shift dZ:>	User input	Shift in Z direction.
<Rotation X:>	User input	Rotation around the X axis.
<Rotation Y:>	User input	Rotation around the Y axis.
<Rotation Z:>	User input	Rotation around the Z axis.
<Scale:>	User input	Scale factor.

Next step

IF	AND	THEN
a field displays -----	the parameter needs to be fixed to a value	highlight the field. **FIX (F4)**. Enter the value of the parameter.
a field displays a value	the parameter needs to be calculated	highlight the field. **ADJST (F4)**.

IF	AND	THEN
all parameters are configured	-	**CONT (F1)** to return to **DET C SYS Determine Coord System Begin**.

37.3.2 Configuring Determine Coordinate System - One Point Localisation

Description

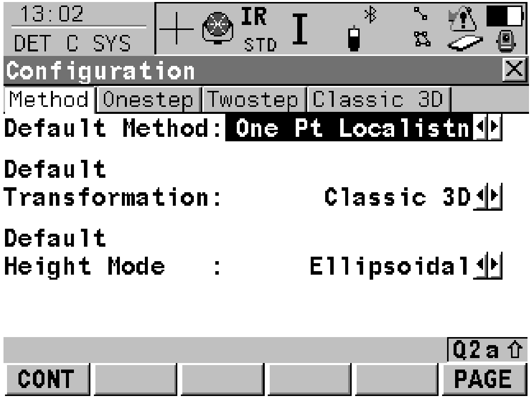
The configuration of **DET C SYS**, one point localisation method, allows options to be set which are used as the default options within the Determine Coordinate System application program when using the one point localisation method. These settings are stored within the active configuration set.

Access step-by-step

Step	Description
1.	Refer to "37.2 Accessing Determine Coordinate System" to access **DET C SYS Determine Coord System Begin**.
2.	**CONF (F2)** to access **DET C SYS Configuration**, **Method** page.
3.	Select **<Default Method: One Pt Localistn>**.

DET C SYS Configuration, Method page

This screen consists of the **Method** page, the **Onestep** page, the **Twostep** page and the **Classic 3D** page. The explanations for the softkeys given below are valid for all pages.



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

PAGE (F6)
To change to another page on this screen.

Description of fields

Field	Option	Description
<Default Method:>	**Normal** or **One Pt Localistn**	Method used to determine the coordinate system. The fields and pages available are different if **<Default Method: Normal>** is selected. Refer to "37.3.1 Configuring Determine Coordinate System - Normal" for information on how to configure **DET C SYS** using the normal method.
<Default Transfor-mation:>	**Onestep**, **Twostep** or **Classic 3D**	The default transformation to be used when determining the coordinate system. Refer to "10.2 Terminology".

Field	Option	Description
<Default Height Mode:>	**Orthometric** or **Ellipsoidal**	The default height mode to be used when determining the coordinate system.

Next step

PAGE (F6) changes to the **Onestep** page. Refer to paragraph "DET C SYS Configuration, Onestep page".

DET C SYS Configuration, Onestep page

Description of fields

Field	Option	Description
<Default Rotation:>		The default rotation method to be used in the transformation process.
	Use WGS84 North	Rotate to North as defined by WGS 1984.
	User Entered	Rotation can be manually typed in.
	Convergnce Angle	Angle between grid North and geodetic North at a certain point. Refer to "39.2 Determine Coordinate System - Onestep Transformation" paragraph "DET C SYS Step 4: Determine Rotation" for a diagram.
	Two WGS84 Points	Rotation defined by two points on the WGS 1984 datum. Refer to "39.2 Determine Coordinate System - Onestep Transformation" paragraph "DET C SYS Step 4: Determine Rotation" for a diagram.

Field	Option	Description
<Default Height SF:>		The default method for determining the height scale factor to be used in the transformation process.
	User Entered	Height scale factor can be manually typed in.
	Known WGS84 Pt	Height scale factor defined by a known point on the WGS 1984 datum.
	Known WGS84 Ht	Height scale factor defined by the known height of a point on the WGS 1984 datum.

Next step

PAGE (F6) changes to the **Twostep** page. Refer to paragraph "DET C SYS Configuration, Twostep page".

DET C SYS Configuration, Twostep page

Description of fields

Field	Option	Description
<Default Rotation:>		The default rotation method to be used in the transformation process.
	Use WGS84 North	Rotate to North as defined by WGS 1984.
	User Entered	Rotation can be manually typed in.
	Convergnce Angle	Angle between grid North and geodetic North at a certain point. Refer to "39.2 Determine Coordinate System - Onestep Transformation" paragraph "DET C SYS Step 4: Determine Rotation" for a diagram.

Field	Option	Description
	Two WGS84 Points	Rotation defined by two points on the WGS 1984 datum. Refer to "39.2 Determine Coordinate System - Onestep Transformation" paragraph "DET C SYS Step 4: Determine Rotation" for a diagram.
<Default Scale:>		The default method for determining the scale factor to be used in the transformation process.
	User Entered	Scale factor can be manually typed in
	Compute CSF	Compute the combined grid and height scale factor.
<Deflt Grid SF:>	**User Entered** or **Known Local Pt**	Available for **<Default Scale: Compute CFS>**. Default method for computing the grid scale factor of the known point.
<Deflt Ht SF:>	**User Entered**, **Known Local Pt** or **Known Local Ht**	Available for **<Default Scale: Compute CFS>**. Default method for computing the height scale factor of the known point.

Next step

PAGE (F6) changes to the **Classic 3D** page. Refer to paragraph "DET C SYS Configuration, Classic 3D page".

DET C SYS Configuration, Classic 3D page

Description of fields

Field	Option	Description
<Default Local Height:>	**Use WGS84 Pt Ht** or **Use Local Pt Ht**	Source of height information to use.

Next step

CONT (F1) returns to **DET C SYS Determine Coord System Begin**.

38 Determine Coordinate System - Normal

38.1 Overview

Description

The Determine Coordinate System application program allows a new coordinate system to be determined or a coordinate system to be updated. The coordinate system is defined by the transformation used to convert coordinates from one geodetic datum to another. Onestep, Twostep or Classic 3D transformations are available. Refer to "37 Determine Coordinate System - General" for more information.

Next step

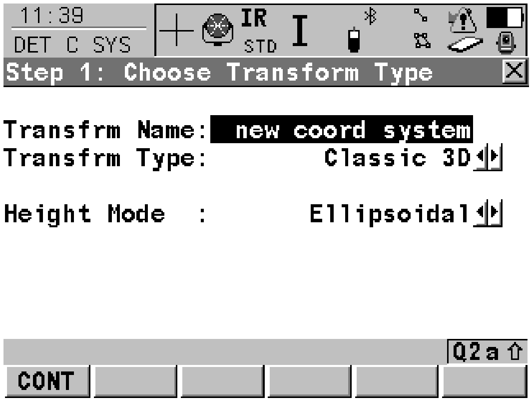
IF	THEN
a new coordinate system is to be determined	Refer to "38.2 Determining a New Coordinate System".
a coordinate system is to be updated	Refer to "38.3 Updating a Coordinate System".

38.2 Determining a New Coordinate System

Access step-by-step

Step	Description
1.	Refer to "37.2 Accessing Determine Coordinate System" to access **DET C SYS Determine Coord System Begin**.
2.	Select **<Method: Normal>**.
3.	**CONT (F1)** to access **DET C SYS Step 1: Choose Transform Type**.

DET C SYS Step 1: Choose Transform Type



CONT (F1)
To confirm the selections and to continue with the subsequent screen.

Description of fields

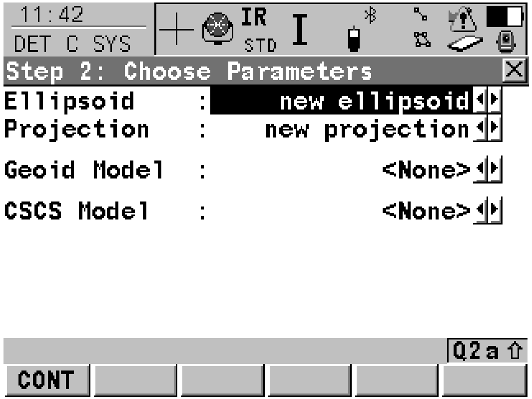
Field	Option	Description
<Transfrm Name:>	User input	A unique name for the transformation. The name may be up to 16 characters in length and may include spaces. If a coordinate system is being updated then its name is displayed.
<Transfrm Type:>		The type of transformation to be used when determining a coordinate system.
	Onestep, **Twostep** or **Classic 3D**	Available when determining a new coordinate system.
	Output	Available when updating a coordinate system. The transformation type shown is the same as the transformation used in the existing system.
<Height Mode:>		The height mode to be used in the determination of a coordinate system.
	Orthometric or **Ellipsoidal**	Available when determining a new coordinate system.
	Output	Available when updating a coordinate system. The height mode shown is the same as the mode used in the existing system.

Next step
CONT (F1) continues to **DET C SYS Step 2: Choose Parameters**.

If a coordinate system was chosen to be edited in **DET C SYS Determine Coord System Begin**, pressing **CONT (F1)** accesses **DET C SYS Step 3: Match Points (n)**. Pressing **ESC** does not re-access **DET C SYS Determine Coord System Begin** but accesses **DET C SYS Step 2: Choose Parameters** and **DET C SYS Step 1: Choose Transform Type.**

DET C SYS Step 2: Choose Parameters

This screen contains different fields, depending on what transformation type was chosen in **DET C SYS Step 1: Choose Transform Type**.



CONT (F1)
To confirm the selections and to continue with the subsequent screen.

For <Transfrm Type: Onestep>

Description of fields

Field	Option	Description
<Geoid Model:>	Choicelist	The geoid model to be used in the transformation. Geoid models from **MANAGE Geoid Models** can be selected.

For <Transfrm Type: Twostep>

Description of fields

Field	Option	Description
<Pre Transform:>	Choicelist	The pre-transformation to use for the preliminary 3D transformation. All 3D transformations from **MANAGE Transformations** can be selected.
<Ellipsoid:>	Choicelist	The ellipsoid to use in the transformation. All ellipsoids from **MANAGE Ellipsoids** can be selected.
	Output	The ellipsoid being used by a hard wired projection when selected in **<Projection:>**.
<Projection:>	Choicelist	The projection to use in the transformation. All projections from **MANAGE Projections** can be selected.
<Geoid Model:>	Choicelist	The geoid model to be used in the transformation. Geoid models from **MANAGE Geoid Models** can be selected.

For <Transfrm Type: Classic 3D>

Description of fields

Field	Option	Description
<Ellipsoid:>	Choicelist	The ellipsoid to use in the transformation. All ellipsoids from **MANAGE Ellipsoids** can be selected.

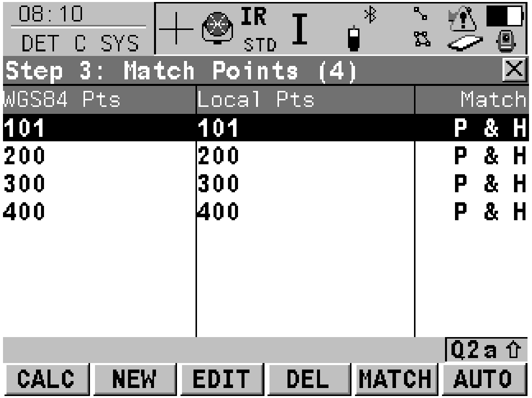
Field	Option	Description
	Output	The ellipsoid being used by a hard wired projection when selected in **<Projection:>**.
<Projection:>	Choicelist	The projection to use in the transformation. All projections from **MANAGE Projections** can be selected.
<Geoid Model:>	Choicelist	The geoid model to use in the transformation. Geoid models from **MANAGE Geoid Models** can be selected.
<CSCS Model:>	Choicelist	The CSCS model to use in the transformation. All CSCS models from **MANAGE CSCS Models** can be selected.

Next step

CONT (F1) continues to **DET C SYS Step 3: Match Points (n)**.

DET C SYS Step 3: Match Points (n)

This screen provides a list of points chosen from **<WGS84 Pts Job:>** and **<Local Pts Job:>**. The number of control points matched between both jobs is indicated in the title, for example **DET C SYS Step 3: Match Points (4)**. Unless there is no pair of matching points in the list all softkeys are available. Refer to "38.4 Matching Points" for information on how to match points.



CALC (F1)

To confirm the selections, compute the transformation and continue with the subsequent screen.

NEW (F2)

To match a new pair of points. This pair is added to the list. A new point can be measured. Refer to "38.4.2 Selecting a New Pair of Matching Points".

EDIT (F3)

To edit the highlighted pair of matched points. Refer to "38.4.3 Editing a Pair of Matching Points".

DEL (F4)

To delete the highlighted pair of matched points from the list.

MATCH (F5)

To change the type of match for a highlighted pair of matched points. Refer to "Description of columns".

AUTO (F6)

To scan both jobs for points that have the same point ID. Points with matching point ID's are added to the list.

SHIFT PARAM (F5)

Available for **<Transfrm Type: Classic 3D>** in **DET C SYS Step 1: Choose Transform Type**. To configure Classic 3D transformation parameters. Refer to "37.3.1 Configuring Determine Coordinate System - Normal" paragraph "DET C SYS Configuration, Classic 3D page".

Description of columns

Column	Description
WGS84 Pts	The point ID of the points chosen from **<WGS84 Pts Job:>**.
Local Pts	The point ID of the points chosen from **<Local Pts Job:>**.
Match	The type of match to be made between the points. This information is used in the transformation calculation. **P**osition **& H**eight, **P**osition **only**, **H**eight **only** or **None**. • For **<Transfrm Type: Onestep>** or **<Transfrm Type: Twostep>** possible options are **P & H**, **P only**, **H only** or **None**. • For **<Transfrm Type: Classic 3D>** possible options are **P & H** or **None**. **None** removes matched common points from the transformation calculation but does not delete them from the list. This can be used to try and improve the residuals that are obtained when calculating the transformation.

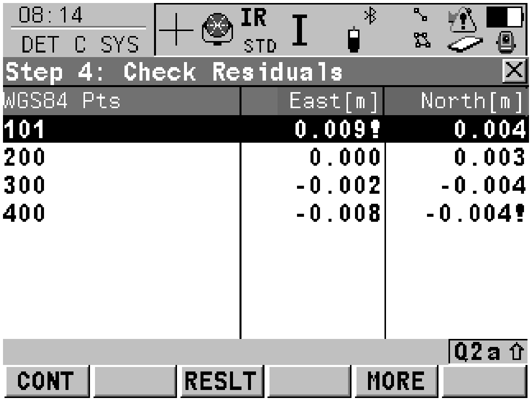
Next step

CALC (F1) computes the transformation and continues to **DET C SYS Step 4: Check Residuals**. Refer to paragraph "DET C SYS Step 4: Check Residuals".

If a coordinate system to be updated contains a point that was deleted from the active job and a new point was created in that job with the same point ID but different coordinates, the coordinates of the old point will still be used for the calculation. Pressing **EDIT (F3)** to edit a highlighted pair of matched points containing the deleted point, will overwrite the coordinates of the old point and the coordinates of the new point will be used in the calculation.

DET C SYS Step 4: Check Residuals

Displays a list of the matched points used in the transformation calculation and their associated residuals.



CONT (F1)
To accept the residuals and to continue with the subsequent screen.

RESLT (F3)
To view results of the transformation. Accesses **DET C SYS Transformation Results**. Refer to "38.5 Transformation Results".

MORE (F5)
To display information about height residuals.

Description of columns

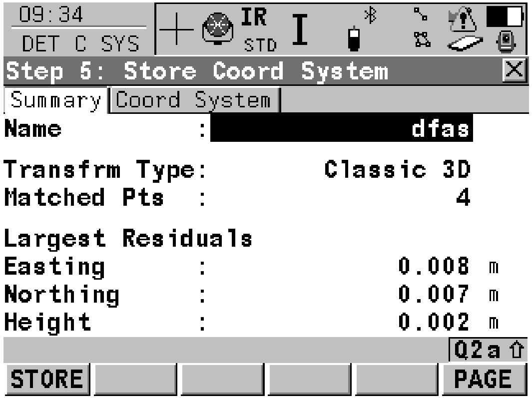
Column	Description
WGS84 Pts	The point ID of the points chosen from **<WGS84 Pts Job:>**.
East	The Easting residual. If positions were not used in the transformation calculation then ----- will be displayed.
North	The Northing residual. If positions were not used in the transformation calculation then ----- will be displayed.
Height	The Height residual. If heights were not used in the transformation calculation then ----- will be displayed.
!	Indicates residuals that exceed the residual limit defined in **DET C SYS Configuration**, **Residuals** page.
!	Indicates the largest residual in **East**, **North** and **Height**.

Next step

IF the residuals are	THEN
unacceptable	**ESC** returns to **DET C SYS Step 3: Match Points (n)**. Matched points can be edited, deleted or temporarily removed from the list and the transformation recalculated.
acceptable	**CONT (F1)** continues to **DET C SYS Step 5: Store Coord System**.

DET C SYS Step 5: Store Coord System, Summary page

This screen consists of the **Summary** page and the **Coord System** page. The **Coord System** page contains different fields, depending on what transformation type was chosen in **DET C SYS Step 1: Choose Transform Type**. The explanations for the softkeys given below are valid for all pages.



STORE (F1)
To store the coordinate system to the DB-X and return to **TPS1200 Main Menu**.

PAGE (F6)
To change to another page on this screen.

Description of fields

Field	Option	Description
<Name:>	User input	The name of the coordinate system can be changed. The name may be up to 16 characters in length and may include spaces.
<Transfrm Type:>	Output	The type of transformation used, as defined in **DET C SYS Step 1: Choose Transform Type**.

Field	Option	Description
<Matched Pts:>	Output	Number of matched points, as defined in **DET C SYS Step 3: Match Points (n)**.
<Easting:>	Output	Largest Easting residual from the transformation calculation.
<Northing:>	Output	Largest Northing residual from the transformation calculation.
<Height:>	Output	Largest Height residual from the transformation calculation.

Next step

PAGE (F6) changes to the **Coord System** page. Refer to paragraph "DET C SYS Step 5: Store Coord System, Coord System page".

DET C SYS Step 5: Store Coord System, Coord System page

For <Transfrm Type: Onestep>

Description of fields

Field	Option	Description
<Residuals:>	**None**, **1/Distance^{XX}** or **Multiquad-ratic**	The method by which the residuals of the control points will be distributed throughout the transformation area. Refer to "37.3.1 Configuring Determine Coordinate System - Normal" paragraph "DET C SYS Configuration, Residuals page".
<Geoid Model:>	Output	Name of geoid model used, as defined in **DET C SYS Step 2: Choose Parameters**.

For <Transfrm Type: Twostep>

Description of fields

Field	Option	Description
<Residuals:>	**None, 1/Distance**$^{\mathbf{XX}}$ or **Multiquadratic**	The method by which the residuals of the control points will be distributed throughout the transformation area. Refer to "37.3.1 Configuring Determine Coordinate System - Normal" paragraph "DET C SYS Configuration, Residuals page".
<Pre Transform:>	Output	Name of the pretransformation used, as defined in **DET C SYS Step 1: Choose Transform Type**.
<Ellipsoid:>	Output	Name of ellipsoid used, as defined in **DET C SYS Step 2: Choose Parameters**.
<Projection:>	Output	Name of projection used, as defined in **DET C SYS Step 2: Choose Parameters**.
<Geoid Model:>	Output	Name of geoid model used, as defined in **DET C SYS Step 2: Choose Parameters**.

For <Transfrm Type: Classic 3D>

Description of fields

Field	Option	Description
<Residuals:>	**None, 1/Distance**^{XX} or **Multiquad-ratic**	The method by which the residuals of the control points will be distributed throughout the transformation area. Refer to "37.3.1 Configuring Determine Coordinate System - Normal" paragraph "DET C SYS Configuration, Residuals page".
<Transform:>	Output	Name of transformation used, as defined in **DET C SYS Step 1: Choose Transform Type**.
<Ellipsoid:>	Output	Name of ellipsoid used, as defined in **DET C SYS Step 2: Choose Parameters**.
<Projection:>	Output	Name of projection used, as defined in **DET C SYS Step 2: Choose Parameters**.
<Geoid Model:>	Output	Name of geoid model used, as defined in **DET C SYS Step 2: Choose Parameters**.
<CSCS Model:>	Output	Name of CSCS model used, as defined in **DET C SYS Step 2: Choose Parameters**.

Next step

STORE (F1) stores the coordinate system to the DB-X and attaches it to the **<WGS84 Pts Job:>** selected in **DET C SYS Determine Coord System Begin**, replacing any coordinate system attached to this job. **<WGS84 Pts Job:>** becomes the active job.

38.3 Updating a Coordinate System

Access step-by-step

Step	Description
1.	Refer to "37.2 Accessing Determine Coordinate System" to access **DET C SYS Determine Coord System Begin**.
2.	Select **<Method: Normal>**.
3.	Enter the name of a coordinate system in <Name:> OR **CSYS (F6)** to select a coordinate system.
4.	**CONT (F1)** to access **DET C SYS Step 3: Match Points (n)**.
5.	All the following steps are identical with the determination of a new coordinate system from **DET C SYS Step 3: Match Points (n)** onwards. Refer to "38.2 Determining a New Coordinate System". Follow the instructions from paragraph "DET C SYS Step 3: Match Points (n)" onwards.

38.4 Matching Points

38.4.1 Overview

Description

Before calculating a transformation, it must be defined which points in **<WGS84 Pts Job:>** and **<Local Pts Job:>** are to be matched. Pairs of matched points are displayed in one line in **DET C SYS Step 3: Match Points (n)**. New pairs of matched points can be created, existing pairs of matched points can be edited and pairs of matched points can be deleted.

38.4.2 Selecting a New Pair of Matching Points

Match points step-by-step

Step	Description
1.	Refer to "38.2 Determining a New Coordinate System" to access **DET C SYS Step 3: Match Points (n)**.
2.	**NEW (F2)** to access **DET C SYS Choose Matching Points**.
3.	**DET C SYS Choose Matching Points** **<WGS84 Point:>** A WGS 1984 control point. All WGS 1984 stored points from **MANAGE Data: Job Name** can be selected. **<Known Point:>** A local control point. All local stored points from **MANAGE Data: Job Name** of any class, except **NONE**, can be selected. **<Match Type:>** The type of match to be made between the points selected in **<WGS84 Point:>** and **<Known Point:>**. **Pos**ition **and Height**, **Pos**ition **Only**, **Height Only** or **None**. • For **<Transfrm Type: Onestep>** or **<Transfrm Type: Twostep>** possible options are **Pos & Ht**, **Pos Only**, **Height Only** or **None**. • For **<Transfrm Type: Classic 3D>** possible options are **Pos & Ht** or **None**. Select a control point from both jobs that occupy the same position on the different datums.
	SURVY (F5). Available when **<Known Point:>** is highlighted. To measure a point and store it in **<Local Pts Job:>**.
4.	**CONT (F1)** returns to **DET C SYS Step 3: Match Points (n)** and adds a new line of matched points to the matched points list.

38.4.3 Editing a Pair of Matching Points

Edit matching points step-by-step

Step	Description
1.	Refer to "38.2 Determining a New Coordinate System" to access **DET C SYS Step 3: Match Points (n)**.
2.	**DET C SYS Step 3: Match Points (n)** Highlight the pair of matching points to be edited.
3.	**EDIT (F3)** to access **DET C SYS Edit Matching Points**.
4.	All the following steps are identical with the selecting of new matching points. Refer to "38.4.2 Selecting a New Pair of Matching Points". Follow the instructions from step 3. onwards.

38.5 Transformation Results

38.5.1 Accessing Transformation Results

Access step-by-step

Step	Description
	The results of a transformation can be displayed during the process of determining or updating a coordinate system.
1.	Refer to "38.2 Determining a New Coordinate System". Follow the instructions to access **DET C SYS Step 4: Check Residuals**.
2.	**RESLT (F3)** to access **DET C SYS Transformation Results**.

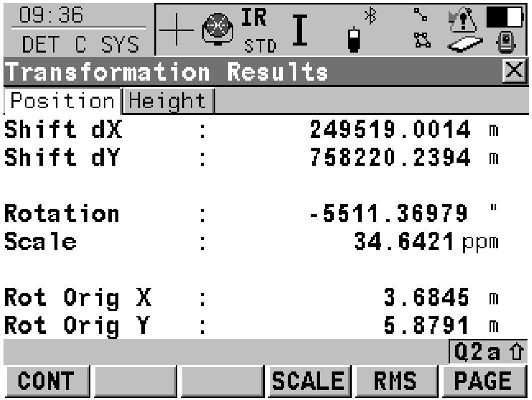
Next step

IF	THEN
<Transfrm Type: Onestep> or **<Transfrm Type: Twostep>**	Refer to "38.5.2 Results for Onestep and Twostep Transformations".
<Transfrm Type: Classic 3D>	Refer to "38.5.3 Results for Classic 3D Transformation".

38.5.2 Results for Onestep and Twostep Transformations

DET C SYS Transformation Results, Position page

Results of the transformation between the WGS 1984 datum and the local datum are shown for each of the transformation parameters. This screen consists of the **Position** page and the **Height** page. The explanations for the softkeys given below are valid for the pages as indicated.



CONT (F1)
To return to **DET C SYS Step 4: Check Residuals**.

SCALE (F4) or **PPM (F4)**
Available on the **Position** page. To switch between **<Scale:>** displaying the true scale and displaying the ppm.

RMS (F5) or **PARAM (F5)**
To switch between the root mean square values of the parameters and the actual parameter values. The name of the screen changes to **DET C SYS Transformation Results rms** when displaying rms values.

PAGE (F6)
To change to another page on this screen.

Description of fields

Field	Option	Description
<Shift dX:>	Output	Shift in X direction.
<Shift dY:>	Output	Shift in Y direction.
<Rotation:>	Output	Rotation of transformation.
<Scale:>	Output	Scale factor used in transformation. Either true scale or ppm.
<Rot Orig X:>	Output	Position in the X direction of the origin of rotation.
<Rot Orig Y:>	Output	Position in the Y direction of the origin of rotation.

Next step

PAGE (F6) changes to the **Height** page. Refer to paragraph "DET C SYS Transformation Results, Height page".

DET C SYS Transformation Results, Height page

Description of fields

Field	Option	Description
<Slope in X:>	Output	Tilt of the transformation in the X direction.
<Slope in Y:>	Output	Tilt of the transformation in the Y direction.
<Height Shift:>	Output	Shift in height between WGS 1984 datum and local datum.

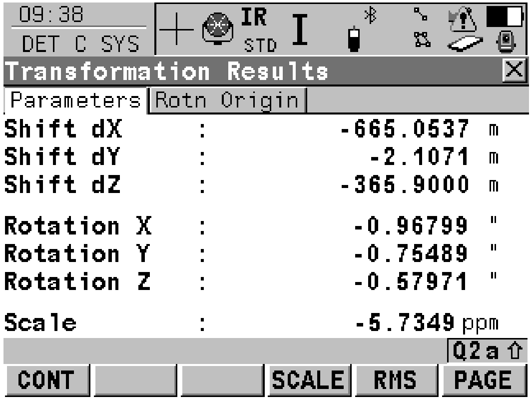
Next step

CONT (F1) returns to **DET C SYS Step 4: Check Residuals**.

38.5.3 Results for Classic 3D Transformation

DET C SYS Transformation Results, Parameters page

Results of the transformation between the WGS 1984 datum and the local datum are shown for each of the transformation parameters. This screen consists of the **Parameters** page and the **Rotn Origin** page. The explanations for the softkeys given below are valid for the pages as indicated.



CONT (F1)
To return to **DET C SYS Step 4: Check Residuals**.

SCALE (F4) or **PPM (F4)**
Available on the **Parameters** page. To switch between **<Scale:>** displaying the true scale and displaying the ppm.

RMS (F5) or **PARAM (F5)**
To switch between the root mean square values of the parameters and the actual parameter values.

PAGE (F6)
To change to another page on this screen.

Description of fields

Field	Option	Description
<Shift dX:>	Output	Shift in X direction.
<Shift dY:>	Output	Shift in Y direction.
<Shift dZ:>	Output	Shift in Z direction.
<Rotation X:>	Output	Rotation around the X axis.

Field	Option	Description
<Rotation Y:>	Output	Rotation around the Y axis.
<Rotation Z:>	Output	Rotation around the Z axis.
<Scale:>	Output	Scale factor used in transformation. Either true scale or ppm.

Next step

PAGE (F6) changes to the **Rotn Origin** page. Refer to paragraph "DET C SYS Transformation Results, Rotn Origin page".

DET C SYS Transformation Results, Rotn Origin page

Description of fields

Field	Option	Description
<Transf Model:>	Output	Classic 3D transformation model used for the transformation as defined in **DET C SYS Configuration, Classic 3D** page.
<Rot Orig X:>	Output	Available for **<Transf Model: Molodensky-Bad>**. Position in the X direction of the origin of rotation.
<Rot Orig Y:>	Output	Available for **<Transf Model: Molodensky-Bad>**. Position in the Y direction of the origin of rotation.
<Rot Orig Z:>	Output	Available for **<Transf Model: Molodensky-Bad>**. Position in the Z direction of the origin of rotation.

Next step

CONT (F1) returns to **DET C SYS Step 4: Check Residuals**.

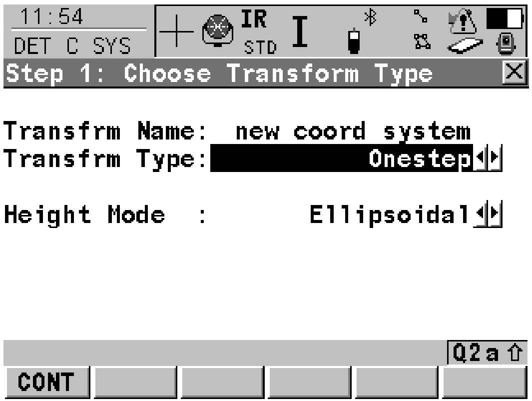
39 Determine Coordinate System - One Point Localisation

39.1 Accessing Determine Coordinate System - One Point Localisation

Access step-by-step

Step	Description
1.	Refer to "37.2 Accessing Determine Coordinate System" to access **DET C SYS Determine Coord System Begin**.
2.	Select **<Method: One Pt Localistn>**.
3.	**CONT (F1)** to access **DET C SYS Step 1: Choose Transform Type**.

DET C SYS
Step 1: Choose Transform Type



CONT (F1)
To confirm the selections and to continue with the subsequent screen.

Description of fields

Field	Option	Description
<Transfrm Name:>	User input	A unique name for the coordinate system. The name may be up to 16 characters in length and may include spaces.
<Transfrm Type:>	**Onestep**, **Twostep** or **Classic 3D**	The type of transformation to be used when determining a coordinate system.
<Height Mode:>	**Orthometric** or **Ellipsoidal**	The height mode to be used in the determination of a coordinate system

Next step

IF	THEN
<Transfrm Type: Onestep>	**CONT (F1)** to access **DET C SYS Step 2: Choose Parameters**. Refer to "39.2 Determine Coordinate System - Onestep Transformation".
<Transfrm Type: Twostep>	**CONT (F1)** to access **DET C SYS Step 2: Choose Parameters**. Refer to "39.3 Determine Coordinate System - Twostep Transformation".
<Transfrm Type: Classic 3D>	**CONT (F1)** to access **DET C SYS Step 2: Choose Parameters**. Refer to "39.4 Determine Coordinate System - Classic 3D Transformation".

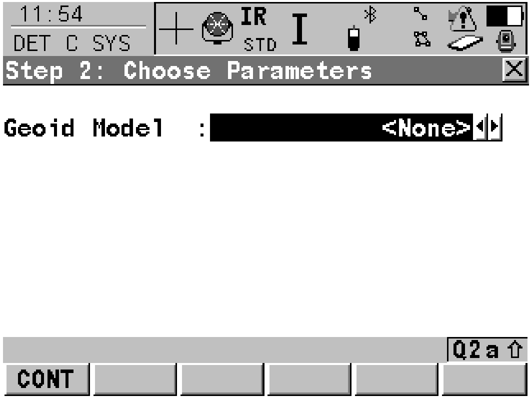
<Azimuth:> is used throughout this chapter. This should always be considered to also mean **<Bearing:>**.

39.2 Determine Coordinate System - Onestep Transformation

Access step-by-step

Step	Description
1.	Refer to "39.1 Accessing Determine Coordinate System - One Point Localisation" to access **DET C SYS Step 1: Choose Transform Type**.
2.	**DET C SYS Step 1: Choose Transform Type** **<Transfrm Type: Onestep>**
3.	**CONT (F1)** to access **DET C SYS Step 2: Choose Parameters**.

DET C SYS
Step 2: Choose Parameters



CONT (F1)
To confirm the selections and to continue with the subsequent screen.

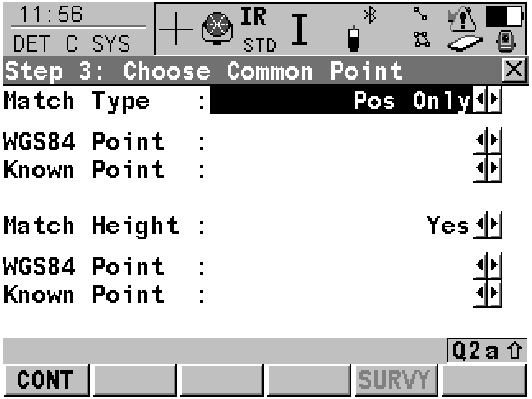
Description of fields

Field	Option	Description
<Geoid Model:>	Choicelist	The geoid model to be used in the transformation. Geoid models from **MANAGE Geoid Models** can be selected.

Next step

CONT (F1) continues to **DET C SYS Step 3: Choose Common Point**.

DET C SYS
Step 3: Choose Common Point



CONT (F1)
To confirm the selections and to continue with the subsequent screen.

SURVY (F5)
Available for **<Known Point:>** being highlighted. To measure a point and store it in **<Local Pts Job:>**.

Description of fields

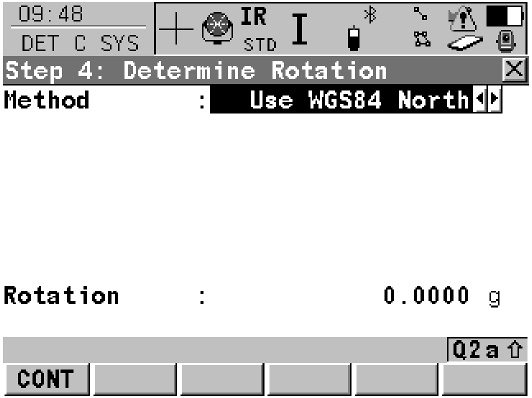
Field	Option	Description
<Match Type:>		How the horizontal and vertical shifts of the transformation should be computed.
	Pos & Height	Position and height are taken from the same pair of matching points.
	Pos Only	Position is taken from one pair of matching points. The height can be taken from another pair of matching points.
<WGS84 Point:>	Choicelist	The point ID of the horizontal and/or vertical control point chosen from **<WGS84 Pts Job:>**. All WGS 1984 points from **MANAGE Data: Job Name** can be selected.
<Known Point:>	Choicelist	The point ID of the horizontal and/or vertical control point chosen from **<Local Pts Job:>**. All local points from **MANAGE Data: Job Name** can be selected.
<Match Height:>	**Yes** or **No**	Available for **<Match Type: Pos Only>**. Activates the determination of the vertical shift from a separate pair of matching points..

Next step

CONT (F1) continues to **DET C SYS Step 4: Determine Rotation**.

DET C SYS
Step 4: Determine Rotation

This screen contains different fields, depending on the **<Method:>** selected. The explanations for the softkeys given below are valid as indicated.



CONT (F1)
To confirm the selections and to continue with the subsequent screen.

INV (F2)
Available for **<Method: Two WGS84 Points>** and **<Method: User Entered>**. To compute an azimuth between two local points. Refer to "39.5 Computing Required Azimuth".

Description of common fields

Field	Option	Description
<Method:>	**Use WGS84 North**, **User Entered**, **Convergnce Angle** or **Two WGS84 Points**	Method by which the rotation angle for the transformation is determined.

For <Method: Use WGS84 North>

Description of fields

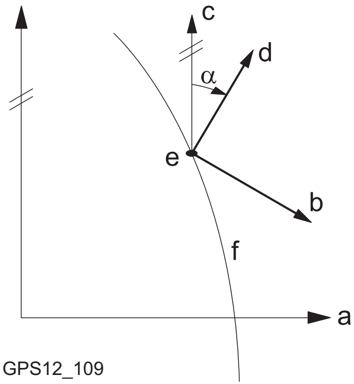
Field	Option	Description
<Rotation:>	Output	Transformation will be rotated to North as defined by the WGS 1984 datum. North is 0.00000°.

For <Method: User Entered>

Description of fields

Field	Option	Description
<Rotation:>	User input	Allows the orientation of the transformation to be manually typed in or calculated in **DET C SYS Compute Required Azimuth**.

For <Method: Convergnce Angle>



GPS12_109

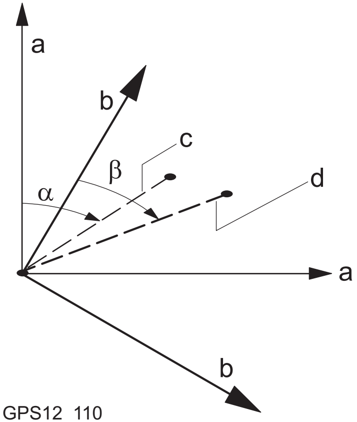
a	WGS 1984 coordinate system
b	Local coordinate system, **<Coord System:>**
c	Geodetic North
d	Grid North
e	Point on WGS 1984 datum, **<WGS84 Point:>**
f	Meridian
α	Convergence angle, **<Rotation:>**

Description of fields

Field	Option	Description
<Coord System:>	Choicelist	Coordinate system to provide the direction of grid North in the area where the control point used for determining the local coordinate system, is located. All coordinate systems from **Main Menu: Manage...\Coordinate Systems** can be selected.
<WGS84 Point:>	Choicelist	WGS 1984 point of which the convergence angle will be calculated. All points from **<WGS84 Pts Job:>** selected in **DET C SYS Determine Coord System Begin** can be selected.

Field	Option	Description
<Rotation:>	Output	The rotation of the transformation calculated as 0.00000^{o} minus the computed convergence angle. The field is updated as **<Coord System:>** and **<WGS84 Point:>** are changed.

For <Method: Two WGS84 Points>



GPS12_110

- a WGS 1984 coordinate system
- b Local coordinate system
- c Line between two WGS 1984 points.
- d Line between two local points
- α Azimuth of two WGS 1984 points, **<Azimuth:>**
- β Known azimuth or azimuth of two local points, **<Reqd Azimuth:>**

Description of fields

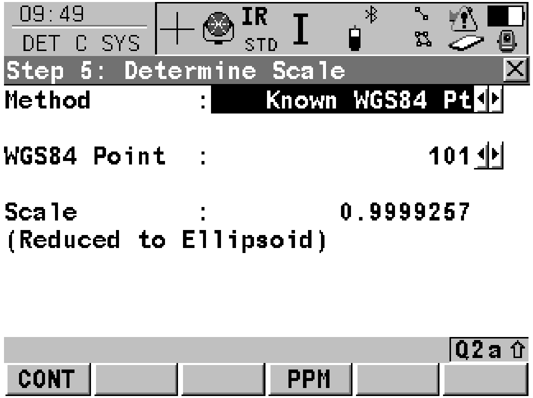
Field	Option	Description
<Point 1:>	Choicelist	First point to use for computation of **<Azimuth:>**. All points from **<WGS84 Pts Job:>** chosen in **DET C SYS Determine Coord System Begin** can be selected.
<Point 2:>	Choicelist	Second point to use for computation of **<Azimuth:>**. All points from **<WGS84 Pts Job:>** chosen in **DET C SYS Determine Coord System Begin** can be selected.
<Azimuth:>	Output	Computed azimuth between **<Point 1:>** and **<Point 2:>**.
<Reqd Azimuth:>	User input	The required grid azimuth, computed between two local points. Refer to "39.5 Computing Required Azimuth".
<Rotation:>	Output	The rotation of the transformation calculated as **<Reqd Azimuth>** minus **<Azimuth>**. The field is updated as **<Point 1:>**, **<Point 2:>** and **<Reqd Azimuth:>** are changed.

Next step

CONT (F1) continues to **DET C SYS Step 5: Determine Scale**.

DET C SYS Step 5: Determine Scale

This screen contains different fields, depending on the **<Method:>** selected. The explanations for the softkeys given below are valid as indicated. The scale is calculated using the formula (r + h)/r where r is the distance from the centre of the ellipsoid to the WGS 1984 point selected in **DET C SYS Step 3: Choose Common Point** and h is the height of this point above the WGS 1984 ellipsoid.



CONT (F1)
To confirm the selections and to continue with the subsequent screen.

SCALE (F4) or **PPM (F4)**
To switch between **<Scale:>** displaying the true scale and displaying the ppm.

Description of common fields

Field	Option	Description
<Method:>	**User Entered**, **Known WGS84 Pt** or **Known WGS84 Ht**	Method of determining the scale factor of the transformation.

For <Method: User Entered>

Description of fields

Field	Option	Description
<Scale:>	User input	Allows the scale factor to be typed in manually.

For <Method: Known WGS84 Pt>

Description of fields

Field	Option	Description
<WGS84 Point:>	Choicelist	WGS 1984 point from which the scale factor will be calculated. The scale factor is calculated using the height of the known WGS 1984 point. All points from the **<WGS84 Pts Job:>** chosen in **DET C SYS Determine Coord System Begin** can be selected.
<Scale:>	Output	The calculated scale factor.

For <Method: Known WGS84 Ht>

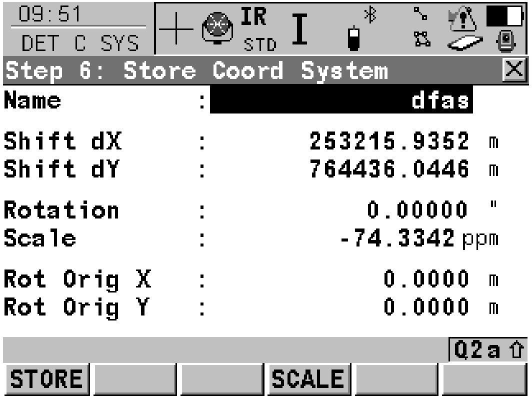
Description of fields

Field	Option	Description
<Known Height:>	User input	The WGS 1984 height of a point can be typed in. The scale factor is calculated using this height.
<Scale:>	Output	The calculated scale factor.

Next step

CONT (F1) continues to **DET C SYS Step 6: Store Coord System**.

DET C SYS Step 6: Store Coord System



STORE (F1)
To store the coordinate system to the DB-X, attach the system to **<WGS84 Pts Job:>** that was selected in **DET C SYS Determine Coord System Begin** and return to **TPS1200 Main Menu**.

SCALE (F4) or **PPM (F4)**
To switch between **<Scale:>** displaying the true scale and displaying the ppm.

Description of fields

Field	Option	Description
<Name:>	User input	A unique name for the coordinate system. The name may be up to 16 characters in length and may include spaces.
<Shift dX:>	Output	Shift in X direction.
<Shift dY:>	Output	Shift in Y direction.
<Rotation:>	Output	Rotation of transformation.

Field	Option	Description
<Scale:>	Output	Scale factor of transformation.
<Rot Orig X:>	Output	Position in the X direction of the origin of rotation.
<Rot Orig Y:>	Output	Position in the Y direction of the origin of rotation.

Next step

STORE (F1) stores the coordinate system and returns to **TPS1200 Main Menu**.

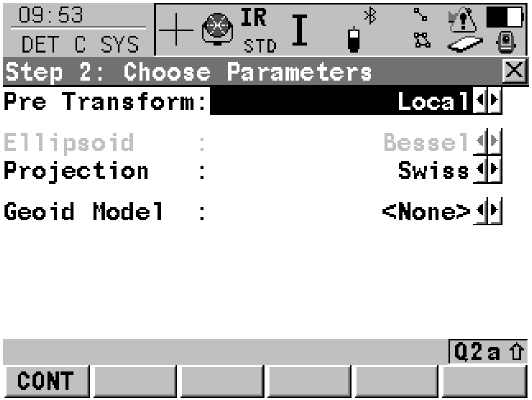
39.3 Determine Coordinate System - Twostep Transformation

39.3.1 Twostep Transformation

Access step-by-step

Step	Description
1.	Refer to "39.1 Accessing Determine Coordinate System - One Point Localisation" to access **DET C SYS Step 1: Choose Transform Type**.
2.	**DET C SYS Step 1: Choose Transform Type** **<Transfrm Type: Twostep>**
3.	**CONT (F1)** to access **DET C SYS Step 2: Choose Parameters**.

DET C SYS
Step 2: Choose Parameters



CONT (F1)
To confirm the selections and to continue with the subsequent screen.

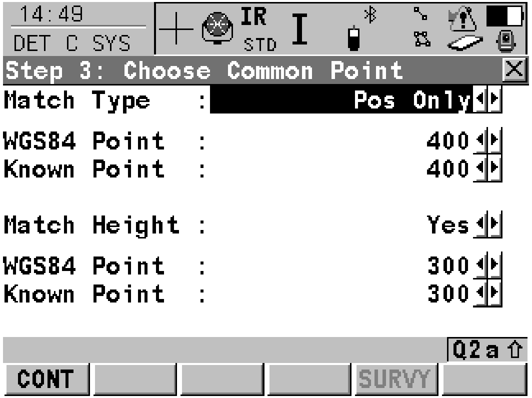
Description of fields

Field	Option	Description
<Pre Transform:>	Choicelist	The pretransformation to be used for the preliminary 3D transformation. All 3D transformations from **MANAGE Transformations** can be selected.
<Ellipsoid:>	Choicelist	The ellipsoid to be used in the transformation. All ellipsoids from **MANAGE Ellipsoids** can be selected.
	Output	The ellipsoid being used by a hard wired projection when selected in **<Projection:>**.
<Projection:>	Choicelist	The projection to be used in the transformation. All projections from **MANAGE Projections** can be selected.
<Geoid Model:>	Choicelist	The geoid model to be used in the transformation. Geoid models from **MANAGE Geoid Models** can be selected.

Next step

CONT (F1) continues to **DET C SYS Step 3: Choose Common Point**.

DET C SYS Step 3: Choose Common Point



CONT (F1)
To confirm the selections and to continue with the subsequent screen.

SURVY (F5)
Available for **<Known Point:>** being highlighted. To measured a point and store it in **<Local Pts Job:>**.

Description of fields

Field	Option	Description
<Match Type:>		How the horizontal and vertical shifts of the transformation should be computed.
	Pos & Height	Position and height are taken from the same pair of matching points.
	Pos Only	Position is taken from one pair of matching points. The height can be taken from another pair of matching points.

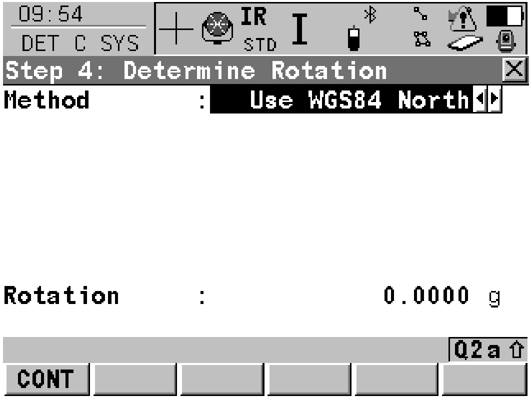
Field	Option	Description
<WGS84 Point:>	Choicelist	The point ID of the horizontal and/or vertical control point chosen from **<WGS84 Pts Job:>**. All WGS 1984 points from **MANAGE Data: Job Name** can be selected.
<Known Point:>	Choicelist	The point ID of the horizontal and/or vertical control point chosen from **<Local Pts Job:>**. All local points from **MANAGE Data: Job Name** can be selected.
<Match Height:>	**Yes** or **No**	Available for **<Match Type: Pos Only>**. Activates the determination of the vertical shift from a separate pair of matching points.

Next step

CONT (F1) continues to **DET C SYS Step 4: Determine Rotation**.

DET C SYS Step 4: Determine Rotation

This screen contains different fields, depending on the **<Method:>** selected. The explanations for the softkeys given below are valid as indicated.



CONT (F1)
To confirm the selections and to continue with the subsequent screen.

INV (F2)
Available for **<Method: Two WGS84 Points>** and **<Method: User Entered>**. To compute an azimuth between two local points. Refer to "39.5 Computing Required Azimuth".

Description of common fields

Field	Option	Description
<Method:>	**Use WGS84 North**, **User Entered**, **Convergnce Angle** or **Two WGS84 Points**	Method by which the rotation angle for the transformation is determined.

For <Method: Use WGS84 North>

Description of fields

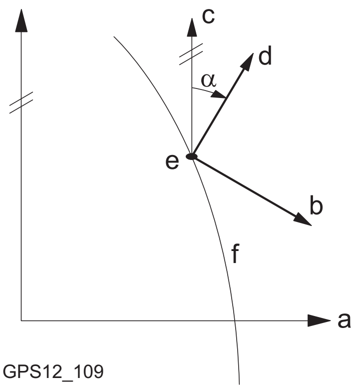
Field	Option	Description
<Rotation:>	Output	Transformation will be rotated to North as defined by the WGS 1984 datum. North is 0.00000^o.

For <Method: User Entered>

Description of fields

Field	Option	Description
<Rotation:>	User input	Allows the orientation of the transformation to be manually typed in or calculated in **DET C SYS Compute Required Azimuth**.

For <Method: Convergnce Angle>



GPS12_109

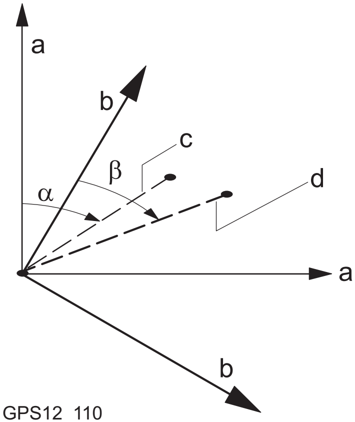
a	WGS 1984 coordinate system
b	Local coordinate system, **<Coord System:>**
c	Geodetic North
d	Grid North
e	Point on WGS 1984 datum, **<WGS84 Point:>**
f	Meridian
α	Convergence angle, **<Rotation:>**

Description of fields

Field	Option	Description
<Coord System:>	Choicelist	Coordinate system to provide the direction of grid North in the area where the control point used for determining the local coordinate system, is located. All coordinate systems from **Main Menu: Manage...\Coordinate Systems** can be selected.
<WGS84 Point:>	Choicelist	WGS 1984 point of which the convergence angle will be calculated. All points from **<WGS84 Pts Job:>** chosen in **DET C SYS Determine Coord System Begin** can be selected.

Field	Option	Description
<Rotation:>	Output	The rotation of the transformation calculated as 0.00000° minus the computed convergence angle. The field is updated as **<Coord System:>** and **<WGS84 Point:>** are changed.

For <Method: Two WGS84 Points>



GPS12_110

a	WGS 1984 coordinate system
b	Local coordinate system
c	Line between two WGS 1984 points.
d	Line between two local points
α	Azimuth of two WGS 1984 points, **<Azimuth:>**
β	Known azimuth or azimuth of two local points, **<Reqd Azimuth:>**

Description of fields

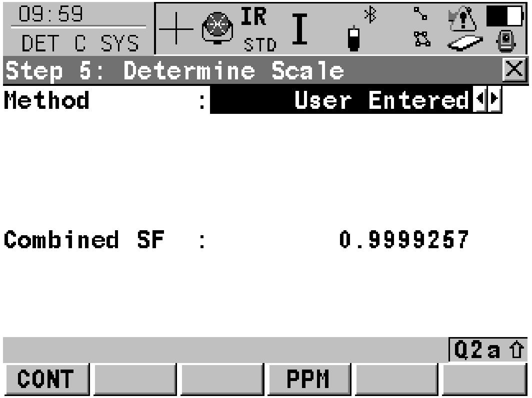
Field	Option	Description
<Point 1:>	Choicelist	First point to use for computation of **<Azimuth:>**. All points from **<WGS84 Pts Job:>** chosen in **DET C SYS Determine Coord System Begin** can be selected.
<Point 2:>	Choicelist	Second point to use for computation of **<Azimuth:>**. All points from **<WGS84 Pts Job:>** chosen in **DET C SYS Determine Coord System Begin** can be selected.
<Azimuth:>	Output	Computed azimuth between **<Point 1:>** and **<Point 2:>**.
<Reqd Azimuth:>	User input	The required grid azimuth, computed between two local points. Refer to "39.5 Computing Required Azimuth".
<Rotation:>	Output	The rotation of the transformation calculated as **<Reqd Azimuth>** minus **<Azimuth>**. The field is updated as **<Point 1:>**, **<Point 2:>** and **<Reqd Azimuth:>** are changed.

Next step

CONT (F1) continues to **DET C SYS Step 5: Determine Scale**.

DET C SYS
Step 5: Determine Scale

This screen contains different fields, depending on the **<Method:>** selected. The explanations for the softkeys given below are valid as indicated. The scale is calculated using the formula (r + h)/r where r is the radius of the ellipsoid at the position of the WGS 1984 point selected in **DET C SYS Step 3: Choose Common Point** and h is the height of this point above the local ellipsoid.



CONT (F1)
To confirm the selections and to continue with the subsequent screen.

GRID (F2)
Available for **<Method: Compute CSF>**. To compute the grid scale factor. Accesses **DET C SYS Compute Grid Scale Factor**. Refer to "39.3.2 Computing the Grid Scale Factor".

HIGHT (F3)
Available for **<Method: Compute CSF>**. To compute the height scale factor. Accesses **DET C SYS Compute Height Scale Factor**. Refer to "39.3.3 Computing the Height Scale Factor".

Description of fields

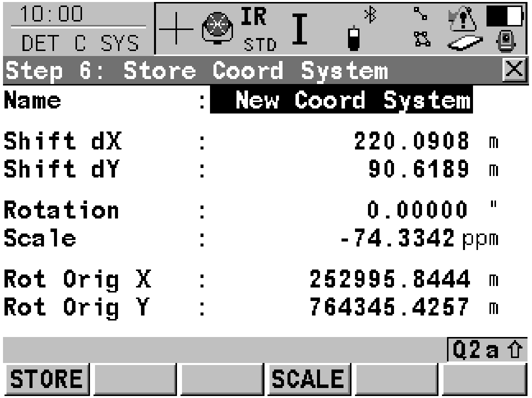
Field	Option	Description
<Method:>	**User Entered** or **Compute CSF**	The default method for determining the **C**ombined **S**cale **F**actor to be used in the transformation process.

Field	Option	Description
<Grid SF:>	Output	Available for **<Method: Compute CSF>**. The grid scale factor as computed in **DET C SYS Compute Grid Scale Factor**.
<Height SF:>	Output	Available for **<Method: Compute CSF>**. The height scale factor as computed in **DET C SYS Compute Height Scale Factor**.
<Combined SF:>		The combined scale factor of the transformation.
	User input	Available for **<Method: User Entered>**. The scale factor can be typed in.
	Output	Available for **<Method: Compute CSF>**. The product of the grid scale factor and the height scale factor.

Next step

CONT (F1) continues to **DET C SYS Step 6: Store Coord System**.

DET C SYS Step 6: Store Coord System



STORE (F1)
To store the coordinate system to the DB-X, attach the system to **<WGS84 Pts Job:>** that was selected in **DET C SYS Determine Coord System Begin** and return to **TPS1200 Main Menu**.

SCALE (F4) or **PPM (F4)**
To switch between **<Scale:>** displaying the true scale and displaying the ppm.

Description of fields

Field	Option	Description
<Name:>	User input	A unique name for the coordinate system. The name may be up to 16 characters in length and may include spaces.
<Shift dX:>	Output	Shift in X direction.
<Shift dY:>	Output	Shift in Y direction.
<Rotation:>	Output	Rotation of transformation.
<Scale:>	Output	Scale factor of transformation.
<Rot Orig X:>	Output	Position in the X direction of the origin of rotation.
<Rot Orig Y:>	Output	Position in the Y direction of the origin of rotation.

Next step

STORE (F1) stores the coordinate system and returns to **TPS1200 Main Menu**.

39.3.2 Computing the Grid Scale Factor

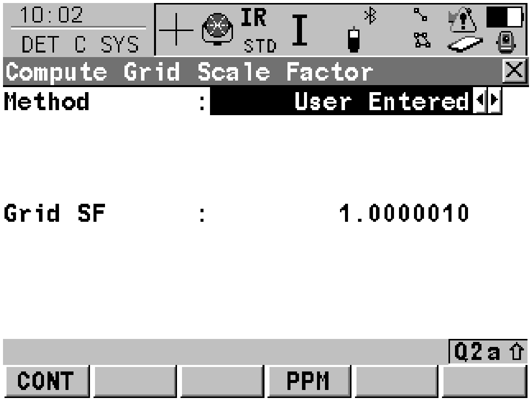
Description

Calculates the grid scale factor. The grid scale factor is the scale factor of the point chosen relative to the projection being used.

Access step-by-step

Step	Description
1.	Refer to "39.1 Accessing Determine Coordinate System - One Point Localisation" to access **DET C SYS Step 1: Choose Transform Type**.
2.	Select **<Transfrm Type: Twostep>**.
3.	Continue to **DET C SYS Step 5: Determine Scale**.
4.	Select **<Method: Compute CSF>**.
5.	**GRID (F2)** to access **DET C SYS Compute Grid Scale Factor**.

DET C SYS Compute Grid Scale Factor



CONT (F1)
To confirm the selections and return to the screen from where this screen was accessed.

Description of fields

Field	Option	Description
<Method:>		Method by which the grid scale factor is to be calculated.
	User Entered	Grid scale factor can be manually typed in.
	Known Local Pt	Grid scale factor is computed using the position of a known local point.
<Local Point:>	Choicelist	Available for **<Method: Known Local Pt>**. The point ID of the point chosen from **<Local Pts Job:>** from which the grid scale factor is computed using the projection selected in **DET C SYS Step 2: Choose Parameters**. All local points from **MANAGE Data: Job Name** can be selected.
<Grid SF:>		The grid scale factor.
	User input	Available for **<Method: User Entered>**. To type in the grid scale factor.
	Output	Available for **<Method: Known Local Pt>**. The computed grid scale factor.

Next step

CONT (F1) returns to **DET C SYS Step 5: Determine Scale**.

39.3.3 Computing the Height Scale Factor

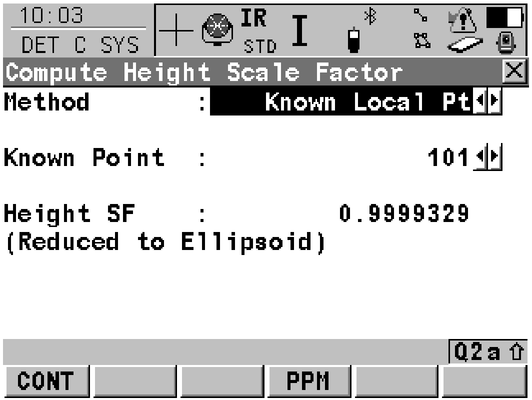
Description

Calculates the height scale factor of the point chosen.

Access step-by-step

Step	Description
1.	Refer to "39.1 Accessing Determine Coordinate System - One Point Localisation" to access **DET C SYS Step 1: Choose Transform Type**.
2.	Select **<Transfrm Type: Twostep>**.
3.	Continue to **DET C SYS Step 5: Determine Scale**.
4.	Select **<Method: Compute CSF>**.
5.	**HIGHT (F3)** to access **DET C SYS Compute Height Scale Factor**.

DET C SYS Compute Height Scale Factor



CONT (F1)
To confirm the selections and return to the screen from where this screen was accessed.

Description of fields

Field	Option	Description
<Method:>		Method by which the height scale factor is to be calculated.
	User Entered	Height scale factor can be manually typed in.
	Known Local Pt	Height scale factor is computed using the height of a known local point.
	Known Local Ht	Height scale factor is computed using the known height of a local point.
<Known Point:>	Choicelist	Available for **<Method: Known Local Pt>**. The point ID of the point chosen from **<Local Pts Job:>** from which the height scale factor is computed. All local points from **MANAGE Data: Job Name** can be selected.
<Known Height:>	User input	Available for **<Method: Known Local Ht>**. A known local height.
<Height SF:>		The height scale factor.
	User input	Available for **<Method: User Entered>**. To type in the height scale factor.
	Output	Available for **<Method: Known Local Pt>** and **<Method: Known Local Ht>**. The computed height scale factor.

Next step

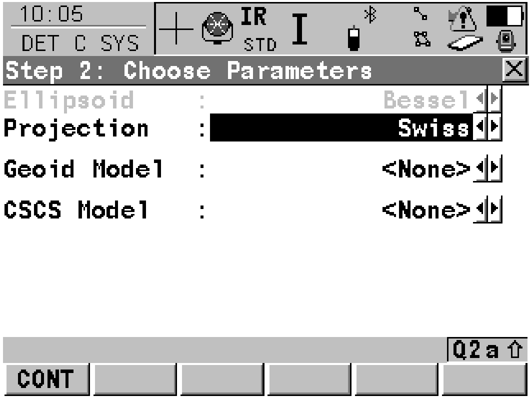
CONT (F1) returns to **DET C SYS Step 5: Determine Scale**.

39.4 Determine Coordinate System - Classic 3D Transformation

Access step-by-step

Step	Description
1.	Refer to "39.1 Accessing Determine Coordinate System - One Point Localisation" to access **DET C SYS Step 1: Choose Transform Type**.
2.	**DET C SYS Step 1: Choose Transform Type** **<Transfrm Type: Classic 3D>**
3.	**CONT (F1)** to access **DET C SYS Step 2: Choose Parameters**.

DET C SYS
Step 2: Choose Parameters



CONT (F1)
To confirm the selections and to continue with the subsequent screen.

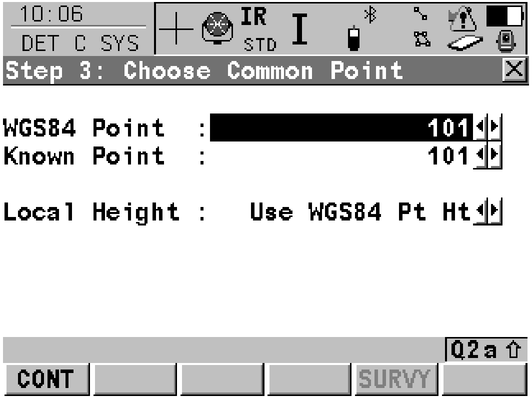
Description of fields

Field	Option	Description
<Ellipsoid:>	Choicelist	The ellipsoid to be used in the transformation. All ellipsoids from **MANAGE Ellipsoids** can be selected.
	Output	The ellipsoid being used by a hard wired projection when selected in **<Projection:>**.
<Projection:>	Choicelist	The projection to be used in the transformation. All projections from **MANAGE Projections** can be selected.
<Geoid Model:>	Choicelist	The geoid model to be used in the transformation. Geoid models from **MANAGE Geoid Models** can be selected.
<CSCS Model:>	Choicelist	The CSCS model to be used in the transformation. All CSCS models from **MANAGE CSCS Models** can be selected.

Next step

CONT (F1) continues to **DET C SYS Step 3: Choose Common Point**.

DET C SYS Step 3: Choose Common Point



CONT (F1)
To confirm the selections and to continue with the subsequent screen.

SURVY (F5)
To measure a point and store it in **<Local Pts Job:>**.

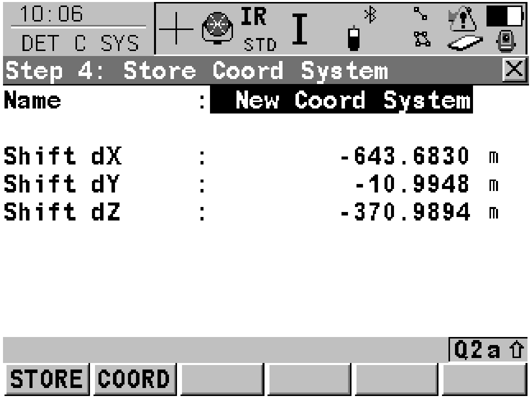
Description of fields

Field	Option	Description
<WGS84 Point:>	Choicelist	The point ID of the control point chosen from **<WGS84 Pts Job:>**. All WGS 1984 points from **MANAGE Data: Job Name** can be selected.
<Known Point:>	Choicelist	The point ID of the control point chosen from **<Local Pts Job:>**. All local points from **MANAGE Data: Job Name** can be selected.
<Local Height:>	**Use WGS84 Pt Ht** or **Use Local Pt Ht**	The source of the height information to use in the transformation.

Next step

CONT (F1) continues to **DET C SYS Step 4: Store Coord System**.

DET C SYS Step 4: Store Coord System



STORE (F1)
To store the coordinate system to the DB-X, attach the system to **<WGS84 Pts Job:>** that was selected in **DET C SYS Determine Coord System Begin** and return to **TPS1200 Main Menu**.

COORD (F2)
To view other coordinate types.

Description of fields

Field	Option	Description
<Shift dX:>	Output	Shift in X direction.
<Shift dY:>	Output	Shift in Y direction.
<Shift dZ:>	Output	Shift in Z direction.

Next step

STORE (F1) stores the coordinate system and returns to **TPS1200 Main Menu**.

39.5 Computing Required Azimuth

Description

Available for **<Method: Two WGS84 Points>** and **<Method: User Entered>** in **DET C SYS Step 4: Determine Rotation**.

Allows two local points to be chosen from **<Local Pts Job:>** selected in **DET C SYS Determine Coord System Begin** between which the required azimuth will be computed. This azimuth is then used with an azimuth computed between two WGS 1984 points chosen from **<WGS84 Pts Job:>** selected in **DET C SYS Determine Coord System Begin**, to calculate the rotation of the transformation.

The computed required azimuth appears in the **<Reqd Azimuth:>** field for **<Method: Two WGS84 Points>** and the **<Rotation:>** field for **<Method: User Entered>** in **DET C SYS Step 4: Determine Rotation**.

Compute azimuth step-by-step

Step	Description
1.	Refer to "39.1 Accessing Determine Coordinate System - One Point Localisation" to access **DET C SYS Step 1: Choose Transform Type**.
2.	Select **<Transfrm Type: Onestep>** or **<Transfrm Type: Twostep>**.
3.	Continue to **DET C SYS Step 4: Determine Rotation**.
4.	Select **<Method: Two WGS84 Points>** or **<Method: User Entered>**.
5.	**INV (F2)** to access **DET C SYS Compute Required Azimuth**.
6.	**DET C SYS Compute Required Azimuth** **<From:>** The point ID of the first known point for the azimuth calculation. **<To:>** The point ID of the second known point for the azimuth calculation. Select the points stored in the **<Local Pts Job:>**.

Step	Description
7.	**CONT (F1)** to calculate the required azimuth and return to **DET C SYS Step 4: Determine Rotation**.

40 GPS Survey

40.1 Application Program

Description

GPS Survey is an application program which is used with SmartStation. The main purpose of this application program is to enable measurement of points in GPS mode without having to run through the Setup application program.

Access

Select **Main Menu: Programs...\GPS Survey**.

OR

Press a hot key configured to access the screen **GPS Survey GPS Survey Begin**. Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

OR

Press **PROG**. Highlight **GPS Survey**. **CONT (F1)**. Refer to "35.2 Accessing the Programs Menu" for information on the **PROG** key.

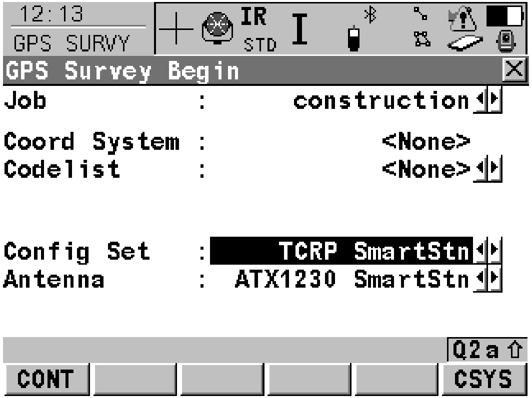
Properties of GPS Survey points

The properties of GPS Survey points are:

Type	Property	Property
Class	**MEAS**	**NAV**
Sub class	**GPS Fixed** **GPS Code only**	**GPS Code only**
Source	**GPS Survey**	**GPS Survey**

Type	Property	Property
Instrument source	**GPS**	**GPS**

GPS SURVEY
GPS Survey Begin



CONT (F1)
To accept changes and access the subsequent screen. The chosen settings become active.

CSYS (F6)
To select a different coordinate system.

Description of fields

Field	Option	Description
<Job:>	Choicelist	The active job. All jobs from **Main Menu: Manage...\Jobs** can be selected.
<Coord System:>	Output	The coordinate system currently attached to the selected **<Job:>**.

Field	Option	Description
<Codelist:>	Choicelist	No codes are stored in the selected **<Job:>**. All codelists from **Main Menu: Manage...\Codelists** can be selected.
	Output	Codes have already been stored in the selected **<Job:>**. If codes had been copied from a System RAM codelist, then the name of the codelist is displayed. If codes have not been copied from a System RAM codelist but typed in manually, then the name of the active job is displayed.
<Config Set:>	Choicelist	The active configuration set. All configuration sets from **Main Menu: Manage...\Configuration Sets** can be selected.
<Antenna:>	Output	Opening the choicelist accesses **MANAGE Antennas**. The default antenna is SmartAntenna.

Next step

CONT (F1) accepts the changes and accesses **GPS SURVEY GPS Survey**.

GPS SURVEY GPS Survey, Survey page

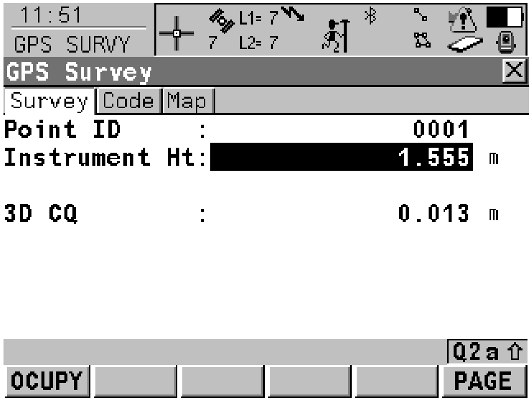
Overview

Important feaures about this screen:

- Upon entering **GPS SURVEY GPS Survey** SmartStation switches into GPS mode.
- The display mask for **GPS SURVEY GPS Survey** is fixed and is not configurable.

- SmartAntenna is automatically turned on upon entry to the screen. SmartAntenna can be turned on beforehand by pressing the ON button located on the side.
- Some of the screen icons change from TPS specific to GPS specific.
- The GPS real-time radio link is automatically activated, if configured.
- The occupation/storing behaviour is dependent on the configuration settings.

Diagram



OCUPY (F1)
To start logging of static observations. The position mode icon changes to the static icon. **(F1)** changes to **STOP**.

STOP (F1)
To end logging of static observations when enough data is collected. When **<Auto STOP: Yes>** in **CONFIGURE Point Occupation Settings**, logging of static observations ends automatically as defined by the stop criteria. The position mode icon changes to the moving icon. **(F1)** changes to **STORE**.

STORE (F1)

To store the measured point. When **<Auto STORE: Yes>** in **CONFIGURE Point Occupation Settings**, the measured point is stored automatically. **(F1)** changes to **OCUPY**.
It may happen that a point with the same point ID exists in the job. If the codes and/or attribute values of the new and the existing point do not match, a screen opens where they can be corrected. Refer to "8.6 Code and Attribute Mismatch".

PAGE (F6)

To change to another page on this screen.

SHIFT AVGE (F2)

To check the residuals for the averaged position. Available for **<Averaging Mode: Average>** and for more than one measured coordinate triplet recorded for the same point. Refer to "6.3.4 Mean Page".

SHIFT ABS (F2)

To check the absolute difference between measurements. Available for **<Averaging Mode: Absolute Diffs>** and for more than one measured coordinate triplet recorded for the same point. Refer to "6.3.4 Mean Page".

SHIFT CONEC (F3) and **SHIFT DISCO (F3)**
To dial the number of the reference station configured in the active configuration set and to hang up immediately after the survey is completed. Available for GPS real-time devices of type digital cellular phone or modem. Available for **<Auto CONEC: No>** in **CONFIGURE GSM Connection**.

SHIFT INIT (F4)
To select an initialisation method and to force a new initialisation. Available for configuration sets allowing phase fixed solutions.

SHIFT INDIV (F5) and **SHIFT RUN (F5)**
To change between entering an individual point ID different to the defined ID template and the running point ID according to the ID template. Refer to "16.1 ID Templates".

Description of fields

Field	Option	Description
<Point ID:>	User input	The identifier for manually occupied points. The configured point ID template is used. The ID can be changed: • To start a new sequence of point ID's overtype the point ID.

Field	Option	Description
		• For an individual point ID independent of the ID template **SHIFT INDIV (F5)**. **SHIFT RUN (F5)** changes back to the next ID from the configured ID template. Refer to "16.1 ID Templates".
<Instrument Ht:>	User input	Current instrument height. SmartAntenna offset is automatically added but not displayed.
<3D CQ:>	Output	The current 3D coordinate quality of the computed position.
<Time at Point:>	Output	The time from when the point is occupied until point occupation is stopped.
<RTK Positions:>	Output	The number of GPS real-time positions recorded over the period of point occupation.

Next step
PAGE (F6) changes to the **Code** page.

GPS SURVEY GPS Survey, Code page

The setting for **<Thematc Codes:>** in **CONFIGURE Coding Settings** determines the availability of the fields and softkeys. Refer to "8 Coding" for information on coding.

Next step
PAGE (F6) changes to the **Map** page.

GPS SURVEY
GPS Survey,
Map page

The **Map** page provides an interactive display of the data. Refer to "34 MapView Interactive Display Feature" for information on the functionality and softkeys available.

Next step

PAGE (F6) changes to the first page on this screen.

40.2 Management of Antennas

40.2.1 Overview

Description

- Leica Geosystems antennas are predefined as default and can be selected from a list.
- Additional antennas can be defined.
- Default antennas contain an elevation dependent correction model.
- New antenna correction models can be set up and transferred to the receiver using LGO.

Default antennas

All Leica Geosystems antennas are supported. The default antenna is SmartAntenna.

Active antenna

One antenna is always considered as the active antenna.

40.2.2 Accessing Antenna Management

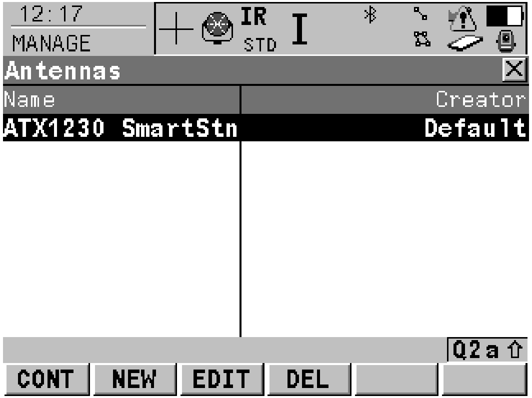
Access

Select **Main Menu: Programs...\GPS Survey**.
From **GPS SURVEY GPS Survey Begin** highlight the choicelist for **<Antenna:>**.
Open the choicelist to access **MANAGE Antennas**.
The default antenna is SmartAntenna.

OR

Select **Main Menu: Programs...\Setup**.
From **SETUP Station Setup Begin** press **CONF (F2)**.
Open the choicelist to access **MANAGE Antennas**.
The default antenna is SmartAntenna.

MANAGE Antennas



CONT (F1)
To select the highlighted antenna and to return to the previous screen.

NEW (F2)
To define a new antenna. Refer to "40.2.3 Creating a New Antenna".

EDIT (F3)
To edit the highlighted antenna. It is not possible to edit default antennas. Refer to "40.2.4 Editing an Antenna".

DEL (F4)
To delete the highlighted antenna. It is not possible to delete default antennas.

SHIFT DEFLT (F5)
To recall previously deleted default antennas and to reset default antennas to the default settings. User defined antennas are not affected.

Next step

IF an antenna	THEN
is to be selected	highlight the desired antenna. **CONT (F1)** closes the screen and returns to the screen from where **MANAGE Antennas** was accessed.
is to be created	highlight the antenna with offset characteristics similar to those required by the new antenna. **NEW (F2)** creates a new antenna. Refer to "40.2.3 Creating a New Antenna".
is to be edited	highlight the desired antenna. **EDIT (F3)**. Refer to "40.2.4 Editing an Antenna".

40.2.3 Creating a New Antenna

Access

Refer to "40.2.2 Accessing Antenna Management" to access **MANAGE Antennas**.

Create new antenna step-by-step

The following table explains the most common settings.

Step	Description
1.	In **MANAGE Antennas** press **NEW (F2)**.
2.	**MANAGE New Antenna**, **General** page **<Name:>** A unique name for the new antenna. **<Hz Offset:>** Horizontal offset of measurement reference point. **<V Offset:>** Vertical offset of measurement reference point. **<L1 PhOffset:>** Offset of L1 phase centre. **<L2 PhOffset:>** Offset of L2 phase centre. **<Copy Additional Corrections:>** Allows additional corrections to be copied from the antenna which was highlighted when **MANAGE New Antenna** was accessed. All offsets are copied from the antenna which was highlighted when **MANAGE New Antenna** was accessed.
3.	**PAGE (F6)** to access **MANAGE New Antenna**, **IGS** page.
4.	**MANAGE New Antenna**, **IGS** page **<IGS Name:>** The **I**nternational **G**PS **S**ervice name of the antenna. **<Serial Number:>** The serial number of the antenna. **<Set Up Number:>** The set up number of the antenna. This identifies the version number of the current calibration.

Step	Description
	The combination of values typed in here provides a unique standardised ID for the antenna being used.
5.	**STORE (F1)** stores the new antenna and returns to **MANAGE Antennas**.

40.2.4 Editing an Antenna

Access

Refer to "40.2.2 Accessing Antenna Management" to access **MANAGE Antennas**.

Edit antenna step-by-step

Step	Description
1.	In **MANAGE Antennas** highlight the antenna to be edited.
2.	**EDIT (F3)** to access **MANAGE Edit Antenna**, **General** page.
3.	**MANAGE Edit Antenna** All the following steps are identical with the creation of a new antenna. All fields can be edited except those of Leica default antennas. Refer to "40.2.3 Creating a New Antenna". Follow the instructions from step 2. onwards.

40.2.5 Antenna Heights

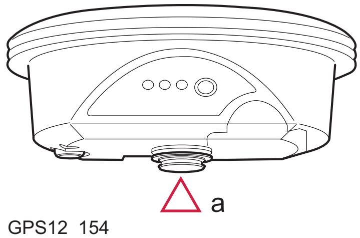
Mechnical Reference Plane

Description

The **M**echanical **R**eference **P**lane

- is where the antenna heights are measured to.
- is where the phase centre variations refer to.
- varies for different antennas.

Diagram



a) The mechanical reference plane is the underside of the threaded metal insert.

41 Hidden Point

41.1 Overview

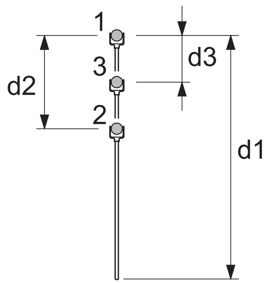
Description

Hidden points cannot be measured directly by TPS. This is because they are not directly visible.

- A hidden point can be calculated from measurements to prisms mounted on a hidden point rod with a known spacing and a known length of the hidden point rod. The hidden point rod may be held at any angle, as long as it is stationary for all measurements.
- Measurements for the hidden point are calculated as if the hidden point was observed directly. These calculated measurements can also be recorded.
- The hidden point rod can have either two or three reflectors. Refer to "41.3 Configuring Hidden Point" for information on configuring the hidden point rod.
- If three reflectors are used the average will be calculated.

Hidden point rod

The reflectors on the hidden point rod are also called auxiliary points after they have been measured.



TPS12_130

1	Reflector 1
2	Reflector 2
3	Reflector 3
d1	Rod length
d2	Distance from reflector 1 to reflector 2
d3	Distance from reflector 1 to reflector 3

Properties of hidden points

The properties stored with the hidden point and auxiliary points are:

Type	Reflector n - auxiliary point	Hidden point
Class	**MEAS**	**MEAS**
Sub class	**COGO**	**COGO**
Source	**Hidden Point**	**Hidden point**
Instrument source	**TPS**	**TPS**

Hidden point tasks

The Hidden Point application program can be used for the following tasks:

- The hidden point program may be used to obtain accurate three dimensional coordinates for a point that is currently blocked from direct measurement by an obstruction between the point and the instrument.
- Determination of flow line locations and elevations in manholes, without measuring from the rim of the manhole to the flow line and estimating corrections for nonverticality of the measuring tape and eccentricity from the measurement on the rim to the horizontal location of the flow line;

- Determination of recesses in building corners for detailed surveys, without estimating right angle offsets, with or without taping of the dimensions;
- Measurements behind overhangs, buttresses and columns for quantity determinations in underground construction or mining, without estimating right angle offsets, with or without taping of the dimensions;
- Measurements of industrial process piping or other equipment in close quarters;
- Detailed architectural surveys for remodeling or cultural preservation or restoration work
- Any place where accurate measurements would require many more instrument setups in order to achieve line of sight from the instrument to the points being measured.

☞ TPS Hidden Point application program does not generate a logfile.

41.2 Accessing Hidden Point

Access

Select **Main Menu: Programs...\Hidden Point**.

OR

Press **PROG**. Highlight **Hidden Point**. **CONT (F1)**. Refer to "35.2 Accessing the Programs Menu" for information on the **PROG** key.

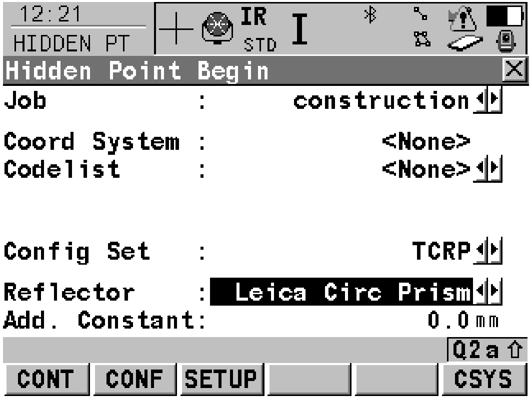
OR

Press a hot key configured to access the screen **HIDDEN PT Hidden Point Begin**. Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

HIDDEN PT
Hidden Point Begin



CONT (F1)
To accept the changes and access the subsequent screen. The chosen settings become active.

CONF (F2)
To configure the Hidden Point application program. Refer to "41.3 Configuring Hidden Point".

SETUP (F3)
To set up station. Accesses **SETUP Station Setup**.

CSYS (F6)
To select a different coordinate system.

Description of fields

Field	Option	Description
<Job:>	Choicelist	The active job. All jobs from **Main Menu: Manage...\Jobs** can be selected.
<Coord System:>	Output	The coordinate system currently attached to the selected **<Job:>**.
<Codelist:>	Choicelist	No codes are stored in the selected job. All codelists from **Main Menu: Manage...\Codelists** can be selected.
	Output	Codes have already been stored in the selected **<Job:>**. If codes had been copied from a System RAM codelist, then the name of the codelist is displayed. If codes have not been copied from a System RAM codelist but typed in, then the name of the active job is displayed.
<Config Set:>	Choicelist	The active configuration set. All configuration sets from **Main Menu: Manage...\Configuration Sets** can be selected.
<Reflector:>	Choicelist	The active reflector. All reflectors from **Main Menu: Manage...\Reflectors** can be selected.
<Add. Constant:>	Output	The additive constant stored with the chosen reflector.

Next step

CONT (F1) accepts changes and accesses **HIDDEN PT Measure Reflector 1**.

41.3 Configuring Hidden Point

Access

Select **Main Menu: Programs...\Hidden Point**. In **HIDDEN PT Hidden Point Begin** press **CONF (F2)** to access **HIDDEN PT Configuration**.

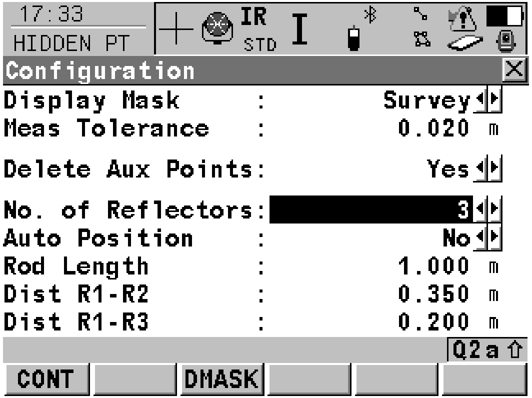
OR

Press **PROG**. Highlight **TPS HIDDEN PT**. **CONT (F1)**. In **HIDDEN PT Hidden Point Begin** press **CONF (F2)** to access **HIDDEN PT Configuration**.

OR

Press **SHIFT CONF (F2)** in **HIDDEN PT Survey Reflector 1**.

HIDDEN PT Configuration



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

DMASK (F3)
To edit the display mask currently being displayed in this field. Accesses **CONFIGURE Define Display Mask n**. Available for **<Display Mask:>** being highlighted. Refer to "16.2 Display Settings".

SHIFT ABOUT (F6)
To display information about the program name, the version number, the date of the version, the copyright and the article number.

Description of fields

Field	Option	Description
<Display Mask:>	Choicelist	The user defined display mask to be shown in **HIDDEN PT Measure Reflector n**. All display masks of the active configuration set defined in **CONFIGURE Display Settings** can be selected.
<Meas Tolerance:>	User input	Limit of the difference between input and measured spacing of the reflectors. For three reflectors being used, limit for maximum deviation of the three measurements.
<Delete Aux Points:>	**Yes** or **No**	The auxiliary points are deleted when the hidden point is stored. The auxiliary points are reflector 1, reflector 2 and reflector 3 of the hidden point rod. The Auxiliary Points ID template is used for the auxiliary points. The Survey Points ID template is used for the computed hidden point.
<No. of Refectors:>	**2** or **3**	Two or three reflectors are used on the rod.
<Auto Position:>	**Yes** or **No**	Available for **<No. of Reflectors: 3>**. The third reflector is aimed at automatically.
<Rod Length:>	User input	Total length of hidden point rod.
<Dist R1-R2:>	User input	Spacing between the centres of reflector 1 and reflector 2.

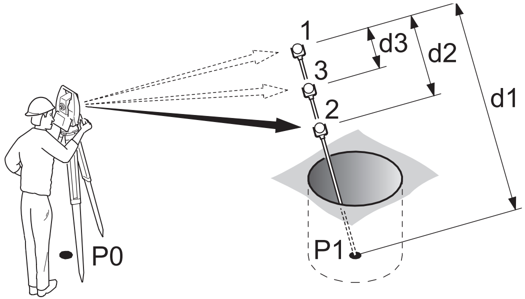
Field	Option	Description
<Dist R1-R3:>	User input	Available for **<No. of Reflectors: 3>**. Spacing between the centres of reflector 1 and reflector 3. Reflector 3 is situated between reflector 1 and reflector 2.

Next step

CONT (F1) returns to the screen from where this screen was accessed from.

41.4 Measuring Hidden Points

Diagram

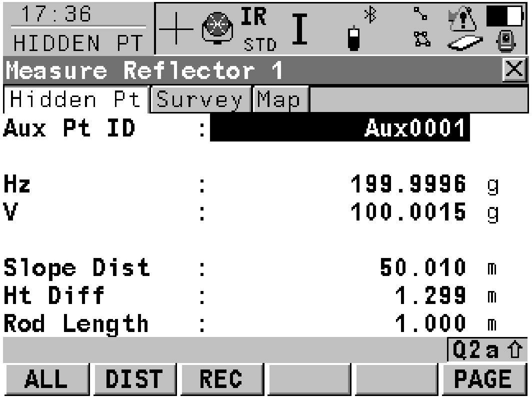


TPS12_127

d1 Rod length
d2 Distance from reflector 1 to reflector 2
d3 Distance from reflector 1 to reflector 3

Measuring hidden point step-by-step

Step	Description	Refer to chapter
1.	Refer to "41.2 Accessing Hidden Point" to access **HIDDEN PT Hidden Point Begin**.	
2.	**CONF (F2)** to access **HIDDEN PT Configuration**.	
3.	**HIDDEN PT Configuration** **<No. of Reflectors: 3>** Enter the values for **<Rod Length:>**, **<Dist R1-R2:>**, **<Dist R1-R3:>**	41.3
4.	**CONT (F1)** to access **HIDDEN PT Hidden Point Begin**.	
5.	**HIDDEN PT Hidden Point Begin** **CONT (F1)** to access **HIDDEN PT Measure Reflector 1**	

Step	Description	Refer to chapter
6.	**HIDDEN PT Measure Reflector 1, Hidden Pt** page  **<Aux Pt ID:>** The point ID of the auxiliary point, the reflector on the hidden point rod. The Auxiliary Points ID template is used. The horizontal angle, vertical angle, slope distance and height difference to reflector 1, the auxiliary point are displayed. **<Rod Length:>** The length of the rod can be adjusted before the hidden point result is displayed. The rod length always keeps the distances R1-R2 for 2 prisms and R1-R3 for 3 prisms into account.	
	PAGE (F6) changes to the **Map** page.	34.5

Step	Description	Refer to chapter
☞	**SHIFT INDIV (F5)** for an individual point ID independent of the ID template. **SHIFT RUN (F5)** changes back to the next ID from the configured ID template.	16.2
7.	**ALL (F1)** measures reflector 1 and accesses **HIDDEN PT Measure Reflector 2**.	
8.	Repeat step 7. for reflector 2 and for reflector 3. ☞ After the last reflector of the hidden point rod is measured, **HIDDEN PT Hidden Point Result, Results** page is accessed.	
9.	**HIDDEN PT Hidden Point Result, Result** page **<Point ID:>** The name of the hidden point. The configured point ID template is used. **<Hz:>**, **<V:>** and **<Slope Dist:>** The calculated horizontal and vertical angle and slope distance to the computed hidden point. ----- is displayed for unavailable information. **<Ht Diff:>** The calculated height difference from instrument to computed hidden point. ----- is displayed for unavailable information. **<Easting:>**, **<Northing:>** and **<Ortho Ht:>** The calculated coordinates of the computed hidden point. ----- is displayed for unavailable information.	
☞	**NEXT (F5)** to store the hidden point and to access **HIDDEN PT Measure Reflector 1**.	

Step	Description	Refer to chapter
	SHIFT INDIV (F5) for an individual point ID independent of the ID template. **SHIFT RUN (F5)** changes back to the next ID from the configured ID template.	16.2
10.	**PAGE (F6)** to change to **Code** page.	
11.	**HIDDEN PT Hidden Point Result, Code** page **<Point Code:>** The thematical code. All codes of the job can be selected. **<Atttribute n:>** The attributes for the thematical code. The behaviour of the fields depend on their definition in the codelist. Type in a code if required.	
12.	**PAGE (F6)** to change to **Plot** page.	
13.	**HIDDEN PT Hidden Point Result, Plot** page Measured distances are indicated by solid arrows.	34.6
14.	**STORE (F1)** to store the hidden point.	

Test or prove hidden points step-by-step

Step	Description	Refer to chapter
1.	Set up and orient the instrument in an open area.	
2.	Repeat steps 1. to 3. from paragraph "Measuring hidden point step-by-step".	
3.	Configure the hidden point rod.	41.3

Step	Description	Refer to chapter
4.	Position the tip of the hidden point rod on a mark that is directly visible from the instrument location.	
5.	Repeat steps 4. to 14. from paragraph "Measuring hidden point step-by-step". ☞ Make sure the hidden point rod does not move between measurements.	
6.	**PROG** to access **TPS1200 Programs**.	
7.	**TPS1200 Programs** **Stakeout** to access **STAKEOUT Stakeout Begin**	
☞	Make sure **<Auto Position: 3D>** is selected in **STAKEOUT Configuration, General** page.	
8.	**STAKEOUT Stakeout Begin** **CONT (F1)** to access **STAKEOUT XX Stakeout, Stake** page	
9.	**STAKEOUT XX Stakeout, Stake page** Select the hidden point.	
☞	Motorised instruments position to the hidden point	

42 Reference Line

42.1 Overview

Description

The Reference Line application program can be used to set out or measure points relative to a reference line or a reference arc.

Tasks

The Reference Line application program can be used for the following tasks:

- Measuring to a line/arc where the position of a target point can be calculated from its position relative to the defined reference line/arc.
- Staking to a line/arc where a target point is known and instructions to locate the point are given relative to the reference line/arc.
- Gridstaking a line/arc where a grid can be staked relative to a reference line/arc.

Other functionality available includes:

- Offsetting the reference line/arc horizontally or vertically. The radius of the arc changes with the horizontal offset.
- Shifting the reference line with parallel offsets or rotating to match predefined setting out instructions.
- Measuring points and staking points on slopes related to a reference line/arc.

Activating the program

The Reference Line application program must be activated via a licence key. Refer to "28 Tools...\Licence Keys" for information on how to activate the application program.

Point types

Reference lines/arcs can be created from points stored as:

- WGS 1984 geodetic

- Local grid

Heights and positions are always taken into account. Points must have full coordinate triplets.

Properties of measured points

The properties stored with staked points are:

- Class: **MEAS**
- Sub class: **TPS**
- Source: **RefLine (Grid), RefLine (Meas)** or **RefLine (Stake)**
- Instrument source: **TPS**

Deleting points

A point that is used to define a reference line/arc can be deleted. A reference line/arc can still be used if one or more points defining the reference line/arc have been deleted. Within **REFLINE Edit Reference Line** and **REFLINE Edit Reference Arc** the deleted point field is shown in grey. Within MapView the reference line is still displayed but the deleted point or points is/are not.

Terms

Reference point: The term "reference point" is used in this chapter to refer to the point from which the perpendicular offset from the reference line/arc, to the target point, is measured. Refer to paragraph "Defining a reference line/arc" and the diagrams for further explanation.

Target point: The design point.

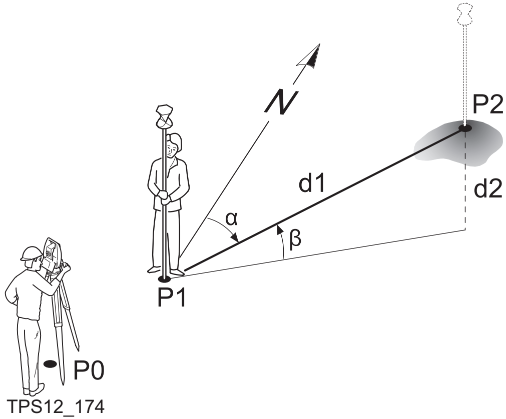
- For measuring to a reference line, this is the point with the coordinates of the current position and the designed or calculated height.
- For staking or grid staking to a reference line, this is the point to be staked.

Measured point: The current position.

Defining a reference line/arc

A reference line can be defined in the following ways:

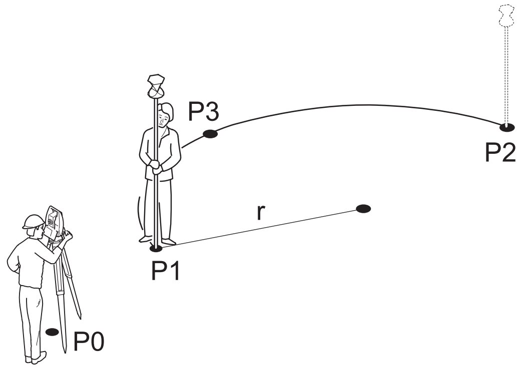
- Two known points
- One known point, an azimuth, a distance and a gradient
- One known point, an azimuth, a distance and a difference in height



P0	Instrument station
P1	Start point
P2	End point
d1	Known distance
d2	Difference in height, ΔHt
α	Azimuth
β	Elevation angle between the start point and the end point

A reference arc can be defined in the following ways:

- Two known points and a radius
- Three known points



TPS12_175

P0	Instrument station
P1	Start point
P2	End point
P3	Known point
r	Radius of arc

Defining chainage

The chainage of the start point of a reference line/arc can be defined.

☞ It is possible to define an arc that has an opening angle of more than 180°.

Coordinate systems

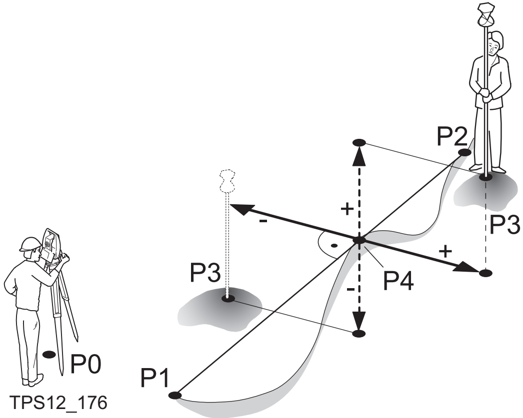
It is possible to use a valid coordinate system but have the line or part of the line lying outside of the projection or CSCS model being used.
In these cases the output fields of all prompts relating to the difference in coordinates between the point being staked and the current position are shown as **-----**.

☞ **<Azimuth:>** is used throughout this chapter. This can also mean **<Bearing:>**.

☞ When describing screens with a title that changes depending on whether a line or an arc was chosen, the terms "line" and "arc" are replaced by XX.

Direction of values

The following diagram shows the direction of positive and negative values for distance and height differences between the target point and the reference point for reference lines.



P0 Instrument station
P1 Start point
P2 End point
P3 Target point
P4 Reference point

42.2 Accessing Reference Line

Access

Select **Main Menu: Programs...\Reference Line.**

OR

Press **PROG**. Highlight **Reference Line**. **CONT (F1)**.

Refer to "35.2 Accessing the Programs Menu" for information on the **PROG** key.

OR

Press a hot key configured to access the screen **REFLINE Reference Line/Arc Begin**.

Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

The Begin screen

CONT (F1)
To confirm the selections and to continue with the subsequent screen.

CONF (F2)
To configure the Reference Line application program. Refer to "42.3 Configuring Reference Line".

SETUP (F3)
To set up station. Accesses **SETUP Station Setup**.

CSYS (F6)
To select a different coordinate system.

Description of fields

Field	Option	Description
<Control Job:>	Choicelist	The original points to be staked and the reference lines/arcs are stored in this job. All jobs from **Main Menu: Manage...\Jobs** can be selected.
<Job:>	Choicelist	The active job. All jobs from **Main Menu: Manage...\Jobs** can be selected. Points which are occupied after staking out are stored in this job. The original points to be staked are not copied to this job.
<Coord System:>	Output	The coordinate system currently attached to the selected **<Job:>**.
<Codelist:>	Choicelist	No codes are stored in the selected **<Job:>**. All codelists from **Main Menu: Manage...\Codelists** can be selected.
	Output	Codes have already been stored in the selected **<Job:>**. If codes had been copied from a System RAM codelist, then the name of the codelist is displayed. If codes have not been copied from a System RAM codelist but typed in manually, then the name of the active job is displayed.
<DTM Job:>	Choicelist	Available for **<Heights: Use DTM Model>** in **REFLINE Configuration**, **Heights** page. To select a DTM to be staked. Heights are then staked out relative to the selected DTM.

Field	Option	Description
<Config Set:>	Choicelist	The active configuration set. All configuration sets from **Main Menu: Manage...\Configuration Sets** can be selected.
<Reflector:>	Choicelist	The active reflector. All reflectors from **Main Menu: Manage...\Reflectors** can be selected.
<Add. Constant:>	Output	The additive constant stored with the chosen reflector.

Next step

IF the Reference Line application program	THEN
is to be accessed	**CONT (F1)** accepts the changes and accesses the Reference Line application program. Refer to "42.4 Starting Reference Line".
is to be configured	**CONF (F2)**. Refer to "42.3 Configuring Reference Line".

42.3 Configuring Reference Line

Description

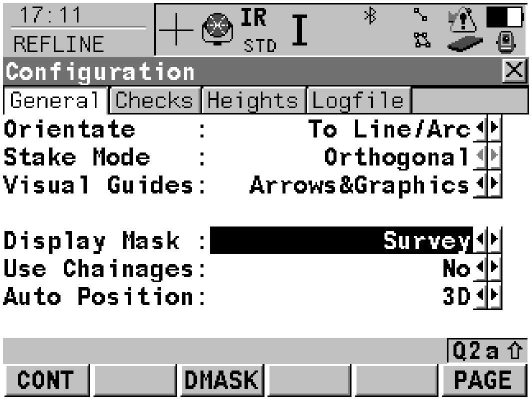
Allows options to be set which are used within the Reference Line application program. These settings are stored within the configuration set.

Access step-by-step

Step	Description
1.	Refer to "42.2 Accessing Reference Line" to access the Begin screen.
2.	**CONF (F2)** to access **REFLINE Configuration**.

The General page

This screen consists of the **General** page, the **Checks** page, the **Heights** page and the **Logfile** page. The explanations for the softkeys given below are valid as indicated.



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

DMASK (F3)
To edit the display mask currently being displayed. Accesses **CONFIGURE Define Display Mask n**. Available when **<Display Mask:>** is highlighted on **General** page. Refer to "16.2 Display Settings".

PAGE (F6)
To change to another page on this screen.

SHIFT ABOUT (F5)
To display information about the application program name, the version number, the date of the version, the copyright and the article number.

Description of fields

Field	Option	Description
<Orientate:>		The reference direction to be used to stakeout points. The stakeout elements and the graphical display shown in the Reference Line application program are based on this selection.
	To Line/Arc	The direction of the orientation is parallel to the reference line or the reference arc.
	To Station	The direction of the orientation is from the measured point to the instrument station.
	From Station	The direction of the orientation is from the instrument station to the measured point.
	To Arrow	The direction of the orientation is from the current position to the point to be staked. The graphical display shows an arrow pointing in the direction of the point to be staked.
<Stake Mode:>		The method of staking out.

Field	Option	Description
	Polar	Available for **<Orientate: From Station>** or **<Orientate: To Station>**. The horizontal distance and angle between the current position and the point to be staked, the height difference as defined in **REFLINE Configuration**, the height of the point to be staked and the check distances are displayed.
	Orthogonal	The distances along and perpendicular to the orientation line between the current position and the point to be staked, the height difference as defined in **REFLINE Configuration**, the height of the point to be staked and the check distances are displayed.
Visual Guides		Selects the visual guides displayed while staking points to lead to the point to be staked out.
	Off	Available unless **<Orientate: To Arrow>**. No symbols or graphics are displayed.
	Arrows	Available unless **<Orientate: To Arrow>**. Arrows are displayed. The arrows show the direction of the difference in distance between the current position and the point to be staked parallel and perpendicular to the reference object.
	Graphics	A graphical display shows the instrument station, the current position and the point to be staked.
	Arrows&Graphics	Arrows and graphics are displayed.

Field	Option	Description
<Display Mask:>	Choicelist	The user defined display mask to be shown in **REFLINE XX Points**. All display masks of the active configuration set defined in **CONFIGURE Display Settings** can be selected.
<Use Chainages:>	**Yes** or **No**	Activates the use of chainages within the reference line application program.
<Chain Format:>		Available for **<Use Chainages: Yes>**. Selects display format for all chainage information fields.
	+123456.789	Default chainage display form.
	+123.4+56.789	Separator between tens and hundreds with additional decimal point.
	+123+456.789	Separator between hundreds and thousands.
	+1234+56.789	Separators between tens and hundreds.
		The distance units **<Int Ft/Inch (fi)>**, **<US Ft/Inch (ft)>**, **<Kilometres (km)>** and **<US Miles (mi)>** are only supported by the first chainage format. All other chainage formats are restricted to the base units **<Metre (m)>**, **<Int Ft (fi)>** and **<US Ft (ft)>**.
<Auto Position:>	**2D**	Instrument positions horizontally to the point to be staked out.
	3D	Instrument positions horizontally and vertically to the point to be staked out.

Field	Option	Description
	Off	Instrument does not position to the point to be staked out.

Next step

PAGE (F6) changes to the **Checks** page.

The Checks page

Description of fields

Field	Option	Description
<Pos Check:>	**Yes** or **No**	Allows a check to be made on the horizontal coordinate difference between the staked point and the point to be staked. If the defined **<Pos Limit:>** is exceeded, the stakeout can be repeated, skipped or stored.
<Pos Limit:>	User input	Available for **<Pos Check: Yes>**. Sets the maximum horizontal coordinate difference which is accepted in the position check.
<Height Check:>	**Yes** or **No**	Allows a check to be made on the vertical difference between the staked point and the point to be staked. If the defined **<Height Limit:>** is exceeded, the stakeout can be repeated, skipped or stored.
<Height Limit:>	User input	Available for **<Height Check: Yes>**. Sets the maximum vertical difference accepted in the height check.

Field	Option	Description
<Beep near Pt:>	**Yes** or **No**	The instrument beeps when the horizontal radial distance from the current position to the point to be staked is equal to or less than defined in **<Dist from Pt:>**.
<Dist from Pt:>	User input	Available for **<Beep near Pt: Yes>**. The horizontal radial distance from the current position to the point to be staked when a beep should be heard.

Next step

PAGE (F6) changes to the **Heights** page.

The Heights page

Description of fields

Field	Option	Description
<Heights:>	Choicelist	Available if this screen was accessed from **REFLINE Reference Line/Arc Begin**. Depending on the task chosen this parameter controls the following. • When measuring to a line/arc, it determines the delta height value which is displayed when points are being measured. • When staking to or gridstaking a line/arc, it determines the height value to be staked out.
	Use Ref Line	Heights are computed along the reference line/arc.

Field	Option	Description
	Use Start Point	Heights are computed relative to the height of the starting point.
	Use DTM Model	The stake out height is computed from the DTM being used.
	Output	Available unless this screen was accessed from **REFLINE Reference Line/Arc Begin**.
<Edit Height:>	**No**	The field **<Height:>** for the height of the current position is displayed in **REFLINE Measure Points**, **Ref XX** page**, REFLINE Enter Offset Values**, **REFLINE XX Stakeout**, **Ref XX** page and **REFLINE +yyy.yy +xxx.xx**, **Stake** page. The value for **<Height:>** cannot be changed.
	Yes	The field **<Design Ht:>** is displayed in **REFLINE Measure Points**, **Ref XX** page**, REFLINE Enter Offset Values**, **REFLINE XX Stakeout**, **Ref XX** page and **REFLINE +yyy.yy +xxx.xx**, **Stake** page. The design height is the height of the point to be staked. The initial value is as configured in the **<Heights:>** field. The value for **<Design Ht:>** can be changed.

Next step

PAGE (F6) changes to the **Logfile** page.

The Logfile page

Description of fields

Field	Option	Description
<Write Logfile:>	**Yes** or **No**	To generate a logfile when the application program is exited. A logfile is a file to which data from an application program is written to. It is generated using the selected **<Format File:>**.
<File Name:>	Choicelist	Available for **<Write Logfile: Yes>**. The name of the file to which the data should be written. A logfile is stored in the \DATA directory of the active memory device. The data is always appended to the file. Opening the choicelist accesses **XX Logfiles** where a name for a new logfile can be created and an existing logfile can be selected or deleted.
<Format File:>	Choicelist	Available for **<Write Logfile: Yes>**. A format file defines which and how data is written to a logfile. Format files are created using LGO. A format file must first be transferred from the CompactFlash card to the System RAM before it can be selected. Refer to "24 Tools...\Transfer Objects..." for information on how to transfer a format file. Opening the choicelist accesses **XX Format Files** where an existing format file can be selected or deleted.

Next step

CONT (F1) returns to the screen from where this screen was accessed.

42.4 Starting Reference Line

42.4.1 Manually Entering a Reference Line/Arc

Description

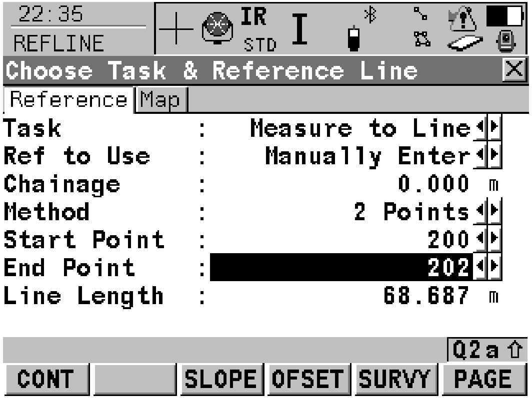
- A reference line/arc can be defined by manually entering known parameters.
- The line/arc is only temporary and is not stored when the program is quit or closed.

Access step-by-step

Step	Description
1.	Refer to "42.2 Accessing Reference Line" to access the Begin screen.
2.	**CONT (F1)** to access **REFLINE Choose Task & Reference Line**.
3.	**REFLINE Choose Task & Reference Line**, **Reference** page. Select **<Ref to Use: Manually Enter>.**

The Reference page

- This screen contains the **Reference** page and the **Map** page. The explanations for the softkeys given below are valid as indicated. The fields available depend on the options chosen for **<Task:>** and **<Method:>** in this screen.
- For all point fields, the MapView interactive display on the **Map** page can be used to select the desired point. Refer to "34 MapView Interactive Display Feature" for information on the functionality and softkeys available.



CONT (F1)
To accept changes and continue with the subsequent screen.

SLOPE (F3)
To set a slope from a defined reference line/arc. Cut/Fill values can then be displayed to the slope when measurements are taken along the reference line/arc.

OFSET (F4)
To set horizontal and vertical offsets, shifts and rotations on the defined reference line or to set horizontal and vertical offsets on a defined reference arc.

SURVY (F5)
Available for **<Ref to Use: Manually Enter>** when a point field is highlighted. To measure a point.

PAGE (F6)
To change to another page on this screen.

SHIFT CONF (F2)
To configure the reference line/arc.

Description of fields

Field	Option	Description
<Task:>		Defines the task to be performed.

Field	Option	Description
	Measure to Line or **Measure to Arc**	Calculates the coordinates of a point from it's position relative to the reference line/arc.
	Stake to Line or **Stake to Arc**	Allows points to be staked relative to the reference line/arc.
	Gridstake Line or **Gridstake Arc**	Allows a grid to be staked out relative to the reference line/arc.
<Method:>		The method by which the reference line/arc will be defined.
		• For **<Task: XX Line>**
	2 Points	Uses two known points to define the reference line.
	Pt/Brg/Dst/Grade	Defines the reference line using a known point, a distance, an azimuth and the gradient of the line.
	Pt/Brg/Dst/ΔHt	The same as above but uses the difference in height instead of the gradient.
		• For **<Task: XX Arc>**
	3 Points	Defines the reference arc using three known points.
	2 Points/Radius	Defines the reference arc with two known points and a known radius.
<Start Point:>	Choicelist	The start point of the reference line/arc. All points from **REFLINE Data: Job Name** can be selected.

Field	Option	Description
<Second Point:>	Choicelist	Available for **<Method: 3 Points>**. The second point of the reference arc. All points from **REFLINE Data: Job Name** can be selected.
<End Point:>	Choicelist	Available for **<Method: 2 Points>**, **<Method: 3 Points>** and **<Method: 2 Points/Radius>**. The end point of the reference line/arc. All points from **REFLINE Data: Job Name** can be selected.
<Line Length:>	Output	Available for **<Ref to Use: Manually Enter>** with **<Method: 2 Points>**. The horizontal grid distance between **<Start Point:>** and **<End Point:>** of the line. ----- is displayed if the distance cannot be calculated.
<Azimuth:>	User input	Available for **<Method: Pt/Brg/Dst/Grade>** and **<Method: Pt/Brg/Dst/ΔHt>**. The azimuth of the reference line.
<Horiz Dist:>	User input	Available for **<Method: Pt/Brg/Dst/Grade>** and **<Method: Pt/Brg/Dst/ΔHt>**. The horizontal distance from the start point to the end point of the reference line.
<Grade:>	User input	Available for **<Method: Pt/Brg/Dst/Grade>**. The gradient of the line from the start point to the end point of the reference line.

Field	Option	Description
<ΔHeight:>	User input	Available for **<Method: Pt/Brg/Dst/ΔHt>**. The difference in height from the start point to the end point of the reference line.
<Radius:>	User input	Available for **<Method: 2 Points/Radius>**. The radius of the reference arc.
<Arc Dist:>	Output	The horizontal grid distance along the arc between **<Start Point:>** and **<End Point:>** of the arc. ----- is displayed if the distance cannot be calculated. ----- is displayed if the distance cannot be calculated.

Next step

PAGE (F6) to access **REFLINE Choose Task & Reference Line**, **Map** page.

The Map page

The **Map** page provides an interactive display of the data. Refer to "34 MapView Interactive Display Feature" for information on the functionality and softkeys available.

Next step

IF	THEN
<Task: Measure to XX>	**CONT (F1)** accepts the changes and accesses **REFLINE Measure Points**. Refer to "42.5 Measuring to a Reference Line/Arc".
<Task: Stake to XX>	**CONT (F1)** accepts the changes and accesses **REFLINE Enter Offset Values**. Refer to "42.6 Staking to a Reference Line/Arc".

IF	THEN
<Task: Gridstake XX>	**CONT (F1)** accepts the changes and accesses **REFLINE Define Grid**. Refer to "42.7 Gridstaking to a Reference Line/Arc".

42.4.2 Selecting an Existing Reference Line/Arc

Description

- Reference lines/arcs can be created, edited, stored and deleted in the **<Control Job:>**.

Access step-by-step

Step	Description
1.	Refer to "42.2 Accessing Reference Line" to access the Begin screen.
2.	**CONT (F1)** to access **REFLINE Choose Task & Reference Line**.
3.	**REFLINE Choose Task & Reference Line**, **Reference** page. Select **<Ref to Use: Select from Job>**.

The Reference page

This screen contains the **Reference** page and the **Map** page. The explanations for the softkeys and the fields are as for manually entering a reference line. The **<Method:>** field is not available and all line definition fields are outputs, all other differences are described below.
The fields shown depend on the options chosen for **<Task:>** and **<Method:>** in **REFLINE New Reference XX**. Refer to paragraph "Creating a reference line/arc step-by-step".

Description of fields

Field	Option	Description
<Ref Line:>	Choicelist	Available for **<Task: XX Line>**. The reference line to be used. Accesses **REFLINE Manage Reference Lines**.

Field	Option	Description
<Ref Arc:>	Choicelist	Available for **<Task: XX Arc>**. The reference arc to be used. Accesses **REFLINE Manage Reference Arcs**.

Next step

PAGE (F6) to access **REFLINE Choose Task & Reference Line**, **Map** page.

The Map page

The **Map** page provides an interactive display of the data. The reference line/arc can be viewed but not defined using this page. Refer to "34 MapView Interactive Display Feature" for information on the functionality and softkeys available.

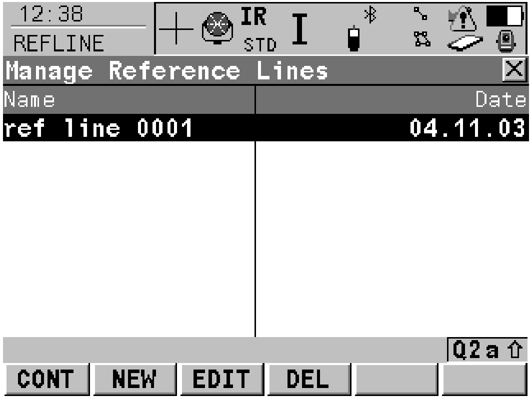
Next step

IF	THEN
the desired reference line/arc needs to be created, edited or selected	highlight **<Ref Line:>** or **<Ref Arc:>** and press **ENTER** to access **REFLINE Manage Reference XX**.
the desired reference line/arc has been selected	• for **<Task: Measure to XX>** **CONT (F1)** to access **REFLINE Measure Points**, **Ref XX** page. Refer to "42.5 Measuring to a Reference Line/Arc". • for **<Task: Stake to XX>** **CONT (F1)** to access **REFLINE Enter Offset Values**. Refer to "42.6 Staking to a Reference Line/Arc".

IF	THEN
	• for **<Task: Gridstake XX>** **CONT (F1)** to access **REFLINE Define Grid**. Refer to "42.7 Gridstaking to a Reference Line/Arc".
offsets are to be defined	**OFSET (F4)** to access **REFLINE Define Offsets**.

Managing reference lines

The screen name will be either **REFLINE Manage Reference Lines** for **<Task: XX Line>** or **REFLINE Manage Reference Arcs** for **<Task: XX Arc>**. Apart from the screen name the appearance of the screen and the functionality of the softkeys is the same.



CONT (F1)
To select the highlighted reference line/arc and to return to the screen from where this screen was accessed.

NEW (F2)
To create a reference line/arc. Refer to paragraph "Creating a reference line/arc step-by-step".

EDIT (F3)
To edit a reference line/arc. Refer to paragraph "Editing a reference line/arc step-by-step".

DEL (F4)
To delete a reference line/arc.

Description of columns

Column	Description
Name	Names of all the reference lines/arcs available in the **<Control Job:>**.
Date	Date that the reference line/arc was created.

Next step

IF a reference line/arc	THEN
is to be selected	highlight the desired reference line/arc. **CONT (F1)** closes the screen and returns to **REFLINE Choose Task & Reference Line**.
is to be created	**NEW (F2)**. Refer to paragraph "Creating a reference line/arc step-by-step".
is to be edited	highlight the reference line/arc and **EDIT (F3)**. Refer to paragraph "Editing a reference line/arc step-by-step".

Creating a reference line/arc step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to "42.2 Accessing Reference Line" to access **REFLINE Reference Line/Arc Begin**.	

Step	Description	Refer to chapter
2.	**CONT (F1)** to access **REFLINE Choose Task & Reference Line**, **Reference** page.	
3.	**REFLINE Choose Task & Reference Line**, **Reference** page Select **<Ref to Use: Select from Job>.**	
4.	Highlight **<Ref Line:>** or **<Ref Arc:>** and press **ENTER** to access **REFLINE Manage Reference XX**.	
5.	**NEW (F2)** to access **REFLINE New Reference XX**, **Input** page.	
6.	**REFLINE New Reference XX**, **Input** page **<Ref ID:>** The ID of the new reference line/arc. The other fields available depend on the option chosen for **<Task:>** in **REFLINE Choose Task & Reference Line**, **Reference** page and **<Method:>** in this screen. • For **<Task: XX Line>** **<Method:>** The method by which the reference line will be defined. **<Method: 2 Points>** uses two known points to define the reference line. **<Method: Pt/Brg/Dst/Grade>** defines the reference line using a known point, a distance, a bearing and the gradient of the line. **<Method: Pt/Brg/Dst/ΔHt>** is the same as above but uses the difference in height instead of the gradient. **<Line Length:>** Available for **<Method: 2 Points>**. The horizontal grid distance between **<Start Point:>** and **<End Point:>** of the line. ----- is displayed if the distance cannot be calculated.	42.4.1

Step	Description	Refer to chapter
	• For **<Task: XX Arc>** **<Method:>** The method by which the reference arc will be defined. **<Method: 3 Points>** defines the reference arc using three known points. **<Method: 2 Points/Radius>** defines the reference arc with two known points and a known radius. **<Arc Dist:>** The horizontal grid distance along the arc between **<Start Point:>** and **<End Point:>** of the arc. ----- is displayed if the distance cannot be calculated. Choose the method by which to define a reference line/arc and enter the appropriate parameters.	
	SURVY (F5) available for **<Start Point:>, <Second Point:>** and **<End Point:>**. To measure a known point.	
	For all point fields, the MapView interactive display on the **Map** page can be used to select the desired point.	34
7.	**PAGE (F6)** to access **REFLINE New Reference XX**, **Map** page.	
8.	**REFLINE New Reference XX**, **Map** page MapView displays the reference line/arc as a solid line.	34.5
9.	**STORE (F1)** to store changes and return to **REFLINE Manage Reference XX**.	

Editing a reference line/arc step-by-step

Step	Description
1.	Refer to "42.4.2 Selecting an Existing Reference Line/Arc" to access **REFLINE Manage Reference XX**.
2.	**EDIT (F3)** to access **REFLINE Edit Reference XX**, **Input** page.
3.	All the following steps are identical with the creation of a new reference line/arc except for the following differences. • All fields except **<Ref ID:>** are output fields. • **SURVY (F5)** is not available. • A **Plot** page replaces the **Map** page. Refer to "34 MapView Interactive Display Feature" for information on the functionality and softkeys available. Refer to paragraph "Creating a reference line/arc step-by-step". Follow the instructions from step 6. onwards.

42.4.3 Defining the Offsets related to a Reference Line/Arc

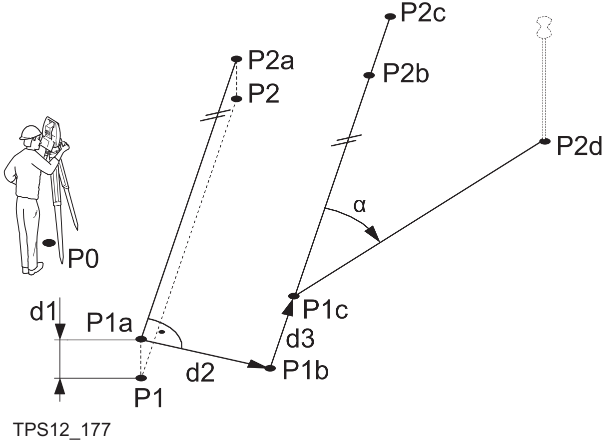
Description

A reference line can be offset, shifted and rotated, a reference arc can be offset.

Access step-by-step

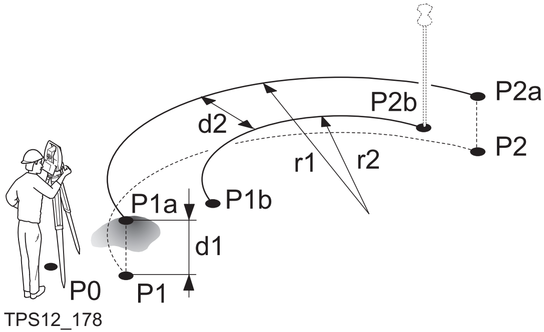
Step	Description
1.	Refer to "42.2 Accessing Reference Line" to access the Begin screen.
2.	**CONT (F1)** to access **REFLINE Choose Task & Reference Line**.
3.	**OFSET (F4)** to access **REFLINE Define Offsets**.

Diagram



Reference line offsets

P0 Instrument station
P1 Start point
P2 End point
P1a Start point with **<Height Offset:>**
P2a End point with **<Height Offset:>**
P1b Start point with **<Offset Line:>**
P2b End point with **<Offset Line:>**
P1c Start point with **<Shift Line:>**
P2c End point with **<Shift Line:>**
P2d End point with **<Rotation Line:>**
d1 **<Height Offset:>**
d2 **<Offset Line:>**
d3 **<Shift Line:>**
α **<Rotation Line:>**

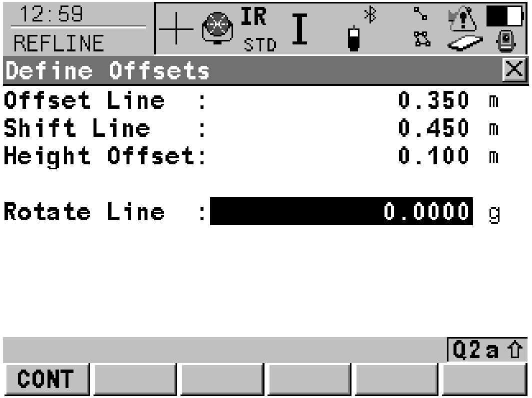


Reference arc offsets

P0	Instrument station
P1	Start point
P2	End point
P1a	Start point with **<Height Offset:>**
P2a	End point with **<Height Offset:>**
P1b	Start point with **<Offset Arc:>**
P2b	End point with **<Offset Arc:>**
d1	**<Height Offset:>**
d2	**<Offset Arc:>**
r1	Radius before offset
r2	Radius after offset

Defining the offsets

This screen contains different fields depending on the options chosen for **<Heights:>** in **REFLINE Configuration**, **Heights** page, and **<Task:>** in **REFLINE Choose Task & Reference Line**, **Reference** page.



CONT (F1)
To confirm the selections and to return to the previous screen.

SHIFT CONF (F2)
To configure the reference line/arc. Refer to "42.3 Configuring Reference Line".

Description of fields

Field	Option	Description
<Offset Line:> or **<Offset Arc:>**	User input	Distance to horizontally offset reference line/arc to the left or right. ☞ When an offset is applied to an arc the radius of the arc changes.
<Shift Line:>	User input	Available for **<Task: XX Line>** unless **<Heights: Use Ref Line>** in **REFLINE Configuration, Heights** page. Distance to horizontally shift reference line forward or back.

Field	Option	Description
<Height Offset:>	User input	Available for **<Heights: Use Start Point>** and **<Heights: Use Ref Line>**. The vertical offset of the reference line/arc.
<DTM Offset:>	User input	Available for **<Heights: Use DTM Model>**. The vertical offset of the DTM model.
<Rotate Line:>	User input	Available for **<Task: XX Line>** unless **<Heights: Use Ref Line>** in **REFLINE Configuration, Heights** page. Angle by which to rotate the reference line.

Next step

CONT (F1) closes the screen and returns to **REFLINE Choose Task & Reference Line**.

42.4.4 Defining the Slope related to a Reference Line/Arc

Description

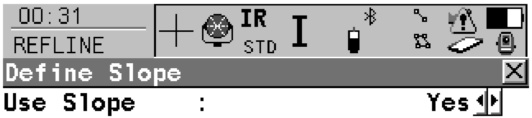
- It is possible to measure points and stake points on slopes related to a reference line/arc. A slope can be defined and cut/fill values can then be displayed to the slope when measuring along the reference line/arc. The slope is a plane from the reference line/arc and extends along the length of the reference line/arc.
- Slopes can be used when measuring to a reference line/arc, staking a point relative to a reference line/arc or performing a grid stakeout relative to a reference line/arc.

Access step-by-step

Step	Description
1.	Refer to "42.2 Accessing Reference Line" to access the Begin screen.
2.	**CONT (F1)** to access **REFLINE Choose Task & Reference Line**.
3.	**SLOPE (F3)** to access **REFLINE Define Slope**.

Step 1) activating the slope method

Step	Description
1.	Ensure that **<Use Slope: Yes>** is selected.



Step 2) defining the slope parameters

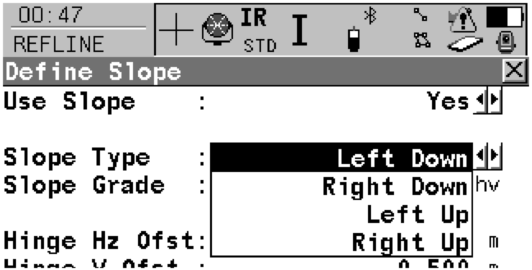
Step	Description
1.	**Defining the slope type**.

<table>
<tr><th>Step</th><th>Description</th></tr>
<tr><td></td><td>
Defining a slope type of <Slope Type: Left Down> creates a downward plane extending to the left of the defined reference line/arc.

Defining a slope type of <Slope Type: Right Down> creates a downward plane extending to the right of the defined reference line/arc.

Defining a slope type of <Slope Type: Left Up> creates an upward plane extending to the left of the defined reference line/arc.

Defining a slope type of <Slope Type: Right Up> creates an upward plane extending to the right of the defined reference line/arc.

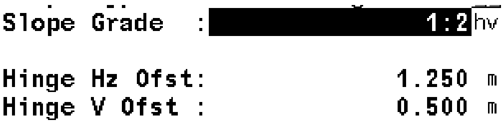


</td></tr>
<tr><td>2.</td><td>
Defining the slope grade.

The inclination of the slope is defined by the slope grade. The units for slope grade are defined in the Configure /Units & Formats screen.

</td></tr>
</table>

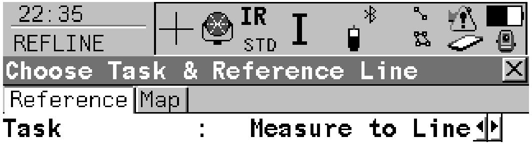
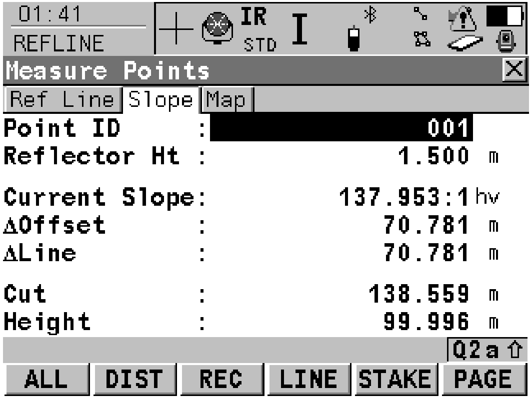
Step 3) defining any necessary offsets

Step	Description
1.	The slope is always defined as starting from a 'hinge line'. The hinge line can be horizontally and/or vertically offset from the reference line/arc. The direction of the reference line/arc is always from the starting point. The offsets are always relative to the direction of the reference line/arc. When Hz Offset=0 and V Offset=0, then the hinge line is the reference line/arc. 

Step 4) defining the display mask

Step	Description
1.	Press **DMASK (F3)** in the Define Slope screen to access the display mask settings This display mask is available when using the slope method. It is user configurable and describes the current reflector position in relation to the defined slope and defined reference line/arc. 

Step 4)
measuring the points

Step	Description
1.	Press **CONT (F1)** to close the Define Slope screen.
2.	Choose the appropriate Task and choose the relevant reference line/arc. 
3.	Press **CONT (F1)** to access the Measure Points screen, move to the Slope page. 

Description of all fields from the Slope Display Mask

Field	Description
<Chainage:>	Displays the current chainage.
<Current Slope:>	Displays the current slope of the reflector position to the hinge.
<Design Slope:>	Displays the slope grade as defined by the user.
<East:>	Displays the Easting coordinate of the current reflector position.
<Height:>	Displays the Height value of the current reflector position.
<North:>	Displays the Northing coordinate of the current reflector position.
<Point ID:>	To enter the point ID.
<Reflector Ht:>	To enter the reflector height.
<SD to Hinge:>	Displays the slope distance offset from the hinge to measured point.
<SD to Line:>	Displays the slope distance offset from line/arc to measured point.
<Slope Cut/Fill:>	Displays the value of the difference between the actual reflector elevation to the slope elevation at that position. A cut is above the slope. A fill is below the slope.
<Start Chainage:>	Displays the starting chainage as defined by the user.
<ΔHeight Hinge:>	Displays the delta height from the current position to the hinge.
<ΔHeight Line:>	Displays the delta height from the current position to the line/arc.
<ΔLine/Arc:>	Displays the horizontal distance from the start point of the line/arc to the base point of the measured point, along the line/arc.
<ΔLine/Arc-End:>	Displays the horizontal distance from the end point of the line/arc to the base point of the measured point, along the line/arc.

Field	Description
<ΔOffset:>	Displays the perpendicular offset from the line/arc to measured point.
<ΔOffset Hinge:>	Displays the perpendicular offset from the hinge to measured point.

42.5 Measuring to a Reference Line/Arc

42.5.1 Measuring the Points

Description

The horizontal and vertical position of a measured point can be calculated relative to the defined reference line/arc.

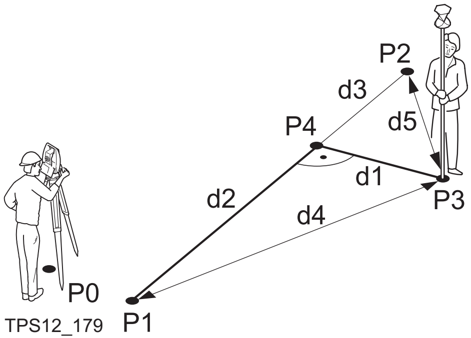
Access

Select **<Task: Measure to XX>** in **REFLINE Choose Task & Reference Line, Reference** page and press **CONT (F1)** to access **REFLINE Measure Points**. Refer to "42.4 Starting Reference Line" to access **REFLINE Choose Task & Reference Line.**

OR

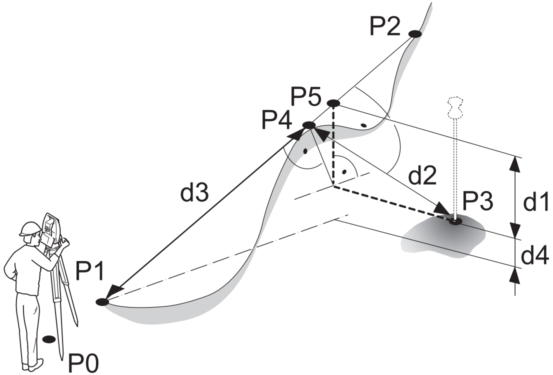
Press **SURVY (F5)** in **REFLINE XX Stakeout** to access **REFLINE Measure Points**. Refer to "42.6 Staking to a Reference Line/Arc" to access **REFLINE XX Stakeout**.

Measure to line - horizontal measurements



P1	Start point
P2	End point
P3	Measured point
P4	Reference point
d1	**<ΔOffset:>**
d2	**<ΔLine:>**
d3	**<ΔLine-End:>**
d4	**<Check Dist 1:>**
d5	**<Check Dist 2:>**

Measure to line - vertical measurements

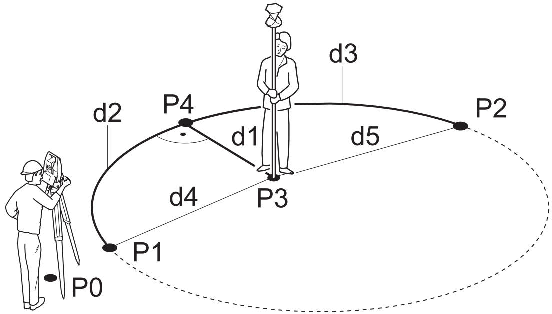


TPS12_180

P0	Instrument station
P1	Start point
P2	End point
P3	Measured point
P4	Temporary point
P5	Reference point
d1	**<ΔHt-Line:>**
d2	**<ΔPerp Dist:>**
d3	**<ΔSpat Dist:>**
d4	**<ΔHt-Start:>**

Measure to arc - horizontal measurements

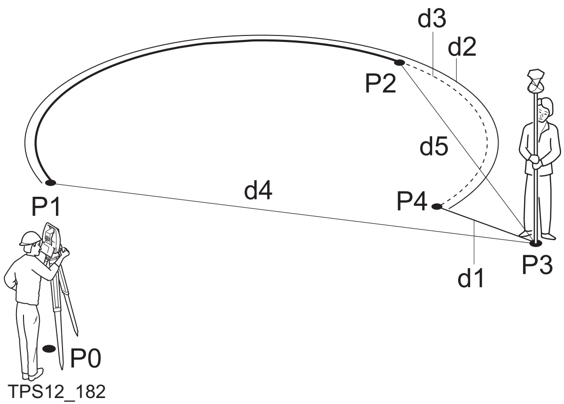
Target point inside arc



TPS12_181

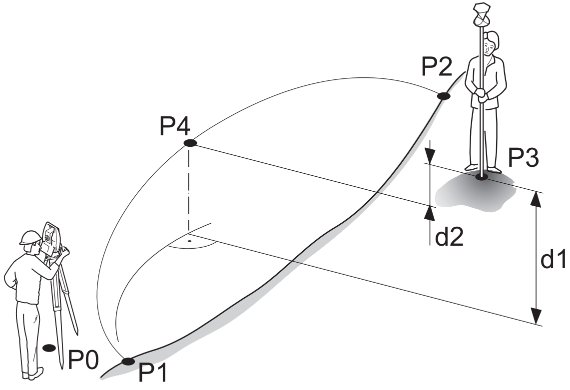
P0	Instrument station
P1	Start point
P2	End point
P3	Measured point
P4	Reference point
d1	**<ΔOffset:>**
d2	**<ΔArc:>**
d3	**<ΔArc-End:>**
d4	**<Check Dist 1:>**
d5	**<Check Dist 2:>**

Target point outside arc



P0	Instrument station
P1	Start point
P2	End point
P3	Measured point
P4	Reference point
d1	**<ΔOffset:>**
d2	**<ΔArc:>**
d3	**<ΔArc-End:>**
d4	**<Check Dist 1:>**
d5	**<Check Dist 2:>**

Measure to arc - vertical measurements

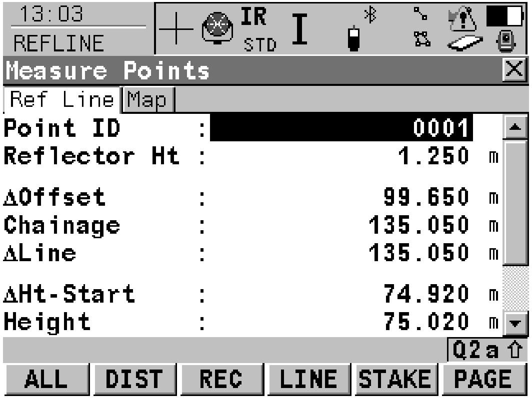


TPS12_187

P0	Instrument station
P1	Start point
P2	End point
P3	Measured point
P4	Reference point
d1	**<ΔHt-Start:>**
d2	**<ΔHt-Arc:>**

The Ref Line page

The pages shown are those from a typical configuration set. An additional page is available when a user defined display mask is used.



ALL (F1)
To measure and record the current position. The point ID is incremented according to the configured point ID template.

DIST (F2)
To measure and display distances. The difference between the current position and the point being staked is displayed.

REC (F3)
To record displayed values. The point ID is incremented according to the configured point ID template.

LINE (F4)
To define/select a reference line/arc. Accesses **REFLINE Choose Task & Reference Line, Reference** page.

STAKE (F5)
To define reference line offsets to be staked out in relation to the reference line. Accesses **REFLINE Enter Offset Values**. Refer to "42.6 Staking to a Reference Line/Arc".

SHIFT CONF (F2)
Available unless **SHIFT AVGE (F2)** is active. To configure a reference line/arc. Accesses **REFLINE Configuration**. Refer to "42.3 Configuring Reference Line".

SHIFT 2FACE (F4)

To take a measurement in Face I and Face II. The point stored is an average of the two measurements.
When using instruments fitted with ATR, the point is automatically measured in both faces, the resulting point is stored and the instrument is returned to the first face.
This hotkey is only available for <**EDM Mode**: **Standard**> and <**EDM Mode**: **Fast**> and in the Survey, Reference Line and Stakeout programs.

SHIFT INDIV (F5) and **SHIFT RUN (F5)**

To change between entering an individual point ID different to the defined ID template and the running point ID according to the ID template. Refer to "16.1 ID Templates".

The fields available depend on the options chosen for **<Heights:>** and **<Edit Height:>** in **REFLINE Configuration**, **Heights** page and **<Task:>** in **REFLINE Choose Task & Reference Line**, **Reference** page. The following fields are always available:

Description of fields

Field	Option	Description
<Point ID:>	User input	The point ID of the point to be measured.

Field	Option	Description
<Reflector Ht:>	User input	The last used reflector height is suggested when accessing **REFLINE Measure Points, Ref XX** page. An individual reflector height can by typed in.
<Chainage>	Output	Chainage of the current position along the line/arc. This is the chainage of the start of the reference line/arc plus **<ΔLine:>**/**<ΔArc:>**.
<ΔOffset:>	Output	Perpendicular offset from the reference line/arc calculated from the reference point to the measured point. For reference arcs, **<ΔOffset:>**, **<ΔArc:>** and **<ΔArc-End:>** values are always calculated so as to produce the smallest **<ΔOffset:>** possible. To ensure this the arc will be extended if necessary. Refer to paragraph "Measure to arc - horizontal measurements".
<Check Dist 1:>	Output	Horizontal distance from start point to measured point.
<Check Dist 2:>	Output	Horizontal distance from end point to measured point.

For <Task: Measure to Line>

Description of fields

Field	Option	Description
<ΔLine:>	Output	Horizontal distance along the reference line from the start point to the reference point.
<ΔLine-End:>	Output	Horizontal distance along the reference line from the end point to the reference point.

For <Task: Measure to Arc>

Description of fields

Field	Option	Description
<ΔArc:>	Output	Horizontal distance along the reference arc from the start point to the reference point.
<ΔArc-End:>	Output	Horizontal distance along the reference arc from the reference point to the end point.

For <Task: Measure to XX>, <Heights: Use Start Point> and <Edit Height: No>

Description of fields

Field	Option	Description
<ΔHt-Start:>	Output	Height difference between the start point and the measured point.
<Height:>	Output	Height of measured point.

For <Task: Measure to Line>, <Heights: Use Ref Line> and <Edit Height: No>

Description of fields

Field	Option	Description
<ΔHt-Line:>	Output	Height difference between the reference point on the line and the measured point.
<Height:>	Output	Height of measured point.
<ΔPerp Dist:>	Output	Slope distance between the reference point and the measured point, perpendicular to the reference line.
<ΔSpatial Dist:>	Output	Slope distance between the start point and the reference point.

For <Task: Measure to Arc>, <Heights: Use Ref Line> and <Edit Height: No>

Description of fields

Field	Option	Description
<ΔHt-Arc:>	Output	Height difference between the reference point on the arc and the measured point.
<Height:>	Output	Height of measured point.

For <Task: Measure to XX>, <Heights: Use DTM Model> and <Edit Height: No>

Description of fields

Field	Option	Description
<ΔHt-DTM:>	Output	Height difference between the measured point and the DTM.
<Height:>	Output	Height of measured point.

For <Task: Measure to XX>, <Heights: XX> and <Edit Height: Yes>

Description of fields

Field	Option	Description
<Design Ht:>	User input	Allows input of the design height of the target point. The suggested value for the **<Design Ht:>** is as configured in the **<Heights:>** field in **REFLINE Configuration, Heights** page.
<ΔHt-Design:>	Output	Height difference between the **<Design Ht:>** and the height of the measured point.

Next step

PAGE (F6) changes to the **Map** page.

The Map page

The **Map** page provides an interactive display of the data. Displayed is also

- the horizontal distance along the reference line/arc from the start point to the reference point.

- the perpendicular offset from the reference line/arc measured from the reference point to the measured point.

Refer to "34 MapView Interactive Display Feature" for information on the functionality and softkeys available.

Next step

PAGE (F6) changes to the first page on this screen.

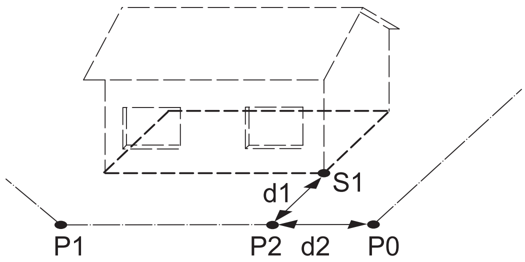
42.5.2 Working Example

Description

Application: The positions of stakes, indicating the corners of a house that is to be built, need to be measured relative to the title boundary of the property that the house is to be built on.
This is done to check that the house is not being built too close to the title boundary in keeping with council regulations.

Reference line/arc: The title boundary is used to define a reference line.

Diagram



GPS12_131

P0	Start point
P1	End point
P2	Reference point
S1	Point to be measured
d1	**<ΔOffset:>**
d2	**<ΔLine:>**

Requirements

- The reference line does not need to be stored.
- **<Write Logfile: Yes>** in **REFLINE Configuration**, **Logfile** page.

Field procedure step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to "42.2 Accessing Reference Line" to access **REFLINE Reference Line/Arc Begin**.	
2.	**REFLINE Reference Line/Arc Begin** Select a job and a configuration set with the settings mentioned above.	42.2
3.	**CONT (F1)** to access **REFLINE Choose Task & Reference Line, Reference** page.	
4.	**REFLINE Choose Task & Reference Line**, **Reference** page **<Task: Measure to Line>** **<Ref to Use: Manually Enter>** **<Method: 2 Points>**	42.4.1
5.	Highlight **<Start Point:>**.	
6.	**SURVY (F5)** to measure P2.	
7.	Highlight **<End Point:>**.	
8.	**SURVY (F5)** to measure P3.	
	The **Map** page provides an interactive display of the defined reference line.	34
9.	**CONT (F1)** to access **REFLINE Measure Points**.	
10.	Walk to the first point to be measured.	
11.	**REFLINE Measure Points**	42.5

Step	Description	Refer to chapter
	<Point ID: S1>	
12.	**ALL (F1)** measures and stores the point.	
	The results are displayed on the screen. The values in the fields indicate the position of the measured point relative to the reference line.	
	It may happen that a point with the same point ID exists in the job. If the codes and/or attribute values of the new and the existing point do not match, a screen opens where they can be corrected.	
13.	Are more points to be measured? • If **yes**, continue with step 14. • If **no**, continue with step 16.	
14.	Walk to the next point	
15.	Repeat steps 11. to 13.	
	The **Map** page provides an interactive display of the defined reference line and the points measured relative to it. Displayed is also • the horizontal distance along the reference line/arc from the start point to the reference point. • the perpendicular offset from the reference line/arc measured from the reference point to the measured point.	34
16.	**SHIFT QUIT (F6)** returns to **TPS1200 Main Menu**.	
	The results are written to the logfile.	

42.6 Staking to a Reference Line/Arc

42.6.1 Staking the Points

Description

Allows for the position of a point to be defined relative to a reference line/arc and then staked.

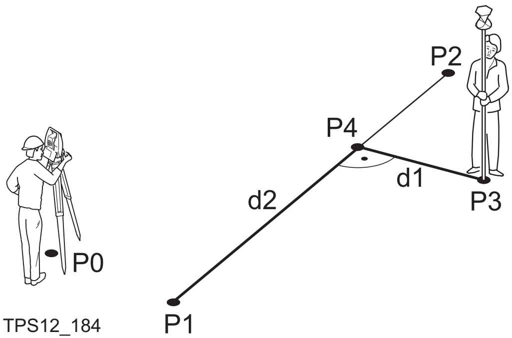
Access

Select **<Task: Stake to XX>** in **REFLINE Choose Task & Reference Line, Reference** page and press **CONT (F1)** to access **REFLINE Enter Offset Values**. Refer to "42.4.3 Defining the Offsets related to a Reference Line/Arc" to access **REFLINE Choose Task & Reference Line.**

OR

Press **STAKE (F5)** in **REFLINE Measure Points**. Refer to "42.5 Measuring to a Reference Line/Arc" to access **REFLINE Measure Points**.

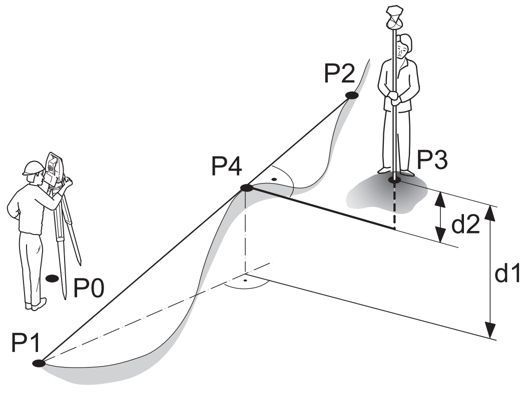
Stake to line - horizontal measurements



TPS12_184

P0	Instrument station
P1	Start point
P2	End point
P3	Target point
P4	Reference point
d1	**<Stake Offset:>**
d2	**<Along Line:>**

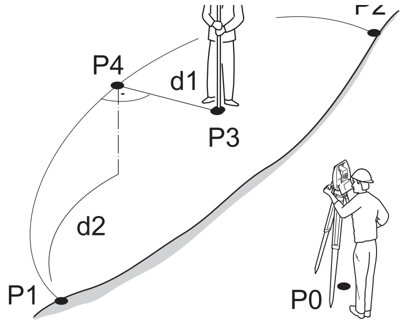
Stake to line - vertical measurements



TPS12_185

P0	Instrument station
P1	Start point
P2	End point
P3	Target point
P4	Reference point
d1	**<Height Offset:>** for **<Heights: Use Start Point>**
d2	**<Height Offset:>** for **<Heights: Use Ref Line>**

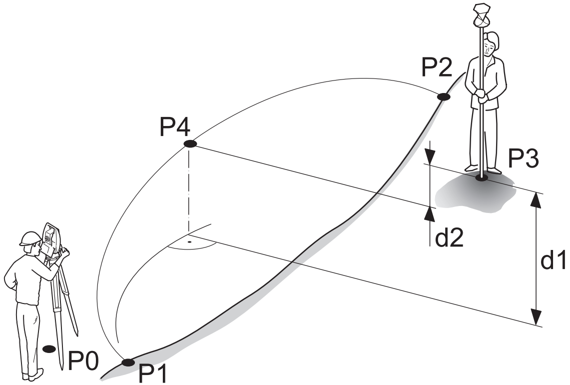
Stake to arc - horizontal measurements



TPS12_186

P0	Instrument station
P1	Start point
P2	End point
P3	Target point
P4	Reference point
d1	**<Stake Offset:>**
d2	**<Along Arc:>**

Stake to arc - vertical measurements

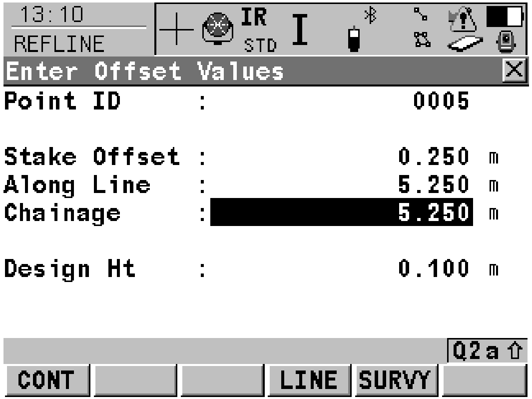


TPS12_187

P0 Instrument station
P1 Start point
P2 End point
P3 Target point
P4 Reference point
d1 **<Height Offset:>** for **<Heights: Use Start Point>**

Entering offset values

This screen is for typing in the stakeout values for a point relative to the reference line/arc. The screen contains different fields depending on the options chosen for **<Heights:>** and **<Edit Height:>** in **REFLINE Configuration**, **Heights** page and **<Task:>** in **REFLINE Choose Task & Reference Line**, **Reference** page. The explanations for the softkeys given below are valid in all cases.



CONT (F1)
To confirm the selections and to continue with the subsequent screen.

LINE (F4)
To define/select a reference line/arc. Accesses **REFLINE Choose Task & Reference Line**.

SURVY (F5)
To measure a point relative to the reference line/arc.

SHIFT CONF (F2)
To configure the reference line/arc. Refer to "42.3 Configuring Reference Line".

SHIFT INDIV (F5) and **SHIFT RUN (F5)**
To change between entering an individual point ID different to the defined ID template and the running point ID according to the ID template. Refer to "16.1 ID Templates".

Description of fields

Field	Option	Description
<Point ID:>	User input	The point ID of the target point to be staked.
<Stake Offset:>	User input	The offset from the reference point to the target point.

Field	Option	Description
<Along Line:>	User input	Available for **<Task: Stake to Line>**. Horizontal distance from the start point to the reference point along the reference line.
<Along Arc:>	User input	Available for **<Task: Stake to Arc>**. Horizontal distance from the start point to the reference point along the reference arc.
<Chainage:>	User input	Chainage along the line/arc. This is the chainage of the start of the reference line/arc plus **<Along Line:>/<Along Arc:>**.
<Height Offset:>	User input	Available for **<Edit Height: No>** unless **<Heights: Use DTM Model>** in **REFLINE Configuration**. The height offset of the target point. • For **<Heights: Use Start Point>** The height of the target point is calculated as the height of the start point plus **<Height Offset:>**. • For **<Heights: Use Ref Line>** The height of the target point is calculated as the height of the reference point plus **<Height Offset:>**.
<Design Ht:>	User input	Available for **<Edit Height: Yes> in REFLINE Configuration, Heights** page. The design height of the target point. • For **<Heights: Use Start Point>** The height of the target point can be input. The suggested height is the height of the start point.

Field	Option	Description
		• For **<Heights: Use Ref Line>** The height of the target point can be input. The suggested height is the height of the reference point.

Next step

CONT (F1) to accept changes and continue to **REFLINE XX Stakeout**.

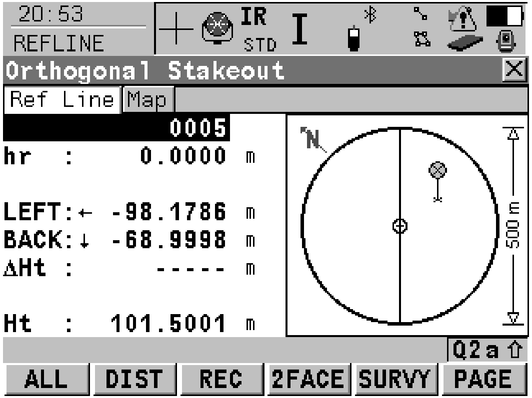
The Ref Line page

The pages shown are those from a typical configuration set. An additional page is available when a user defined display mask is used.

Refer to "46.4.1 Elements of the Graphical Display in the Stakeout" for an explanation of the appearance of the elements of the graphical display within this screen. The display changes depending on what option is chosen for **<Orientate:>** in **REFLINE Configuration, General** page.

This screen contains different fields depending on the options chosen for **<Stake Mode:>** in **REFLINE Configuration, General** page. The explanations for the fields and softkeys given below are valid as indicated.

If **<Auto Position: Yes>** in **STAKEOUT Configuration, General** page the instrument will position the telescope to the point to be staked automatically.



ALL (F1)

To measure the point being staked and return to the **REFLINE Enter Offset Values** screen. The last used values are displayed. The point ID is incremented according to the configured point ID template.

DIST (F2)

To measure and display distances. The difference between the current position and the point being staked is displayed.

REC (F3)

To record displayed values.

2FACE (F4)

To take a measurement in Face I and Face II. The point stored is an average of the two measurements.

When using instruments fitted with ATR, the point is automatically measured in both faces, the resulting point is stored and the instrument is returned to the first face.

This hotkey is only available for <**EDM Mode**: **Standard**> and <**EDM Mode**: **Fast**> and in the Survey, Reference Line and Stakeout programs.

SURVY (F5)

To measure a point. Accesses **REFLINE Measure Points**. Refer to "42.5 Measuring to a Reference Line/Arc".

PAGE (F6)
To change to another page on this screen.

SHIFT CONF (F2)
To configure a reference line/arc. Accesses **REFLINE Configuration**. Refer to "42.3 Configuring Reference Line".

SHIFT POS2D (F3)
To position the telescope (X,Y) onto the point to be staked.

SHIFT POS3D (F4)
To position the telescope (X,Y,Z) onto the point to be staked.

SHIFT INDIV (F5) and **SHIFT RUN (F5)**
To change between entering an individual point ID different to the defined ID template and the running point ID according to the ID template. Refer to "16.1 ID Templates".

Description of fields

Field	Option	Description
<Point ID:>	User input	The point ID of the target point to be staked.
<Reflector Ht:> or **<hr:>**	User input	The default reflector height as defined in the active configuration set is suggested.

Field	Option	Description
<ΔHt-Line:>, **<ΔHt-Start:>,** **<ΔHt-DTM:>,** **<ΔHt-Design:>** or **<ΔHt:>**	Output	Displays the difference between the measured height and the height to be staked.
<Height:> or **<Ht:>**	Output	Available for **<Edit Height: No>** in **REFLINE Configuration**, **Heights** page. The height of the measured point is displayed.
<Design Ht:> or **<D Ht:>**	User input	Available for **<Edit Height: Yes>** in **REFLINE Configuration**, **Heights** page. The design height as shown in **REFLINE Enter Offset Value**.
<Check Dist 1:>	Output	Available for **<Visual Guides: Off>** and **<Visual Guides: Arrows>**. Horizontal distance from start point to target point.
<Check Dist 2:>	Output	Available for **<Visual Guides: Off>** and **<Visual Guides: Arrows>**. Available for horizontal distance from end point to target point.

For <Stake Mode: Polar>

Description of fields

Field	Option	Description
<ΔHz:>	Output	Horizontal angle between the point to be staked and the current position as seen from the instrument station.
<ΔDistance:> or **<ΔDst:>**	Output	Horizontal distance from the current position to the point to be staked along the line between the instrument and the current position.

For <Orientate: To Line/Arc> and <Stake Mode: Orthogonal>

Description of fields

Field	Option	Description
<ΔOffset:> or **<ΔOff:>**	Output	Horizontal distance from the point to be staked to the current position perpendicular to the reference line/arc.
<ΔLine:>, **<ΔLne:>** or **<ΔArc:>**	Output	Horizontal distance from the point to be staked to the current position along the reference line/arc.

For <Orientate: To Station>, <Orientate: From Station> or <Orientate: To Arrow> and

<Stake Mode: Orthogonal>

Description of fields

Field	Option	Description
<LEFT:> or **<RGHT:>**	Output	Offset from the point to be staked out to the current position, perpendicular to the orientation line. If **<Orientate: From Station>**, this value is positive when the point to be staked is to the right of the line of orientation when looking from the instrument station towards the current position. If **<Orientate: To Station>**, this value is positive when the point to be staked is to the right of the line of orientation when looking from the current position towards the instrument station. If **<Orientate: To Arrow>** this value is always zero.
<FORW:> or **<BACK:>**	Output	Horizontal distance between the point to be staked and the current position along the orientation line. If **<Orientate: From Station>**, this value is positive when the point to be staked is behind the current position when looking from the instrument station towards the current position. If **<Orientate: To Station>**, this value is positive when the point to be staked is between the current position and the instrument station.

Next step

PAGE (F6) changes to the **Map** page.

The Map page

The **Map** page provides an interactive display of the data. Displayed is also

- the horizontal distance from the current position to the point to be staked along the line between the instrument and the current position or along the orientation line.
- the difference between the measured height and the height to be staked.

Refer to "34 MapView Interactive Display Feature" for information on the functionality and softkeys available.

Next step

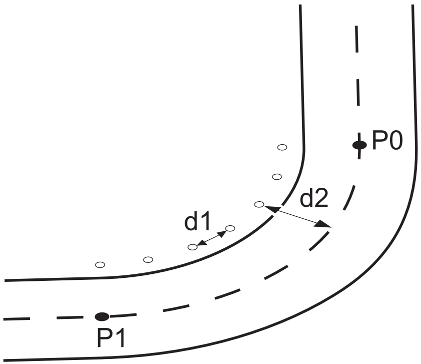
PAGE (F6) changes to the first page on this screen.

42.6.2 Working Example

Description

Application:	A curb is to be defined using offsets from the centreline of a road that is being built.
Reference line/arc:	The defined centre line of the curve is used as a reference arc.
Working technique:	set **<EDM Mode: Tracking>** and **<Automation: LOCK>** in **CONFIGURE EDM & ATR Settings**.

Diagram



TPS12_132

P0	Start point
P1	End point
d1	**<Along Arc:>**
d2	**<Stake Offset:>**

Requirements

- The reference arc is already defined and saved in a job.
- **<Write Logfile: Yes>** in **REFLINE Configuration**, **Logfile** page.

Field procedure step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to "42.2 Accessing Reference Line" to access **REFLINE Reference Line/Arc Begin**.	
2.	**REFLINE Reference Line/Arc Begin** Select a job and a configuration set with the settings mentioned above.	42.2
3.	**CONT (F1)** to access **REFLINE Choose Task & Reference Line, Reference** page.	
4.	**REFLINE Choose Task & Reference Line**, **Reference** page **<Task: Stake to Arc>** **<Ref to Use: Select from Job>**	42.4.2
5.	Highlight **<Ref Arc:>**.	
6.	**ENTER** to access **REFLINE Manage Reference Arcs**.	
7.	**REFLINE Manage Reference Arcs** Select the correct reference arc.	42.4
8.	**CONT (F1)** returns to **REFLINE Choose Task & Reference Line**, **Reference** page.	
☞	The **Map** page provides an interactive display of the defined reference arc.	34
9.	**CONT (F1)** to access **REFLINE Enter Offset Values**.	

Step	Description	Refer to chapter
10.	**REFLINE Enter Offset Values** **<Point ID: CL1>** **<Stake Offset: 5.20000>** **<Along Arc: 2.0000>** **<Height Offset: 0.0000>**	42.6
11.	**CONT (F1)** to **REFLINE XX Stakeout, Ref XX** page.	
12.	**REFLINE XX Stakeout**, **Ref XX** page Depending on the configuration of the staking options in **REFLINE Configuration**, **General** page, the graphical display and the values in the fields indicate how to find the point to be staked. The values are updated constantly.	
13.	**ALL (F1)** measures and stores the point.	
	The results are displayed on the screen.	
	It may happen that a point with the same point ID exists in the job. If the codes and/or attribute values of the new and the existing point do not match, a screen opens where they can be corrected.	
14.	Are more points to be staked? • If **yes**, continue with step 15. • If **no**, continue with step 17.	
15.	**REFLINE Enter Offset Values**	42.6

Step	Description	Refer to chapter
	Enter the parameters of the next point to be staked.	
16.	Repeat steps 11. to 14.	
☞	The **Map** page provides an interactive display of the defined reference arc and the points that have been staked out. Displayed is also • the horizontal distance from the current position to the point to be staked along the line between the instrument and the current position or along the orientation line. • the difference between the measured height and the height to be staked.	34
17.	**SHIFT QUIT (F6)** returns to **TPS1200 Main Menu**.	
☞	The results are written to the logfile.	

42.7 Gridstaking to a Reference Line/Arc

42.7.1 Gridstaking the Points

Description

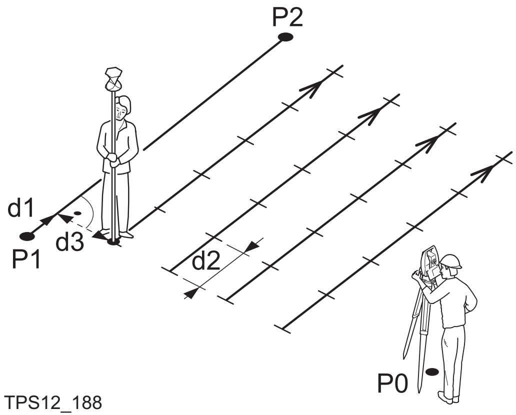
A grid can be defined relative to a reference line/arc and points staked out in that defined grid.

Access step-by-step

Step	Description
1.	Refer to "42.2 Accessing Reference Line" to access the Begin screen.
2.	**CONT (F1)** to access **REFLINE Choose Task & Reference Line**.
3.	**REFLINE Choose Task & Reference Line, Reference** page **<Task: Gridstake XX>**.
4.	**CONT (F1)** to access **REFLINE Define Grid**.

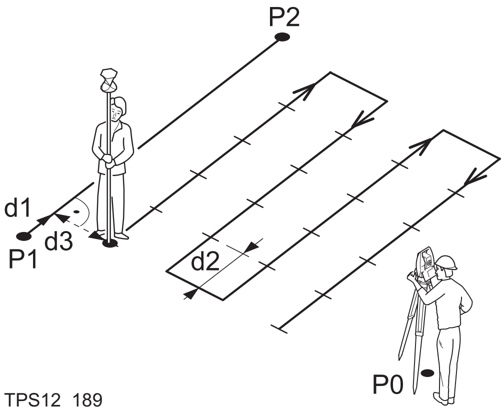
Gridstake line methods

Start at Begin



P0 Instrument station
P1 Start point
P2 End point
d1 **<Begin at Stn:>**
d2 **<Increment:>**
d3 **<Line Offsets:>**

Current Station

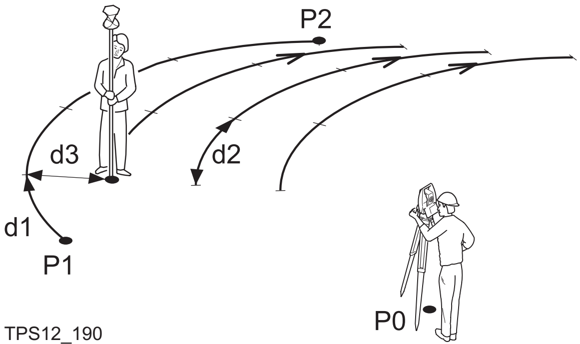


TPS12_189

P0	Instrument station
P1	Start point
P2	End point
d1	**<Begin at Stn:>**
d2	**<Increment:>**
d3	**<Line Offsets:>**

Gridstake arc methods

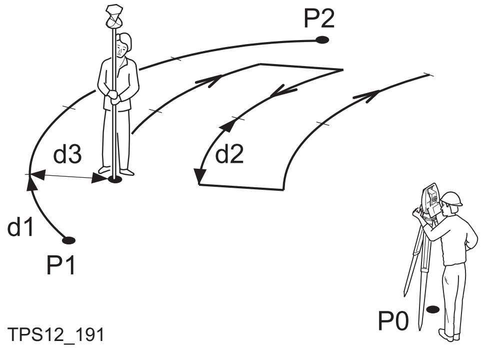
Start at Begin



TPS12_190

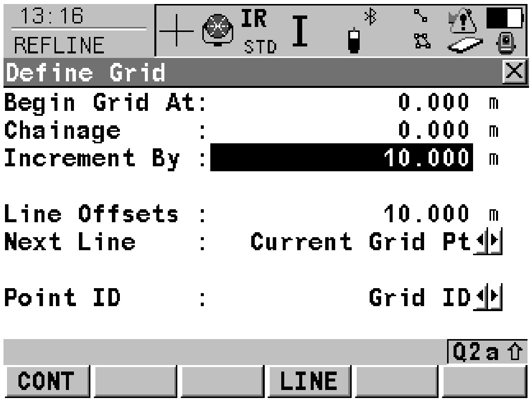
P0	Instrument station
P1	Start point
P2	End point
d1	**<Begin at Stn:>**
d2	**<Increment:>**
d3	**<Line Offsets:>**

Current Station



P0	Instrument station
P1	Start point
P2	End point
d1	**<Begin at Stn:>**
d2	**<Increment:>**
d3	**<Line Offsets:>**

Defining the grid



CONT (F1)
To confirm the selections and to continue with the subsequent screen.

LINE (F4)
To define/select a reference line/arc. Accesses **REFLINE Choose Task & Reference Line**.

SHIFT CONF (F2)
To configure the reference line/arc. Refer to "42.3 Configuring Reference Line".

Description of fields

Field	Option	Description
<Begin Grid at:>	User input	Distance along the reference line/arc from the start point to the first target point to be staked.
<Chainage:>	User input	Chainage of the first target point to be staked along the line/arc. This is the chainage of the start of the reference line/arc plus **<Begin Grid At:>**.
<Increment by:>	User input	Spacing between points on the grid line.
<Line Offsets:>	User input	Spacing between grid lines.
<Next Line:>		Method by which the grid will be staked out.
	Start at Begin	Each new grid line is started at the same end as where the previous grid line started.
	Current Grid Pt	Each new grid line is started at the same end as where the previous grid line finished.
<Point ID:>		Determines the format of the point ID for grid points.
	Grid ID	Point ID is shown as the position of the grid being staked where +yyy.yy is the station position along the grid line and +xxx.xx is the grid line offset.
	Pt ID Template	The point ID template as defined in the active configuration set is used. The point ID template can be defined for **<Survey Pts:>** in **CONFIGURE ID Templates**. Refer to "16.1 ID Templates".

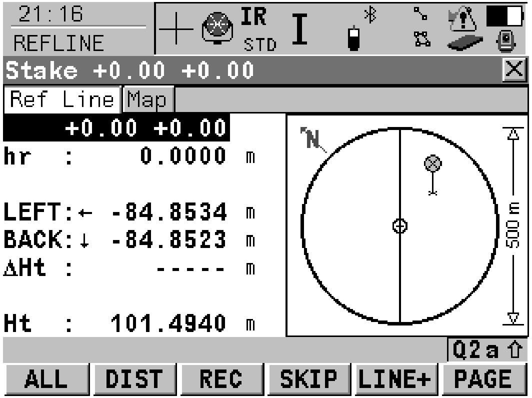
Next step

CONT (F1) to accept changes and continue to **REFLINE Stake +yyy.yy +xxx.xx**, **Ref XX** page.

The Ref Line page

The title of this screen indicates the position of the grid being staked where +yyy.yy is the station position along the grid line and +xxx.xx is the grid line offset.

The functionality of this screen is very similar to **REFLINE XX Stakeout, Ref XX** page. Differences between the two screens are outlined below.



SKIP (F4)
To skip the currently displayed station and increment to the next station.

LINE (F5)
To start staking the next grid line. The position of the first point on the new line is determined by the option selected for **<Next Line:>.**

Description of fields

Field	Option	Description
<Point ID:>	User input	The point ID of the grid point to be staked. The point ID is based on the selection for **<Point ID:>** in **REFLINE Define Grid**. If a different point ID is typed in, the next point ID will still be shown as the next automatically computed point ID.
<Design Ht:> or **<D Ht:>**	User input	Available for **<Edit Height: Yes>** in **REFLINE Configuration**, **Heights** page. To type in the design height. If a design height has been entered and **SKIP (F4)** or **LINE (F5)** is used the true grid height for the next point is shown as the suggested height.

Next step

PAGE (F6) changes to the **Map** page.

The Map page

The **Map** page provides an interactive display of the data. Displayed is also

- the horizontal distance from the current position to the point to be staked along the line between the instrument and the current position or along the orientation line.
- the difference between the measured height and the height to be staked.

Refer to "34 MapView Interactive Display Feature" for information on the functionality and softkeys available.

Next step

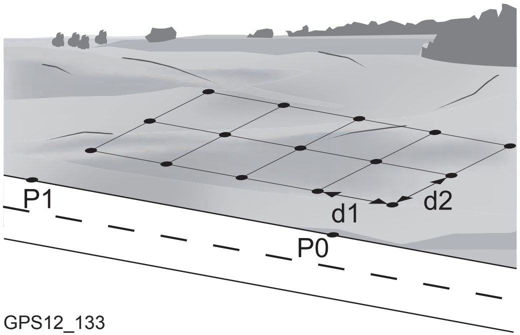
PAGE (F6) changes to the first page on this screen.

42.7.2 Working Example

Description

Application:	The positions of bore-holes need to be staked out in a regular grid over the area of a site to be used for landfill.
Reference line/arc:	Two known points on the site can be used to define the reference line.
Working technique:	set **<EDM Mode: Tracking>** and **<Automation: LOCK>** in **CONFIGURE EDM & ATR Settings**.

Diagram



GPS12_133

P0 Start point
P1 End point
d1 **<Increment By:>**
d2 **<Line Offsets:>**

Requirements

- A new reference line needs to be created and saved with the job.
- **<Write Logfile: Yes>** in **REFLINE Configuration**, **Logfile** page.

Field procedure step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to "42.2 Accessing Reference Line" to access **REFLINE Reference Line/Arc Begin**.	
2.	**REFLINE Reference Line/Arc Begin** Select a job and a configuration set with the settings mentioned above.	42.2
3.	**CONT (F1)** to access **REFLINE Choose Task & Reference Line, Reference** page.	
4.	**REFLINE Choose Task & Reference Line**, **Reference** page **<Task: Gridstake Line>** **<Ref to Use: Select from Job>**	42.4.1
5.	Highlight **<Ref Line:>**.	
6.	**ENTER** to access **REFLINE Manage Reference Lines**.	
7.	**NEW (F2)** to access **REFLINE New Reference Line**, **Input** page.	
8.	**REFLINE New Reference Line**, **Input** page **<Ref ID: Line001>** **<Method: 2 Points>** Select the appropriate points from the choicelist.	42.4.1

Step	Description	Refer to chapter
☞	The **Map** page provides an interactive display of the defined reference line.	34
9.	**STORE (F1)**.	
10.	**CONT (F1)** returns to **REFLINE Choose Task & Reference Line**, **Reference** page.	
☞	The **Map** page provides an interactive display of the defined reference line.	34
11.	**CONT (F1)** to access **REFLINE Define Grid**.	
12.	**REFLINE Define Grid** **<Begin Grid at: 0>** **<Increment by: 20>** **<Line Offsets: 20>** **<Next Line: Current Grid Pt>** **<Point ID: Grid ID>**	42.7
13.	**CONT (F1)** to access **REFLINE Stake +yyy.yy +xxx.xx, Ref XX** page.	
14.	**REFLINE Stake +yyy.yy +xxx.xx**, **Ref XX** page Depending on the configuration of the staking options in **REFLINE Configuration**, **General** page, the graphical display and the values in the fields indicate how to find the point to be staked. The values are updated constantly.	42.7

Step	Description	Refer to chapter
15.	**ALL (F1)** measures and stores the point.	
	The results are displayed on the screen.	
	It may happen that a point with the same point ID exists in the job. If the codes and/or attribute values of the new and the existing point do not match, a screen opens where they can be corrected.	
16.	Repeat steps 14. and 15. until all grid points have been staked.	
	The **Map** page provides a graphical view of the defined reference line and the points that have been staked out. Displayed is also • the horizontal distance from the current position to the point to be staked along the line between the instrument and the current position or along the orientation line. • the difference between the measured height and the height to be staked.	34
17.	**SHIFT QUIT (F6)** returns to **TPS1200 Main Menu**.	
	The results are written to the logfile.	

43 Reference Plane & Face Scan

43.1 Overview

Description

The Reference Plane & Face Scan application program can be used to measure points relative to a reference plane. A reference plane can also be scanned via Face Scan.

Reference plane tasks

The Reference Plane & Face Scan application program can be used for the following tasks:

- Measuring points to calculate and store the perpendicular distance to the plane.
- Viewing and storing the instrument and/or local coordinates of the measured points.
- Viewing and storing the height difference from the measured points to the plane.
- Scanning a defined area.

☞ Face scan is available for motorised instruments with reflectorless EDM.

☞ Planes can only be computed with grid coordinates.

Activating the application program

The Reference Plane application program must be activated via a licence key. Refer to "28 Tools...\Licence Keys" for information on how to activate the application program.

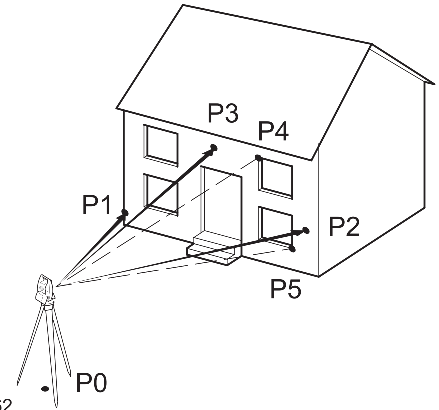
Properties of measured points

The properties stored with measured points are:

Type	Reference Plane	Face Scan
Class	**MEAS**	**MEAS**
Sub class	**TPS**	**TPS**

Type	Reference Plane	Face Scan
Source	**Ref Plane (Meas)** or **Ref Plane (Face Scan Meas)**	**Face Scan**
Instrument source	**TPS**	**TPS**

Defining a reference plane



TPS12_162

P0	Instrument station
P1	Point defining reference plane
P2	Point defining reference plane
P3	Point defining reference plane
P4	Measured point
P5	Measured point

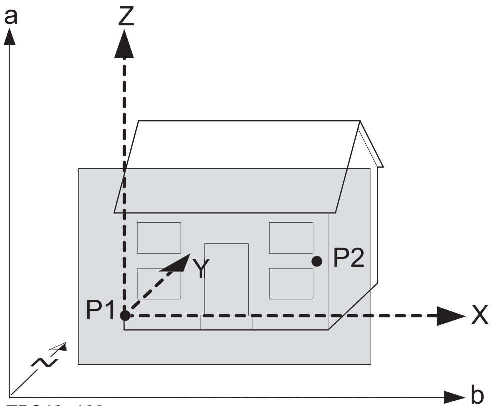
Reference planes are created using a right hand system. For two points defining a plane a vertical plane is used. A reference plane is defined with the X axis and the Z axis of the plane. The Y axis of the plane defines the positive direction of the Y axis. A reference plane can be defined in the following ways.

- vertical
- tilted

Vertical plane

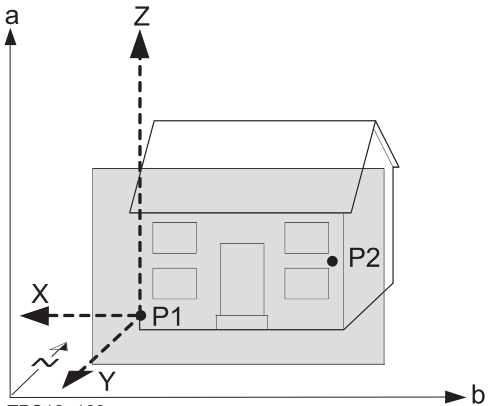
The axis of the vertical reference plane are:

X axis:	Horizontal and parallel to the plane; X axis starts in point defined as origin point
Z axis:	Parallel to the instrument zenith and parallel to the plane
Y axis:	Perpendicular to the plane; increases in the direction as defined
☞	Offsets are applied in the direction of the Y axis.



TPS12_163

a	Height
b	Easting
N	Northing
P1	Origin of plane
P2	Point of plane
X	X axis of plane
Y	Y axis of plane
Z	Z axis of plane



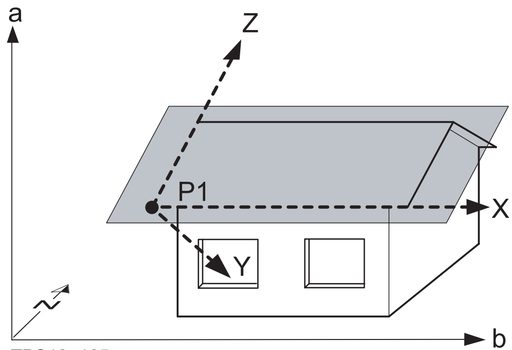
TPS12_163a

a	Height
b	Easting
N	Northing
P1	Origin of plane
P2	Point of plane
X	X axis of plane
Y	Y axis of plane
Z	Z axis of plane

Tilted plane

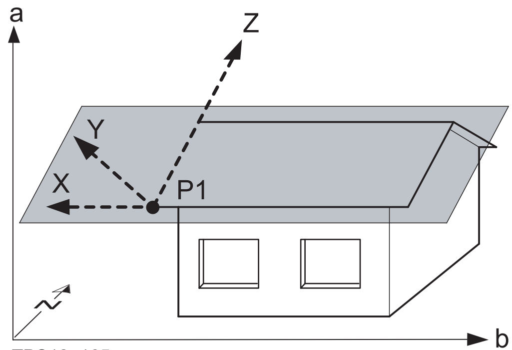
Any number of points define the plane, perimeter to be scanned is defined by a bottom left-topright window. The axis of the tilted reference plane are:

X axis:	Horizontal and parallel to the plane
Z axis:	Defined by steepest direction of the plane
Y axis:	Perpendicular to the plane; increases in the direction as defined
☞	Offsets are applied in the direction of the Y axis.



TPS12_165

a	Height
b	Easting
N	Northing
P1	Origin of plane
X	X axis of plane
Y	Y axis of plane
Z	Z axis of plane



TPS12_165a

a	Height
b	Easting
N	Northing
P1	Origin of plane
X	X axis of plane
Y	Y axis of plane
Z	Z axis of plane

☞ With four or more points a least squares adjustment is calculated resulting in a best fit plane.

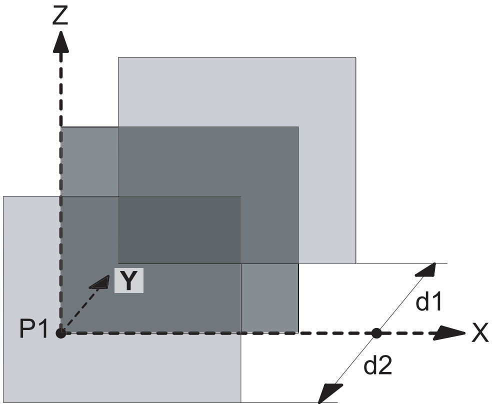
Origin

The origin of the reference plane can be defined to be in the plane coordinates or in the instrument coordinates.

Positive direction of plane

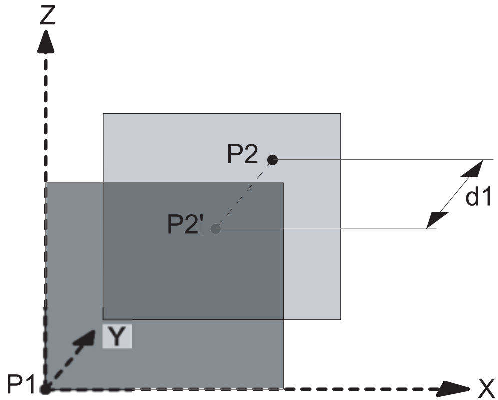
The positive direction of the plane is defined by the direction of the Y axis. The direction can be changed by selecting a point which defines the negative direction of the Y axis.

Offset of the plane



TPS12_164

P1 Origin of plane
X X axis of plane
Y Y axis of plane
Z Z axis of plane
d1 Positive offset
d2 Negative offset



TPS12_164a

P1 Origin of plane
P2 Point defining offset of plane
P2’ P2 projected on original plane
d1 Offset defined by P2
X X axis of plane
Y Y axis of plane
Z Z axis of plane

43.2 Accessing Reference Plane

Access

Select **Main Menu: Programs...\Reference Plane**.

OR

Press **PROG**. Highlight **Reference Plane. CONT (F1)**. Refer to "35.2 Accessing the Programs Menu" for information on the **PROG** key.

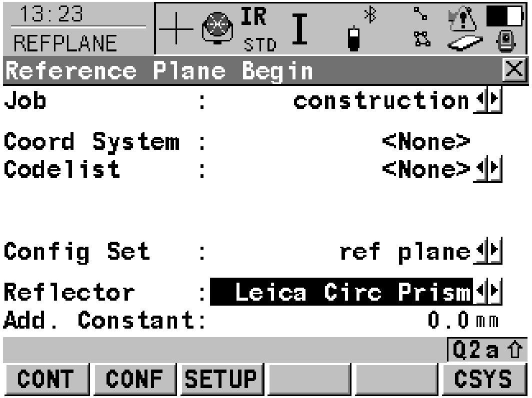
OR

Press a hot key configured to access the screen **REFPLANE Reference Plane Begin**. Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

REFPLANE
Reference Plane Begin



CONT (F1)
To confirm the selections and to continue with the subsequent screen.

CONF (F2)
To configure the Reference Plane application program. Refer to "43.3 Configuring Reference Plane".

SETUP (F3)
To set up station. Accesses **SETUP Station Setup**.

CSYS (F6)
To select a different coordinate system.

Description of fields

Field	Option	Description
<Job:>	Choicelist	The active job. All jobs from **Main Menu: Manage...\Jobs** can be selected.
<Coord System:>	Output	The coordinate system currently attached to the selected **<Job:>**.
<Codelist:>	Choicelist	No codes are stored in the selected job. All codelists from **Main Menu: Manage...\Codelists** can be selected.
	Output	Codes have already been stored in the selected **<Job:>**. If codes had been copied from a System RAM codelist, then the name of the codelist is displayed. If codes have not been copied from a System RAM codelist but typed in manually, then the name of the active job is displayed.
<Config Set:>	Choicelist	The active configuration set. All configuration sets from **Main Menu: Manage...\Configuration Sets** can be selected.
<Reflector:>	Choicelist	The active reflector. All reflectors from **Main Menu: Manage...\Reflectors** can be selected.
<Add. Constant:>	Output	The additive constant stored with the chosen reflector.

Next step

IF the Reference Plane application program	THEN
is to be accessed	**CONT (F1)** accepts the changes and accesses the Reference Plane application program.
is to be configured	**CONF (F2)**. Refer to "43.3 Configuring Reference Plane".

43.3 Configuring Reference Plane

Description

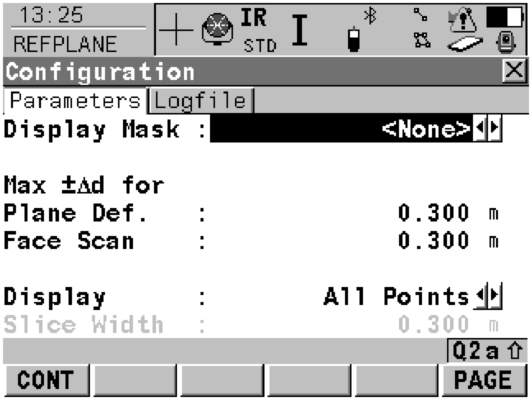
Allows options to be set which are used within the Reference Plane application program. These settings are stored within the configuation set.

Access step-by-step

Step	Description
1.	Refer to "43.2 Accessing Reference Plane" to access **REFPLANE Reference Plane Begin**.
2.	**CONF (F2)** to access **REFPLANE Configuration**.

REFPLANE Configuration, Parameters page

This screen consists of the **Parameters** page and the **Logfile** page.



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

DMASK (F3)
To edit and display mask currently being displayed. Accesses **CONFIGURE Define Display Mask n**. Available when **<Display Mask:>** is highlighted on **Parameters** page. Refer to "16.2 Display Settings".

PAGE (F6)
To change to another page on this screen.

SHIFT ABOUT (F5)

To display information about the application program name, the version number, the date of the version, the copyright and the article number.

Description of fields

Field	Option	Description
<Display Mask:>	Choicelist	The user defined display mask is shown in **REFPLANE Measure Points to Plane**. All display masks of the active configuration set defined in **CONFIGURE Display Settings** can be selected.
<Max ±Δd for Plane Def.:>	User input	The maximum perpendicuar deviation of a point from the calculated plane.
<Face Scan:>	User input	The maximum perpendicular deviation of a measured point in face scan from defined plane. Scanned points outside the defined limit are not stored.
<Display:>		This parameter defines the points displayed in the Plot and Map page views of the Reference Plane application program in the plan view.
	All Points	**<Display: All Points>** displays all points in the plan view.
	Points in Slice	**<Display: Points in Slice>** displays points whithin the defined **<Slice Width:>** in the plan view.
<Slice Width:>		Available for **<Display: Points in Slice>**.

Field	Option	Description
	User input	This parameter defines the distance from the plane in which points are displayed. This distance is applied to both sides of the plane. If lines and areas are to be displayed in a particular Map page, then parts of lines and areas falling within the defined slice are also displayed.

Next step

PAGE (F6) changes to the **Logfile** page. Refer to paragraph "REFPLANE Configuration, Logfile page"

REFPLANE Configuration, Logfile page

Description of fields

Field	Option	Description
<Write Logfile:>	**Yes** or **No**	To generate a logfile when the application program is exited. A logfile is a file to which data from an application program is written to. It is genereated using the selected **<Format File:>**.
<File Name:>	Choicelist	Available for **<Write Logfile: Yes>**. The name of the file to which the data should be written. A logfile is stored in the \DATA directory of the active memory device. The data is always appended to the file.

Field	Option	Description
		Opening the choicelist accesses **XX Logfiles** where a name for a new logfile can be created and an existing logfile can be selected or deleted.
<Format File:>	Choicelist	Available for **<Write Logfile: Yes>**. A format file defines which and how data is written to a logfile. Format files are created using LGO. A format file must first be transferred from the CompactFlash card to the System RAM before it can be selected. Refer to "24 Tools...\Transfer Objects..." for information on how to transfer a format file. Opening the choicelist accesses **XX Format Files** where an existing format file can be selected or deleted.

Next step

CONT (F1) returns to the screen from where this screen was accessed.

43.4 Managing Reference Planes

Description

A reference plane is used to measure points relative to the plane or to scan the plane.

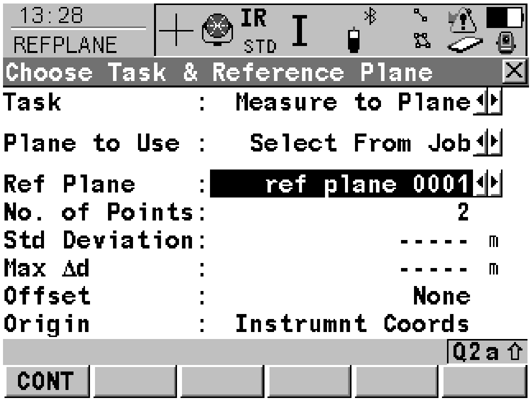
Measure to plane

- Reference planes can be created, edited, stored and deleted in the active job.
- The reference planes can be recalled for later use.
- The plane can be shifted through a point or a defined offset.

Scan a plane

<Task: Scan> in **REFPLANE Choose Task & Reference Plane** to scan the selected plane with the defined grid.

REFPLANE Choose Task & Reference Plane



CONT (F1)
To accept changes and to continue with the subsequent screen.

SHIFT CONF (F2)
To configure the reference plane. Refer to "43.3 Configuring Reference Plane".

Description of fields

Field	Option	Description
<Task:>	**Measure to Plane**	The coordinates of measured points are calculated relative to the reference plane.
	Scan	Measures a sequence of points along a vertical, tilted or horizontal face.
<Plane to Use:>	**Create New Plane**	Defines a new reference plane.
	Select From Job	Reference plane is selected in **<Ref Plane:>**.
<Ref Plane:>	Choicelist	Available for **<Plane to Use: Select From Job>**. The reference plane to be used. Accesses **REFPLANE Manage Reference Planes**.
<No. of Points:>	Output	Available for **<Plane to Use: Select From Job>**. Number of points used for plane definition for the plane shown in the **<Ref Plane:>**.
<Std Deviation:>	Output	Standard deviation of used points for plane definition. ----- is displayed for less than four points.
<Max Δd:>	Output	Maximum distance between a point and the calculated plane. ----- is displayed for less than four points.
<Offset:>	Output	The offset method used as defined in **REFPLANE XX Reference Plane, Offset** page.
<Origin:>	Output	The origin method used as defined in **REFPLANE XX Reference Plane, Origin** page.

Next step

IF	THEN
a new plane is to be created	**CONT (F1)** accesses **REFPLANE New Reference Plane, General** page. Refer to paragraph "Create reference plane step-by-step".
points are to be measured to a plane	**CONT (F1)** accesssses **REFPLANE Measure Points to Plane, Reference** page. Refer to "43.5 Measuring Points to a Reference Plane".
a plane is to be scanned	**CONT (F1)** accesses **REFPLANE Define Scanning Parameters**. Refer to "43.6 Scanning a Plane".

Create reference plane step-by-step

Step	Description	Refer to chapter
1.	Refer to "43.2 Accessing Reference Plane" to access **REFPLANE Reference Plane Begin**.	
2.	**CONT (F1)** to access **REFPLANE Choose Task & Reference Plane**.	
3.	**REFPLANE Choose Task & Reference Plane** Select **<Plane to Use: Create New Plane>**.	
4.	**CONT (F1)** to access **REFPLANE New Reference Plane, General** page. **NEW (F2)** in **REFPLANE Manage Reference Planes** to access **REFPLANE New Reference Plane, General** page.	

Step	Description	Refer to chapter
5.	**REFPLANE New Reference Plane, General** page **<Ref Plane:>** The ID of the new reference plane. **<No. of Points:>** Number of points used for plane definition. **<Std Deviation:>** Standard deviation of used points for plane definition. ----- is displayed unless more than four points are used to define the plane. **<Max Δd:>** Maximum distance between measured point and defined plane. ----- is displayed unless more than four points are used to define the plane.	
6.	**PAGE (F6)** to change to the **Points** page.	
7.	**REFPLANE New Reference Plane, Points** page. An * is shown to the right of the point for a point which will be used as origin of the plane. An **!** is shown to the left of the point if the point is outside maximum distance between a point and the calculated plane as defined in **REFPLANE Configuration**, **Parameters** page. The column **Δd(m)** displays the perpendicular distance of the point from the definition of the plane.	
	ADD (F2) to add points from **REFPLANE Data: Job Name** to define the reference plane.	
	USE (F3) to change between **Yes** and **No** for the highlighted point.	

Step	Description	Refer to chapter
☞	**DEL (F4)** to remove the highlighted point from the list.	
☞	**SURVY (F5)** to measure a point to be used for the plane. ☞ **DONE (F4)** to return to **REFPLANE New Reference Plane**.	
☞	**SHIFT ORIGN (F4)** to use the highlighted point as the origin of the plane.	
8.	**PAGE (F6)** to change to the **Origin** page.	
9.	**REFPLANE New Reference Plane, Origin** page. **<Use As Origin: Plane Coords>** Point results are additionally stored with X, Y, Z coordinates based on the local plane coordinate system. **<Use As Origin: Instrumnt Coords>** Points on the plane have instrument coordinates. **<X-coord:>** Available for **<Use As Origin: Plane Coords>**. Enter local X coordinate of origin. The origin is defined as the projection of the measured point onto the calculated plane. **<Z-coord:>** Available for **<Use As Origin: Plane Coords>**. Enter local Z coordinate of origin. The origin is defined as the projection of the measured point onto the calculated plane. **<Point:>** Defines the positive direction of the Y axis.	
☞	**DIREC (F5)** Available for **<Point:>** being hightlighted. To access **REFPLANE Survey: XX**. Measure a point to define the positive plane direction.	
10.	**PAGE (F6)** to change to the **Offset** page.	

Step	Description	Refer to chapter
11.	**REFPLANE New Reference Plane, Offset** page **<Define Offset:>** An offset can be defined by a point or a distance. The defined plane is shifted along the Y axis by the offset. **<Offset PtID:>** Available for **<Define Offset: By Point ID>**. Point ID of offset point. **<Offset:>** Distance by which to offset the plane along the Y axis. For **<Define Offset: By Distance>** the distance can be entered. For **<Define Offset: By Point ID>** the calculated distance to the adjusted plane is displayed. **<Offset:----->** if no values are available.	
	OFSET (F5) Available for **<Offset PtID:>** being highlighted. To access **REFPLANE Survey: XX, Survey** page. Measure a point to define the offset point.	
12.	**PAGE (F6)** to change to the **Plot** page.	
13.	**REFPLANE New Reference Plane, Plot** page Points displayed depend on the settings in **REFPLANE Configuration, Parameters** page. Points defining the plane are displayed in black, the other points are displayed in grey.	43.3
	SHIFT FACE (F1) to access the face view of the plane. **SHIFT PLAN (F1)** to access the plan view of the plane.	
14.	**STORE (F1)** to compute and store the reference plane.	

Edit a reference plane step-by-step

Step	Description
1.	Refer to "43.2 Accessing Reference Plane" to access **REFPLANE Reference Plane Begin**.
2.	**CONT (F1)** to access **REFPLANE Choose Task & Reference Plane**.
3.	**REFPLANE Choose Task & Reference Plane** Select **<Plane to Use: Select From Job>**. Highlight **<Ref Plane:>**
4.	**ENTER** to access **REFPLANE Manage Reference Planes**.
5.	**REFPLANE Manage Reference Planes** **EDIT (F3)** to access **REFPLANE Edit Reference Plane, General** page.
6.	**REFPLANE Edit Reference Plane, General** page Continue with Step 5. from paragraph "Create reference plane step-by-step".

Select a reference plane from the job step-by-step

Step	Description
1.	Refer to "43.2 Accessing Reference Plane" to access **REFPLANE Reference Plane Begin**.
2.	**CONT (F1)** to access **REFPLANE Choose Task & Reference Plane**.
3.	**REFPLANE Choose Task & Reference Plane** Select **<Plane to Use: Select From Job>**.
4.	Highlight **<Ref Plane:>**
5.	**ENTER** to access **REFPLANE Manage Reference Planes**.

Step	Description
6.	**REFPLANE Manage Reference Planes** Select a reference plane.
☞	**MORE (F5)** displays information about date and time of when the reference plane was created and the number of points defining the plane.
7.	**CONT (F1)** to access **REFPLANE Measure Points to Plane, Reference** page.

43.5 Measuring Points to a Reference Plane

Measure points to plane step-by-step

Step	Description
1.	Refer to "43.2 Accessing Reference Plane" to access **REFPLANE Reference Plane Begin**.
2.	**CONT (F1)** to access **REFPLANE Choose Task & Reference Plane**.
3.	**REFPLANE Choose Task & Reference Plane** Select a reference plane. Refer to paragraph "Select a reference plane from the job step-by-step".
4.	**CONT (F1)** to access **REFPLANE Measure Points to Plane, Reference** page.
5.	**REFPLANE Measure Points to Plane, Reference** page **<Offset ÄPer d:>** The perpendicular distance between measured point and adjusted plane. **<Offset ΔHt:>** The vertical distance between measured point and adjusted plane. For **<Use As Origin: Plane Coords>** **<X Coordinate:>**, **<Y Coordinate:>** and **<Z Coordinate:>** are displayed. For **<Use As Origin: Instrumnt Coords>** **<Easting:>**, **<Northing:>** and **<Height:>** are displayed.
	CMPR (F4) to calculate offsets to previously measured points. **STORE (F1)** to store the results for the point currently being displayed. **DONE (F4)** to return to **REFPLANE Measure Points to Plane, Reference** page.

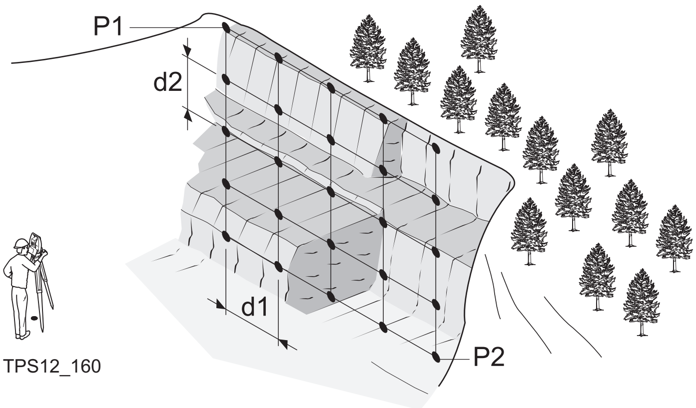
Step	Description
☞	**PLANE (F5)** to edit the selected reference plane.
☞	**SHIFT INDIV (F5)** for an individual point ID independent of the ID template. **SHIFT RUN (F5)** changes back to the next ID from the configured ID template.
6.	**PAGE (F6)** to change to the **Map** page.
7.	**REFPLANE Measure Points to Plane, Map** page.
☞	**SHIFT FACE (F1)** to access the face view of the plane. ☞ **SHIFT PLAN (F1)** to access the plan view of the plane.
8.	**ALL (F1)** to measure points on the plane.

43.6 Scanning a Plane

Description

Face Scan automates the process of measuring a sequence of points along the defined vertical, tilted or horizontal face. The boundaries of the window of interest and the interval values for vertical and horizontal grid are defined by the user. Face scan can be run on motorised instruments with the option "reflectorless EDM" only.

Diagram



TPS12_160

Known

P1 First corner of plane

P2 Second corner of plane

d1 **<Horizontal:>** grid spacing

d2 **<Up Slope:>** grid spacing

Unknown

Grid point coordinates

Scan a new plane step-by-step

Step	Description	Refer to chapter
1.	Refer to "43.2 Accessing Reference Plane" to access **REFPLANE Reference Plane Begin**.	
2.	**CONT (F1)** to access **REFPLANE Choose Task & Reference Plane**.	

Step	Description	Refer to chapter
	SHIFT CONF (F2) to access **REFPLANE Configuration, Parameters** page.	43.3
3.	**REFPLANE Choose Task & Reference Plane** **<Task: Scan>** **<Plane to Use: Create New Plane>**	
4.	**CONT (F1)** to access **REFPLANE New Reference Plane**	
5.	**REFPLANE New Reference Plane** Define new reference plane. Refer to paragraph "Create reference plane step-by-step".	
6.	**STORE (F1)** to store the new reference plane.	
7.	Define the first and second corner of the area to be scanned.	
8.	**REFPLANE Define Scanning Parameters** For tilted and vertical planes: **<Horizontal:>** Horizontal grid distance. **<Up Slope:>** Up slope grid distance. **<Pt ID Inc:>** The incrementation used for **<Start Pt ID:>**. No point ID template used.	

Step	Description	Refer to chapter
	• For **<Start Pt ID: RMS>** and **<Pt ID Inc: 10>** the points are **<Point ID: RMS>**, **<Point ID: RMS10>**, **<Point ID: RMS20>**, ..., **<Point ID: RMS100>**, ... • For **<Start Pt ID: 100>** and **<Pt ID Inc: 10>** the points are **<Point ID: 100>**, **<Point ID: 110>**, ..., **<Point ID: 200>**, **<Point ID: 210>**, ... • For **<Start Pt ID: abcdefghijklmn89>** and **<Pt ID Inc: 10>** the points are **<Point ID: abcdefghijklmn99>**, point ID incrementing fails. **<Scan Area:>** Size of the area to be scanned. **<Estimated Pts:>** Estimated number of points to be scanned.	
9.	**START (F1)** to access **REFPLANE Scanning Status, Scanning** page.	
	PAUSE (F3) to pause the scanning of points. **SCAN (F3)** to continue scanning.	
	STOP (F1) to stop the scanning of points.	
10.	**REFPLANE Scanning Status, Scanning** page Status of the scanning is displayed when under process. **<Pts Scanned:>** Number of points being scanned. **<Pts Remaining:>** Number of points remaining to be scanned. **<Pts Rejected:>** Number of skipped points. **<% Completed:>** Percentage of points scanned.	

Step	Description	Refer to chapter
	<Time Left:> Estimated time remaining until scan is finished. **<Point ID:>** Point ID of last stored point.	
11.	**PAGE (F6)** to access **REFPLANE Scanning Status, Plot** page	
12.	**REFPLANE Scanning Status, Plot** page Points currently scanned are displayed in black, previously measured points, lines and areas are dispayed in grey.	
	SHIFT FACE (F1) to access the face view of the plane. **SHIFT PLAN (F1)** to access the plan view of the plane.	
13.	**CONT (F1)** to access **REFPLANE Choose Task & Reference Plane**.	

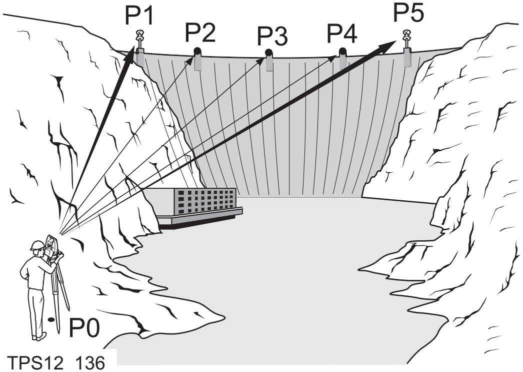
44 Sets of Angles

44.1 Overview

Description

- Sets of Angles:
  - This program (which can include Monitoring as an option) is used to measure multiple sets of directions and distances (optional) to pre-defined target points in one or two faces.
  - The mean direction and mean distance (optional) to each target point, within a set is calculated. The residual for each direction and distance (optional) within a set is also calculated.
  - The reduced average direction and average distance (optional) to each target point, for all active sets is calculated.
- Monitoring:
  - This module can be integrated within the Sets of Angles program.
  - With this module, it is possible to use a timer to enable repeated and automated angle and distances measurements to pre-defined target points at defined intervals.

Diagram



Known:

P1 Pre-defined target point - E,N,Height (optional)
P2 Pre-defined target point - E,N,Height (optional)
P3 Pre-defined target point - E,N,Height (optional)
P4 Pre-defined target point - E,N,Height (optional)
P5 Pre-defined target point - E,N,Height (optional)

Unknown:

a) Mean direction and mean distance (optional) to each target point, within a set
b) Residual for each direction and distance (optional), within a set
c) Reduced average direction and average distance (optional) to each target point, for all active sets

Measure at least:

a) Two target points
b) Two sets

ATR - automatic target recognition	ATR search and ATR measurements can be performed to a reflector. After completing the first measurements to each target point, the measurements to the target points in subsequent sets are automated.
Station setup and station orientation	A station set up and station orientation is required before starting the Sets of Angles program, if oriented grid coordinates are to be recorded.
Point properties	The properties stored with Sets of Angles points are: • Class: **MEAS** or **NONE** • Sub class: **TPS** • Source: **Sets of Angles** • Instrument source: **TPS**
Point averaging	An average is never calculated for Sets of Angles points, even if a measured point of class **MEAS** already exists with the same point ID.

44.2 Sets of Angles

44.2.1 Accessing Sets of Angles

Access

Select **Main Menu: Programs...\Sets of Angles**.

OR

Press **PROG**. Highlight **Sets of Angles**. **CONT (F1)**.

Refer to "35.2 Accessing the Programs Menu" for information on the **PROG** key.

OR

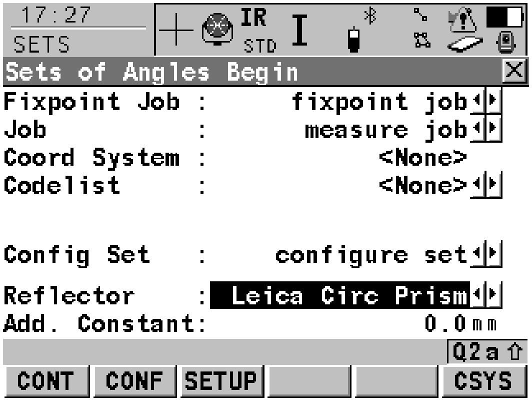
Press a hot key configured to access the screen **SETS Sets of Angles Begin**.

Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

SETS
Sets of Angles Begin



CONT (F1)
To accept changes and access the next screen. The chosen settings become active.

CONF (F2)
To configure the Sets of Angles program. Accesses **SETS Configuration**. Refer to "44.2.2 Configuring Sets of Angles".

SETUP (F3)
To set up the station. Accesses **SETUP Station Setup**.

CSYS (F6)
To select a different coordinate system.

Description of fields

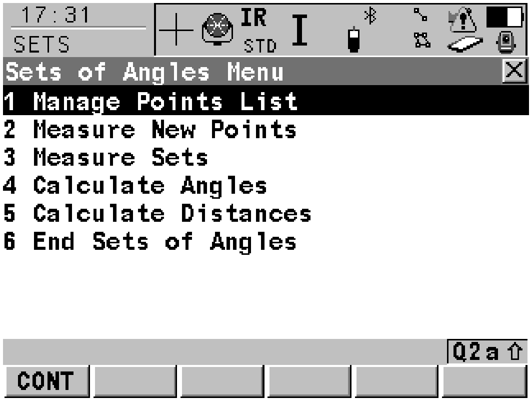
Field	Option	Description
<Fixpoint Job:>	Choicelist	The job where the target points to be observed can be selected and a points list created. All jobs from **Main Menu: Manage...\Jobs** can be selected. Determines the active coordinate system. The data from this job is shown in **MANAGE Data: Job Name**.
<Job:>	Choicelist	The active job. All jobs from **Main Menu: Manage...\Jobs** can be selected. Determines the active coordinate system. The data from this job is shown in **MANAGE Data: Job Name**.
<Coord System:>	Output	The coordinate system currently attached to the selected **<Job:>**.
<Codelist:>	Choicelist	No codes are stored in the selected job. All codelists from **Main Menu: Manage...\Codelists** can be selected.
	Output	Codes have already been stored in the selected job. If codes had been copied from a System RAM codelist, then the name of the codelist is displayed. If codes have not been copied from a System RAM codelist but typed in, then the name of the active job is displayed.

Field	Option	Description
<Config Set:>	Choicelist	The active configuration set. All configuration sets from **Main Menu: Manage...\Configuration Sets** can be selected.
<Reflector:>	Choicelist	The reflector currently set in the selected configuration set. All reflectors from **Main Menu: Manage...\Reflectors** can be selected.
<Add. Constant:>	Output	The additive constant stored with the chosen reflector.

Next step

CONT (F1) accepts the changes and accesses **SETS Sets of Angles Menu**.

SETS Sets of Angles Menu



CONT (F1)
To select the highlighted option and to continue with the next screen.

SHIFT CONF (F2)
To configure the Sets of Angles program. Accesses **SETS Configuration**. Refer to "44.2.2 Configuring Sets of Angles".

Description of Sets of Angles Menu options

SETS menu options	Description	Refer to chapter
Manage Points List	To create, edit and manage a points list of the target points for the survey.	44.2.3
Measure New Points	To define the target points and to measure the first set.	44.2.4
Measure Sets	To measure the second set and any further sets.	44.2.5
Calculate Angles	To calculate horizontal/vertical angles and their residuals.	44.2.6
Calculate Distances	To calculate distances and their residuals.	44.2.6
End Sets of Angles	To end the Sets of Angles program.	

Next step

IF the Sets of Angles application program	THEN
is to be accessed	highlight the relevant option and press **CONT (F1)**. Refer to stated chapters above.
is to be configured	**CONF (F2)**. Refer to "44.2.2 Configuring Sets of Angles".
is to be ended	highlight **End Sets of Angles** and **CONT (F1)**.

44.2.2 Configuring Sets of Angles

Access

Select **Main Menu: Programs...\Sets of Angles**. **CONT (F1)**. In **SETS Sets of Angles Begin** press **CONF (F2)** to access **SETS Configuration, Parameters** page.

OR

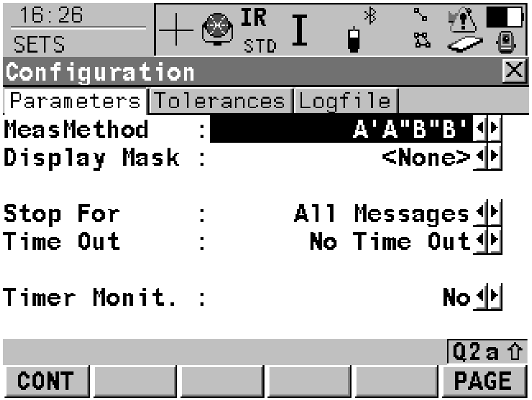
Press **PROG**. Highlight **Sets of Angles**. **CONT (F1)**. In **SETS Sets of Angles Begin** press **CONF (F2)** to access **SETS Configuration, Parameters** page.

OR

Press **SHIFT CONF (F2)** in **SETS Sets of Angles Menu**.

SETS Configuration, Parameters page

This screen consists of the **Parameters** page, the **Tolerances** page and the **Logfile** page. The explanations for the softkeys given below are valid for all pages, unless otherwise stated



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

DEFLT (F5)
Available for default configuration sets. To recall the default settings.

PAGE (F6)
To change to another page on this screen.

SHIFT ABOUT (F5)
To display information about the program name, the version number, the date of the version, the copyright and the article number.

Description of fields

Field	Option	Description
<MeasMethod:>		• Determines the order in which the target points are to be measured.
	$\mathbf{A^{I}A^{II}B^{II}B^{I}}$	• The target points are measured in face **I** and face **II**. • point A **I** - point A **II** - point B **II** - point B **I** ...
	$\mathbf{A^{I}A^{II}B^{I}B^{II}}$	• The target points are measured in face **I** and face **II**. • point A **I** - point A **II** - point B **I** - point B **II** ...
	$\mathbf{A^{I}B^{I}A^{II}B^{II}}$	• The target points are measured in face **I** and face **II**. • point A **I** - point B **I**... point A **II** - point B **II** ...
	$\mathbf{A^{I}B^{I}B^{II}A^{II}}$	• The target points are measured in face **I** and face **II**. • point A **I** - point B **I** ... point B **II** - point A **II** ...
	$\mathbf{A^{I}B^{I}C^{I}D^{I}}$	• The target points are only measured in face **I**. • point A **I** - point B **I** - point C **I** - point D **I** ...
<Display Mask:>	Choicelist	The user defined display mask to be shown in **SETS Select Points - Survey**. All display masks of the active configuration set defined in **CONFIGURE Display Settings** can be selected.
<Stop For:>	Choicelist	To define what action is taken when a message dialog appears during a measurement set.
	All Messages	All message dialogs are displayed as per normal and are closed as defined by the settings in **<Time Out:>**.

Field	Option	Description
	Tol Exceed Only	Only the message dialog relating to the exceeding of tolerances is displayed and is closed as defined by the settings in **<Time Out:>**.
	Never	• No message dialogs are displayed except for specific warnings. • Specific warnings which affect the instrument and it's ability to continue with the monitoring process will be displayed and will remain on the screen. These include the overheating of the instrument, low battery levels, unavailable space on the CompactFlash card.
<Time Out:>		To define the time delay for the automatic closing of message dialogs during a measurement set. This choicelist is not available when **<Stop For: Never>**.
	No Time Out	There is no automatic closure of message dialogs. When a message dialog appears, it is only closed by pressing **YES (F4)**.
	1 sec to **60 sec**	All message dialogs are automatically closed as defined by these individual time settings.
<Timer Monit.:>		This input field is only available when Monitoring is registered through the licence key.
	Yes	Automatic monitoring of target points is activated.
	No	Automatic monitoring of target points is not activated. The Sets of Angles application will apply.

Next step

PAGE (F6) changes to the **Tolerances** page.

SETS Configuration, Tolerances page

Description of fields

Field	Option	Description
<Use Tolerances:>	**Yes** or **No**	The entered horizontal, vertical and distance tolerances are checked during the measurements to verify accurate pointing and measurements.
<Hz Tolerance:>	User input	Tolerance for horizontal directions.
<V Tolerance:>	User input	Tolerance for vertical directions
<Dist Tolerance:>	User input	Tolerance for distances.

Next step

PAGE (F6) changes to the **Logfile** page.

SETS Configuration, Logfile page

Description of fields

Field	Option	Description
<Write Logfile:>	**Yes** or **No**	To generate a logfile when the application program is exited. A logfile is a file to which data from an application program is written to. It is generated using the selected **<Format File:>**.

Field	Option	Description
<File Name:>	Choicelist	Available for **<Write Logfile: Yes>**. The name of the file to which the data should be written. A logfile is stored in the \DATA directory of the active memory device. The data is always appended to the file. Opening the choicelist accesses **XX Logfiles** where a name for a new logfile can be created and an existing logfile can be selected or deleted.
<Format File:>	Choicelist	Available for **<Write Logfile: Yes>**. A format file defines which and how data is written to a logfile. Format files are created using LGO. A format file must first be transferred from the CompactFlash card to the System RAM before it can be selected. Refer to "24 Tools...\Transfer Objects..." for information on how to transfer a format file. Opening the choicelist accesses **XX Format Files** where an existing format file can be selected or deleted.

Next step
PAGE (F6) changes to the first page on this screen.

44.2.3 Managing the Points List

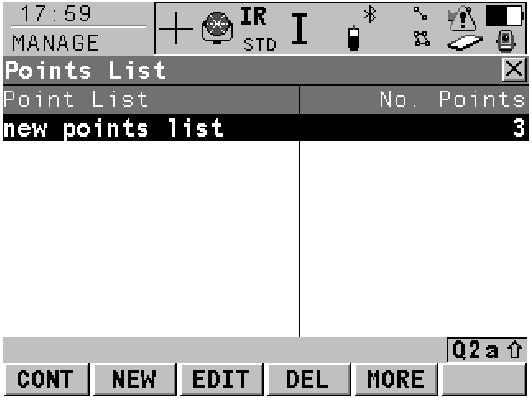
Description

A points list of the target points for the survey can be created, edited and managed. New points are always added from the fixpoint job, as defined in the Sets of Angles Begin screen.

Access

Highlight **Manage Points List** in **SETS Sets of Angles Menu** and **CONT (F1)**.

MANAGE Points List



CONT (F1)
To return to the Sets of Angles Menu.

NEW (F2)
To create a new points list.

EDIT (F3)
To edit an existing points list.

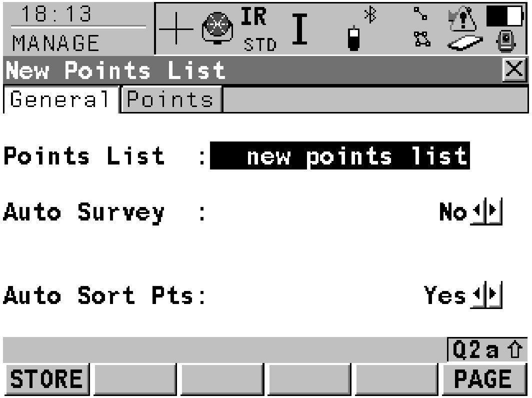
DEL (F4)
To delete an existing points list.

MORE (F5)
To display additional information.

SHIFT HOME (F2)
To move the focus to the top of all the lists.

SHIFT END (F3)
To move the focus to the end of all the lists.

MANAGE
New Points List, General page

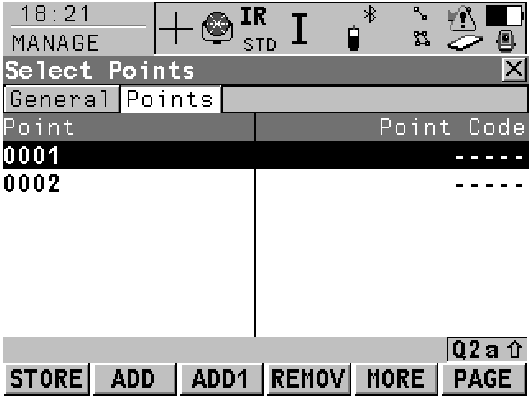


STORE (F1)
To store the new points list.

Description of fields

Field	Option	Description
<Points List:>	User input	The name of the points list.
<Auto Survey:>	**Yes** or **No**	To automatically survey the target points (the instrument will automatically turn and measure the target point). For instruments with ATR.
<Auto Sort Pts:>	**Yes** or **No**	To automatically sort the target points (the instrument will work in a clockwise direction and find the shortest path to move between the target points).

MANAGE Select Points, Points page



STORE (F1)
To store the points to the list.

ADD (F2)
To add points from the fixpoint job to the list.

ADD 1 (F3)
To add one point from the fixpoint job to the list.

REMOV (F4)
To remove the highlighted point from the list. The point itself is not deleted.

MORE (F5)
To display additional information.

44.2.4 Measuring the New Points

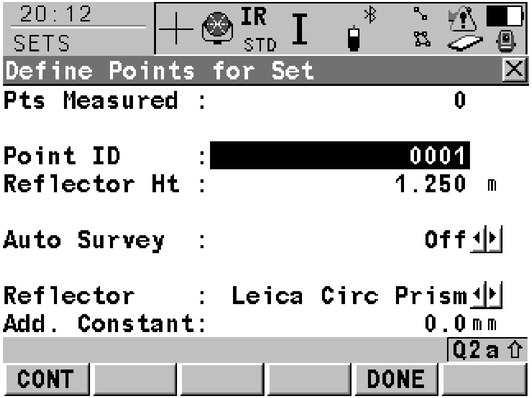
Description

The points to be used for Sets of Angles can be selected and the first set measured. The measurement settings of the first measurement to each point are used for all further sets.

Access

Highlight **Measure New Points** in **SETS Sets of Angles Menu** and **CONT (F1)**.

SETS
Define Points for Set



CONT (F1)
To measure the entered point and to access **SETS Select Points - Survey**.

DONE (F5)
To finish selection of points and access **SETS Sets of Angles Menu** for further steps.

SHIFT GETPT (F4)
To select points stored in the database.

SHIFT INDIV (F5) and **SHIFT RUN (F5)**
To change between entering an individual point ID different to the defined ID template and the running point ID according to the ID template. Refer to "16.1 ID Templates" for more information on point ID templates.

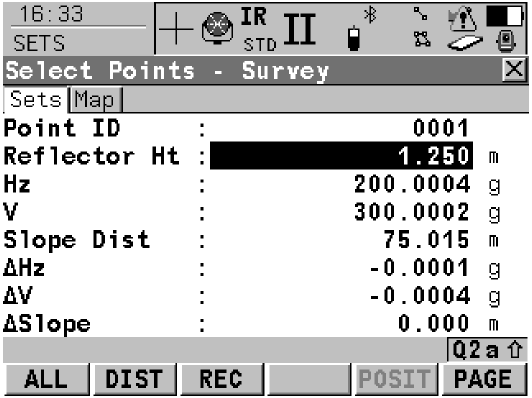
Description of fields

Field	Option	Description
<Auto Survey:>	**On** or **Off**	For instruments with ATR and **<Auto Survey: On>** ATR search and ATR measurements are done to specified targets in additional sets.

Next step

IF points	THEN
are to be measured	**CONT (F1)** to access **SETS Select Points - Survey**.
are to be taken from the database	**SHIFT GETPT (F4)** to access **SETS Data: Job Name**.
are not to be selected	**DONE (F5)** to access **SETS Sets of Angles Menu**.

SETS
Select Points - Survey, Sets page



ALL (F1)
To measure and store angles and distance and to return to **SETS Define Points for Set**.

DIST (F2)
To measure a distance.

REC (F3)
To store data and to return to **SETS Define Points for Set**.

POSIT (F5)
To position the instrument to the selected target point.

PAGE (F6)
To change to another page on this screen.

Description of fields
The fields are the same as in **SETS Set XX of XX, Pt XX of XX**.

Next step
ALL (F1) to measure and store and to return to **SETS Define Points for Set**.

Select points step-by-step

The step-by-step description explains how to measure points if **<MeasMethod: $A^{I}B^{I}B^{II}A^{II}$>** and **<Auto Survey: On>** are set.

Step	Description
1.	**SETS Define Points for Set**
2.	Is a point to be selected from the database?

Step	Description
	• If **yes**, continue with step 3. • If **no**, continue with step 5.
3.	**SHIFT GETPT (F4)** to access **SETS Data: Job Name**.
4.	**SETS Data: Job Name** Highlight the desired point and **CONT (F1)** to access **SETS Select Points**. Continue with step 6.
5.	Type in **<Point ID:>** if new or different point ID is required.
6.	**CONT (F1)** to access **SETS Select Points - Survey**.
7.	**SETS Select Points - Survey** **ALL (F1)** to measure and store angles and distance and return to **SETS Define Points For Set**.
8.	Repeat step 2. to step 7. until all points are selected
9.	**DONE (F5)** to end selection of points.

☞ If **<Auto Survey: On>**, instruments with ATR automatically measure the selected points in the second face of the first set.

44.2.5 Measuring the Sets

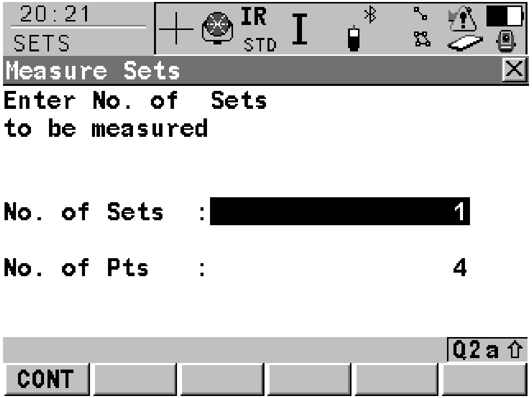
Description

The selected points from **SETS Measure New Points** are used for measuring further sets. The settings of measurements are taken from the first measurement to each target.

Access

Highlight **Measure Sets** in **SETS Sets of Angles Menu** and **CONT (F1)**.

SETS Measure Sets



CONT (F1):
Opens **SETS Point Measurement - Survey** to measure the points. For **<Auto Survey: On>** measurements are done automatically.

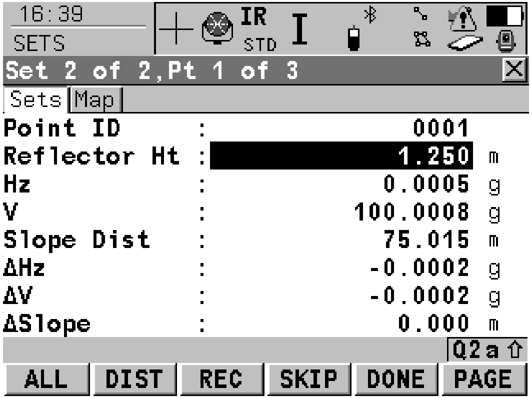
Description of fields

Field	Option	Description
<No. of Sets:>	User input	The number of sets to measure with the target points. There is a maximum of 99 sets allowed.
<No. of Pts:>	Output	The number of target points.

Next step

CONT (F1) to measure further sets of the defined points.

SETS
Set XX of XX,
Pt XX of XX,
Sets page



ALL (F1)
To measure and store angles and distances and to increment to next point.

DIST (F2)
To measure a distance.

REC (F3)
To store data and to increment to next point.

SKIP (F4)
To skip measuring the displayed point and continue with the next point.

DONE (F5)
To end the sets of angles measurements and to return to **SETS Sets of Angles Menu**.

PAGE (F6)
To change to another page on this screen.

SHIFT POSIT (F5)
To position the instrument to the selected target point.

Description of fields

Field	Option	Description
<Δ Hz:>	Output	Difference between the current horizontal angle and the horizontal angle to this target when selected.

Field	Option	Description
<Δ V:>	Output	Difference between the current vertical angle and the horizontal angle to this target when selected.
<Δ Slope:>	Output	Difference between the current slope distance to the target and the slope distance to this target when selected.

Next step

ALL (F1) to measure further sets of the selected points.

☞

- Motorised instruments point automatically in the direction of the targets.
- Instruments with ATR and **<Auto Survey: On>** measure the targets automatically.

Measure sets step-by-step

Step	Description
1.	Refer to " Select points step-by-step" for information on how to select points.
2.	**SETS Measure Sets** **<No. of Sets:>** enter the number of sets to be measured.
3.	**CONT (F1)** to access **SETS Set XX of XX, Pt XX of XX, Sets** page. • motorised instruments measure the targets automatically. • non motorised instruments guide to the next point to be measured; follow the instructions given.
4.	**SETS Set XX of XX, Pt XX of XX, Sets** page. **ALL (F1)** to measure and record.

Step	Description
☞	**SKIP (F4)** to skip the measurement of a point. Sets with incomplete measurements are not stored.
5.	Repeat step 4. until all sets are measured.
6.	**DONE (F5)** or automatic after all sets are measured to access **SETS Sets of Angles Menu**. Calculations can be done now.

☞ For the calculation two entire sets must be measured. Horizontal and vertical angles and distances can be calculated individually.

44.2.6 Calculations - Calculating Angles and Distances in Two Faces

Description

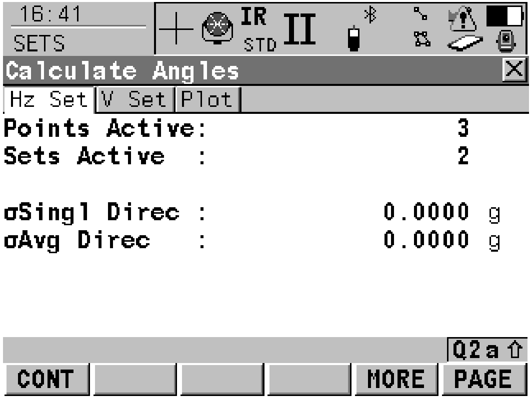
For two and more sets measured with angles and distances in two faces calculations can be done for angles and distances. For sets measured in one face the results can be viewed but no calculations are done. Refer to "44.2.8 Calculations - Viewing Results in One Face" for more information.

Access

Highlight **Calculate Angles** in **SETS Sets of Angles Menu** and **CONT (F1)**.

SETS Calculate XX, XX Set page

The softkeys are the same for vertical angles, horizontal angles and for distances.



CONT (F1)
To access **SETS Sets of Angles Menu**.

MORE (F5)
To view results of calculation.

PAGE (F6)
To change to another page on this screen.

Description of fields

Field	Option	Description
<Points Active:>	Output	Number of active points which are set to **On** in the **Use** column and used for calculation.
<Sets Active:>	Output	Number of active sets which are set to **On** in the **Use** column and used for calculation.
<σSingl Direc:>	Output	Standard deviation of a single horizontal or vertical direction.
<σSingl Dist:>	Output	Standard deviation of a single distance.
<σAvg Direc:>	Output	Standard deviation of the average horizontal or vertical direction.
<σAvg Dist:>	Output	Standard deviation of the average distance.

Next step

IF	THEN
calculations are to be exited	**CONT (F1)** to access **SETS Sets of Angles Menu**.
results are to be viewed	**MORE (F5)** to access **SETS View XX Results**.

SETS Calculate XX, Plot page

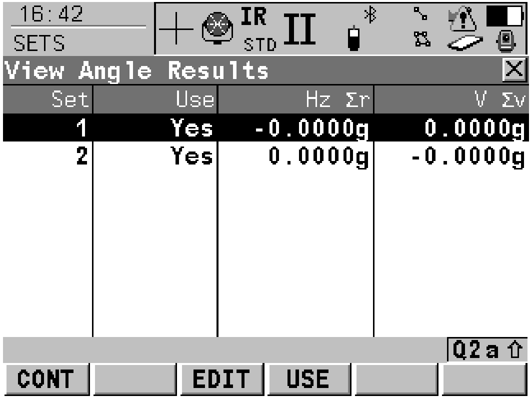
The functionality and softkeys available are described in the MapView chapter. Refer to "34.6 Plot Mode - MapView Screen Area" for information functionality.

44.2.7 Calculations - Viewing Angle and Distance Results in Two Faces

Access

Press **MORE (F5)** in **SETS Calculate Angles or SETS Calculate Distances**

SETS
View XX Results



CONT (F1)
To access **SETS Calculate XX**.

EDIT (F3)
To access **SETS View Residuals in Set XX**.

USE (F4)
To set **Yes** or **No** in the **Use** column for the highlighted set.

Description of columns

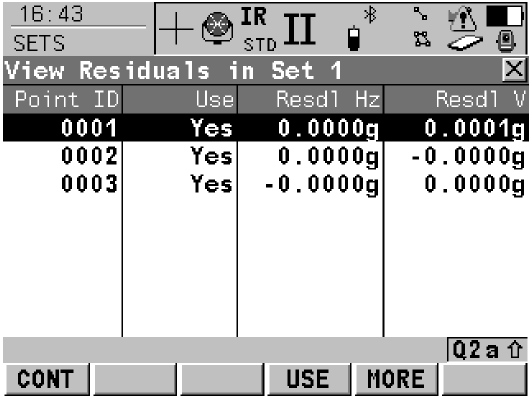
Column	Description
Set	Displays the numbers of all sets measured.
Use	For **Yes**: The selected set is used for calculations. For **No**: The selected set is not used for calculations.
Hz Σr	Shows the calculated Σr in Hz of the selected set. Σr is the sum of the difference between the reduced average direction and each sets directions. For sets not used for calculation ----- is shown.

Column	Description
V Σr	Shows the calculated Σr in V of the selected set. Σr is the sum of the difference between the average V angles and each sets V angles. For sets not used for calculation ----- is shown.

Next step

IF	THEN
results of a single set are to be edited	**EDIT (F3)** to access **SETS View Residuals in Set XX**.
results are to be exited	**CONT (F1)** to access **SETS Calculate XX**.
the setting for use is to be changed	**USE (F4)** to change between **Yes** and **No** for the highlighted set.

SETS
View Residuals in Set XX



CONT (F1)
To access **SETS View XX Results**.

USE (F4)
To set **Yes** or **No** in the **Use** column for the highlighted point.

MORE (F5)
To view additional information.

Description of columns when calculating angles

Column	Description
Point ID	• This column is always visible. • Point ID of the measured points in the order they were defined and measured in **SETS Measure New Points** truncated to six digits from the right.
	• The following three columns appear together. By pressing **MORE (F5)** these columns are replaced with other columns.
Use	• For **Yes**: The selected point is used for calculations in all sets. • For **No**: The selected point is not used for calculations in all sets.
Resdl Hz	• Residual in the Hz value of the selected point within the single set.

Column	Description
Resdl V	• Residual in the V value of the selected point within the single set.
	• The following two columns appear together. By pressing **MORE (F5)** these columns are replaced with other columns.
Avg Hz	• Reduced Average Hz value of the point in all active sets.
Avg V	• Average V value of the point in all active sets.
	• The following two columns appear together. By pressing **MORE (F5)** these columns are replaced with other columns.
Mean Hz	• Mean Hz value of the point within the single set.
Mean V	• Mean V value of the point within the single set.

Description of columns when calculating distances

Column	Description
Point ID	• This column is always visible. • Point ID of the measured points in the order they were defined and measured in **SETS Measure New Points** truncated to six digits from the right.
	• The following three columns appear together. By pressing **MORE (F5)** these columns are replaced with other columns.
Use	• For **Yes**: The selected point is used for calculations in all sets. • For **No**: The selected point is not used for calculations in all sets.
Resdl SD	• Residual in the distance value of the point within the single set.

Column	Description
Avg SD	• Average distance value of the point in all active sets.
	• The following column appears. By pressing **MORE (F5)** this column is replaced with other columns.
Mean SD	• Mean distance value of the point within the single set.

Next step

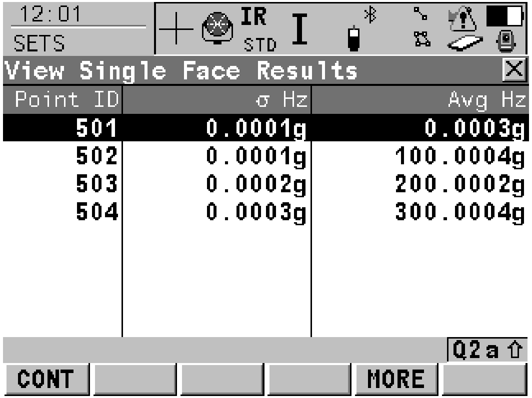
IF	THEN
additional information is to be viewed	**MORE (F5)** to show additional information.
residuals are to be exited	**CONT (F1)** to access **SETS View XX Results**.
the setting for use is to be changed	**USE (F4)** to change between **Yes** and **No** for the highlighted point.

44.2.8 Calculations - Viewing Results in One Face

Access

Highlight **Calculate XX** in **SETS Sets of Angles Menu** and press **CONT (F1)**.

SETS
View Single Face
Results



CONT (F1)
To access **SETS Sets of Angles Menu**.

MORE (F5)
To view additional columns.

Description of columns

Column	Description
Point ID	Point ID of the measured points in the order they were defined and measured in **SETS Measure New Points** truncated to six digits from the right.
σ Hz	Standard deviation of all Hz readings to the point.
Mean Hz	Mean value of all Hz readings to the current point.
σ V	Standard deviation of all V readings to the current point.

Column	Description
Mean V	Mean value of all V readings to the current point.
σ Dist	Standard deviation of all distance measurements to the current point.
Mean SD	Mean value of all distance measurements to the current point.

Next step

IF	THEN
other columns are to be viewed	**MORE (F5)** to view additional columns.
viewing results is to be exited	**CONT (F1)** to access **SETS Sets of Angles Menu**. Refer to "44.2.1 Accessing Sets of Angles".

44.3 Monitoring

Description

- Monitoring is a module integrated within the Sets of Angles application program.
- Monitoring uses a timer to enable repeated and automated angle and distances measurements to pre-defined target points at defined intervals. The ability to configure the handling of message dialogs during measurement sets is also enabled.

Important aspects

- For monitoring, instruments must be motorised.

Access

- Monitoring is licence protected and is only activated through a licence key. The licence key can be entered manually or loaded from the CompactFlash card.
- Refer to "44.2.1 Accessing Sets of Angles" for details on accessing Monitoring.

Monitoring preparation

- This step-by-step desciption is an example on preparing a set for monitoring.
- Refer to "44.2 Sets of Angles" for a complete description of the Sets of Angles program.

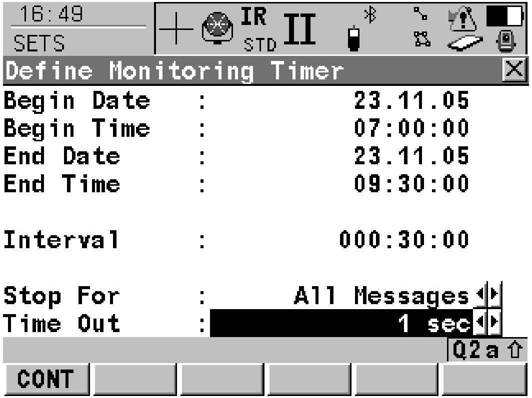
Step	Description
1.	From **Main Menu: Programs...** select **Sets of Angles**.
1.	Press **CONT (F1)** to access the **SETS Sets of Angles Begin** screen.
2.	Set station coordinates and station orientation - **SETUP (F3)**.
3.	Configure Sets of Angles for monitoring - **CONF (F2)**. For the **Parameters** page: • **<MeasMethod: $A^{I}B^{I}B^{II}A^{II}$>** (for example purposes only). • **<Display Mask: None>** (for example purposes only). • **<Stop For: All Messages>** (for example purposes only).

Step	Description
	• **<Time Out: 10 secs>** (for example purposes only). • **<Timer Monit.: Yes>** (this option must be selected for monitoring). This will enable the access to the **SETS Define Monitoring Timer** screen.
4.	Press **CONT (F1)** to access the **SETS Sets of Angles Menu** screen.
5.	Select **Measure New Points**.
6.	Press **CONT (F1)** to access the **SETS Define Points for Set** screen
7.	Enter details of the target point as required. For each target point, ensure that **<Auto Survey: On>** is set. This will enable the automated measurement and recording of the target point in the other face and the automated measurement and recording of all target points during monitoring.
8.	Press **CONT (F1)** to access the **SETS Select Points - Survey** screen.
9.	Measure and record the measurement to the target point as required.
10.	Continue with steps 7/8/9 until all target points for the first measurement set have been measured and recorded.
11.	Press **DONE (F5)** to complete the selection of the target points for the first measurement set in one face and to begin the measurement of the target points in the other face. On completion the **SETS Sets of Angles Menu** screen will be accessed.
12.	Select **Measure Sets**.
13.	Press **CONT (F1)** to access the **SETS Define Monitoring Timer** screen. Refer to "SETS Define Monitoring Timer" for information about the screen.

SETS Define Monitoring Timer

Decription

- This screen enables the entry of dates, times, intervals and the handling of message dialogs during a measurement set. When all required information is entered press **CONT (F1)** to begin the monitoring process.



CONT (F1)
To begin the monitoring process.

Description of fields

- The format of all date and time input fields is defined in **CONFIGURE Units and Formats**.
- The format of the interval input field is hh:mm:ss.

Field	Option	Description
<Begin Date:>	User Input	Start date for monitoring.
<Begin Time:>	User Input	Start time for monitoring.
<End Date:>	User Input	End date for monitoring.

Field	Option	Description
<End Time:>	User Input	End time for monitoring.
<Interval:>	User Input	The time between the start of each scheduled measurement set.
<Stop For:>	Choicelist	• To define what action is taken when a message dialog appears during a measurement set. • The setting for this input field has already been defined in the configuration. Here, it can be changed if required, before starting the monitoring process.
<Time Out:>	Choicelist	• To define the time delay for the automatic closing of message dialogs during a measurement set. This choicelist is not available when **<Stop For: Never>**. • The setting for this input field has already been defined in the configuration. Here, it can be changed if required, before starting the monitoring process.

Monitoring interval

Description

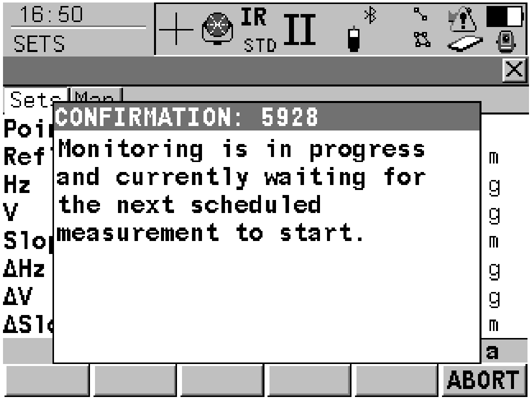
- The times and dates entered define the time frame for the monitoring.
- The time interval defines the starting time for each measurement set which is from **<Begin Time:>** to the next **<Begin Time:>**.

Example

- Data - 3 target points; 4 measure sets; Begin Date: 20.04.2002; Begin Time: 14:00:00; End Date 23.04.2002; End Time 14:00:00; Interval 30 min
- Results - The time taken to measure 4 sets of 3 target points in both faces is 10 minutes. The measurements will start at 14:00:00 on 20.04.2002. At 14:10:00 the first measurement set is complete. The instrument will wait until 14:30:00 for the next scheduled measurement set.

Monitoring in progress

This screen displays a notice that monitoring is in progress.



ABORT (F6)
To stop the monitoring process and return to the **SETS Sets of Angles Menu** screen.

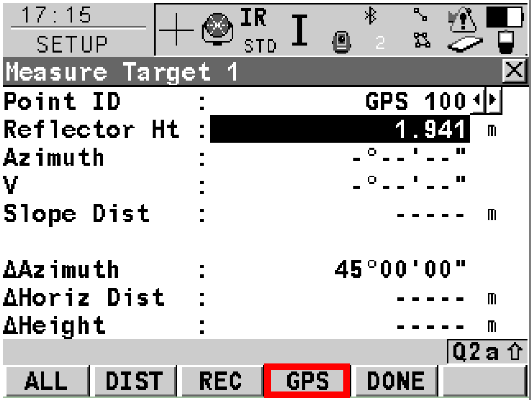
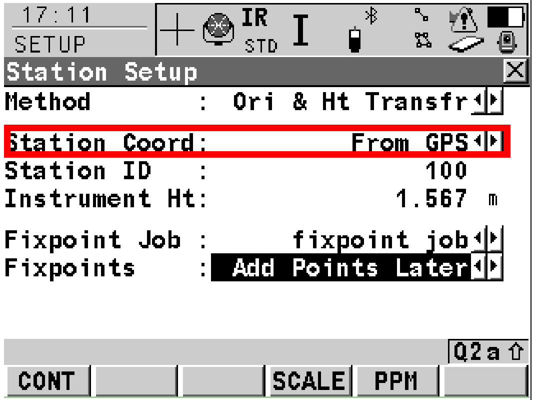
Calculations

Refer to "44.2 Sets of Angles" for information about calculations and the viewing of results.

45 Setup

45.1 Overview

Description

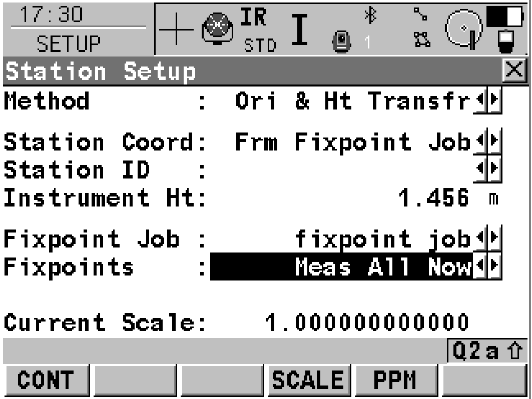
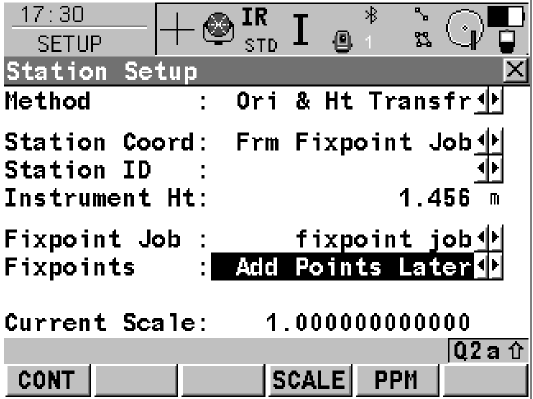
<table>
<tr><th colspan="2">Setup</th></tr>
<tr><td colspan="2">The Setup program is used when setting up a TPS station, to determine the TPS station coordinates (with TPS and/or GPS measurements) and setting the TPS orientation.</td></tr>
<tr><th>Setup with GPS, using SmartPole</th><th>Setup with GPS, using SmartStation</th></tr>
<tr><td>SmartPole enables target points to to be determined from GPS measurements, which can then be used as control points for the TPS station setup.</td><td>SmartStation enables TPS station coordinates (position and height) to be determined from GPS measurements.</td></tr>
<tr><td>
</td><td>
</td></tr>
</table>

Setup methods

Setup Method	"Standard" setup type	"On-the-Fly" setup type	Methods for TPS1200	Methods for SmartPole	Methods for SmartStation
Set Azimuth	✓		✓		✓
Known Backsight Point	✓		✓	✓	✓
Orientation & Height Transfer	✓	✓	✓	✓	✓
Resection	✓	✓	✓	✓	
Resection Helmert	✓	✓	✓	✓	
Local Resection	✓		✓		

- Each setup method requires different input data and a different number of target points.
- All setup methods are described in "45.6 Setup Methods".

Setup types

"Standard" setup	"On-the-Fly" setup
This type of setup is the traditional type. The user must always measure all setup points consecutively to complete the setup. The TPS station coordinates and TPS orientation must be set before measuring survey points.	This setup allows the user to measure setup points and survey points as they work or "on the fly". The TPS station coordinates and TPS orientation do not have to be set before measuring survey points. This can be done at anytime during the survey.
Fixpoints=Meas All Now must be set.	**Fixpoints=Add Points Later** must be set.
	
	This setup can only be used when measuring survey points. When staking out points, the TPS station coordinates and TPS orientation must first be set.

Incomplete setups

- For a "Standard" setup, the user must always measure all setup points consecutively to complete the setup. This type of setup is always regarded as a complete setup.
- For an "On-the-Fly" setup, the setup points can be measured together with the survey points. It is not necessary to complete the setup before measuring survey points. In this state, this type of setup is regarded as an incomplete setup.

An incomplete setup can be accessed in the following ways:		
1.	When pressing **SETUP (F3)** in the Begin screen of a program (other than Setup), a message is displayed to notify that the setup is incomplete. It is then possible to:	
	a) start Setup and continue to measure additional fixpoints, or	**OK (F4)**
	b) start Setup and create a new station setup, or	**NEW (F2)**
	c) leave Setup and continue with the existing program	**ABORT (F6)**
2.	When pressing **CONT (F1)** in the Begin screen of any program, a message is displayed to notify that the setup is incomplete. It is then possible to:	
	a) continue with the existing program*, or	**CONT (F1)**
	b) start Setup and create a new station setup, or	**NEW (F3)**
	c) start Setup and continue to measure additional fixpoints.	**SETUP (F6)**
3.	Assigning the function **FUNC Continue Open Setup** to the User Menu or a Hot Key.	

* The Setup Reminder screen (if it has been set) is not displayed in this instance.
In the Survey program, Setup can be accessed by **SETUP (F5)**.

Properties of setup points

TPS Points

The properties stored with a TPS point are:

Type	Station	Target
Class	**REF**	**MEAS** or **NONE**
Sub class	**TPS**	**TPS**
Source	**Setup (setup method)**	**Setup (setup method)**
Instrument source	**TPS**	**TPS**

GPS points (only applicable when using SmartPole or SmartStation)

The properties stored with a GPS point are:

Type	Station	Station
Class	**MEAS**	**NAV**
Sub class	**GPS Fixed / GPS Code only**	**GPS Code only**
Source	**Setup (setup method)**	**Setup (setup method)**
Instrument source	**GPS**	**GPS**

45.2 Accessing Setup

Access

Select **Main Menu: Programs...\Setup**.

OR

Press **PROG**. Highlight **Setup**. **CONT (F1)**.

Refer to "35.2 Accessing the Programs Menu" for details on the **PROG** key.

OR

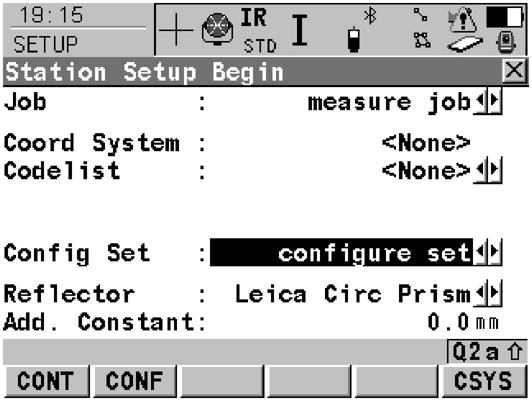
Press **USER** (configuring the User Menu to include the Setup program).

Refer to "2.2 USER Key" for details on the **USER** key.

OR

Press **SETUP (F3)** in the **Begin** screen of another program (other than Setup).

SETUP
Station Setup Begin



CONT (F1)
To accept changes and access the subsequent screen. The chosen settings become active.

CONF (F2)
To configure the Setup application program. Accesses **SETUP Configuration**. Refer to "45.3 Configuring Setup".

CSYS (F6)
To select a different coordinate system.

Description of fields

Field	Option	Description
<Job:>	Choicelist	The active job. All jobs from **Main Menu: Manage...\Jobs** can be selected.
<Coord System:>	Output	The coordinate system currently attached to the selected **<Job:>**. A coordinate system is required for a station setup with GPS.
<Codelist:>	Choicelist	No codes are stored in the selected job. All codelists from **Main Menu: Manage...\Codelists** can be selected.
	Output	Codes have already been stored in the selected job. If codes had been copied from a System RAM codelist, then the name of the codelist is displayed. If codes have not been copied from a System RAM codelist but typed in, then the name of the active job is displayed.
<Config Set:>	Choicelist	The active configuration set. All configuration sets from **Main Menu: Manage...\Configuration Sets** can be selected.
<Reflector:>	Choicelist	The reflector currently set in the selected configuration set. All reflectors from **Main Menu: Manage...\Reflectors** can be selected.
<Add. Constant:>	Output	The additive constant stored with the chosen reflector.

Next step

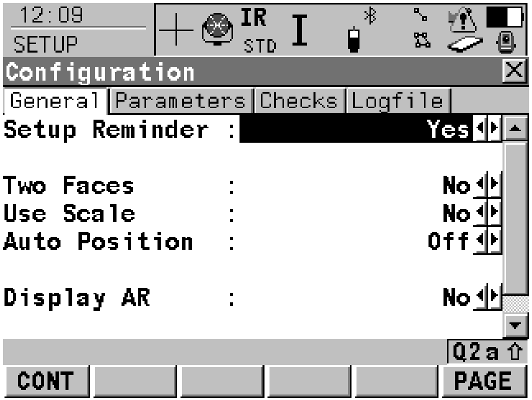
IF the Setup application program	THEN
is to be accessed	**CONT (F1)** to accept the changes and continue.
is to be configured	**CONF (F2)**. Refer to "45.3 Configuring Setup".

45.3 Configuring Setup

Access

Select **Main Menu: Programs...\Setup**.
In SETUP Station Setup Begin press **CONF (F2)** to access **SETUP Configuration**.
OR
Press **PROG**. Highlight **Setup**. **CONT (F1)**.
In SETUP Station Setup Begin press **CONF (F2)** to access **SETUP Configuration**.
OR
Press **SHIFT CONF (F2)** in **SETUP Station Setup**.

SETUP Configuration, General page



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.
PAGE (F6)
To change to another page on this screen.
SHIFT ABOUT (F5)
To display information about the program name, the version number, the date of the version, the copyright and the article number.

Description of fields

Field	Option	Description
<Setup Reminder:>	Choicelist	Current instrument setup details can be displayed to remind the user to either keep the current instrument setup or to create a new instrument setup. Refer to "45.6.1 Setup Reminder" for details.
	Yes	Whenever **CONT (F1)** is pressed in a **Begin** screen, the current setup information is displayed.
	No	Whenever **CONT (F1)** is pressed in a **Begin** screen, the current setup information is not displayed and the program continues as normal.
<Two Faces:>	Choicelist	Defines if the instrument measures the second face automatically after storing the first.
	Yes	After storing a measurement with **ALL (F1)** or **REC (F3)** motorised instruments change face automatically, non-motorised instruments access **SETUP Telescope Positioning**. The measurements of face **I** and face **II** are averaged on the base of face **I**. The averaged value is stored.
	No	No automatic measurement in two faces. For the setup methods **<Method: Set Azimuth>** or **<Method: Known BS Point**> the selected option in the field **<Two Faces:>** is ignored. For these setup methods, measurements are not made in two faces.

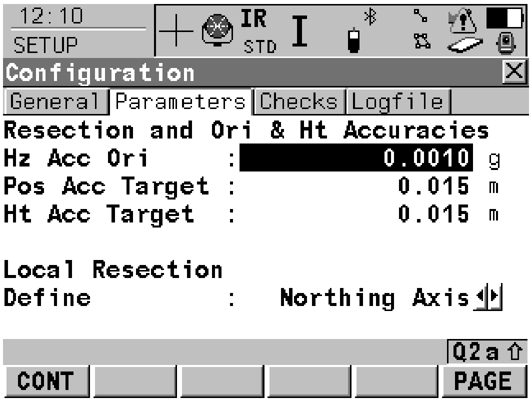
Field	Option	Description
<Use Scale:>	Choicelist	The appearance of the **SETUP Results** screen differs with this setting.
	Yes	The calculated scale factor and ppm value from the resection and orientation and height transfer calculation are displayed in the **SETUP Results, Sigma** page. The ppm value may be set in the system as the geometric ppm value. In **SETUP Station Setup** the **<Current Scale:>** is displayed and **PPM (F5)** is available.
	No	The calculated scale factor from the resection calculation is displayed in the **SETUP Results, Sigma** page but cannot be set as the geometric ppm value.
<Auto Position:>	**2D**	Instrument positions horizontally to the point.
	3D	Instrument positions horizontally and vertically to the point.
	Off	Instrument does not position to the point.
<Display AR:>	Choicelist	To set the direction to the backsight point to zero.
	Yes	Sets **<AR: 0.0000>** towards the backsight point. If set in the current display mask, **<AR:>** displays the horizontal angle difference between the backsight point and the measured point. This has no effect on the set orientation.

Field	Option	Description
	No	Does not set a value for **<AR:>**. If the display mask is configured to display **<AR:>** in the Survey application program, the value is identical to the azimuth. If **<Set Angle Right: Yes>** and more than one backsight point is used, the behaviour is as for **<Set Angle Right: No>**.
<Antenna:>	Choicelist	Applicable when the SmartAntenna is connected. Opening the choicelist accesses **MANAGE Antennas**. The default antenna is the SmartAntenna.

Next step

PAGE (F6) changes to the **Parameters** page.

SETUP Configuration, Parameters page



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

PAGE (F6)
To change to another page on this screen.

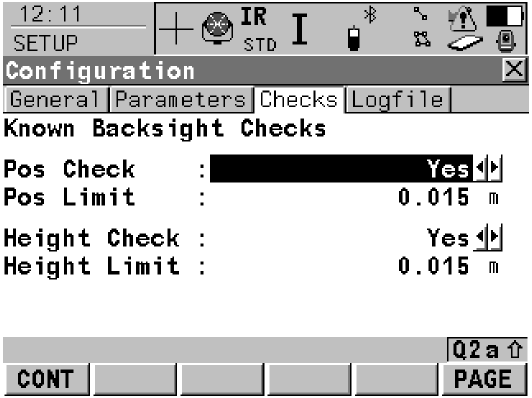
SHIFT ABOUT (F5)
To display information about the program name, the version number, the date of the version, the copyright and the article number.

Description of fields

Field	Option	Description
When Method=Resections, Ori & Ht Transfer, the following fields apply:		
<Hz Acc Ori:>	User input	For Resection or Orientation and Height Transfer. Limit for the standard deviation of the orientation for resection and orientation and height transfer.
<Pos Acc Target:>	User input	For Resection or Orientation and Height Transfer. Position accuracy of the target point for resection and orientation and height transfer.
<Ht Acc Target:>	User input	For Resection or Orientation and Height Transfer. Height accuracy of the target point for resection and orientation and height transfer.
When Method=Local Resection, the following fields apply:		
<Define:>	Choicelist	For Local Resection. To define the positive North or positive East axis.
	Northing Axis	The second point measured defines the direction of the positive North axis.
	Easting Axis	The second point measured defines the direction of the positive East axis.
When Method=Resection Helmert, the following fields apply:		
<Weighting:>	**1/Distance** or **1/Distance**^{2}	To change the distance weighting that is used in the calculation of the station height in the resection.

Next step
PAGE (F6) changes to the **Checks** page.

SETUP Configuration, Checks page



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

PAGE (F6)
To change to another page on this screen.

SHIFT ABOUT (F5)
To display information about the program name, the version number, the date of the version, the copyright and the article number.

Description of fields

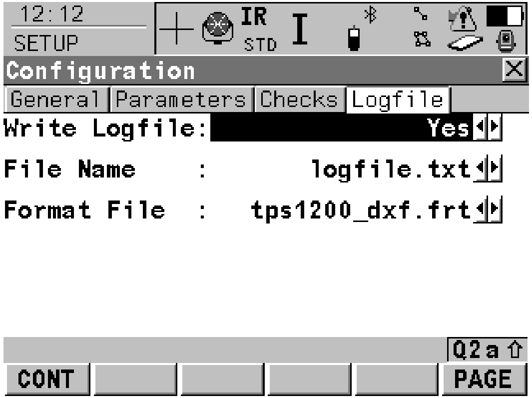
Field	Option	Description
When Method=Known BS Point, the following fields apply:		
<Pos Check:>	**Yes** or **No**	Allows a check to be made on the horizontal coordinate difference between the existing and the measured known backsight point. If the defined **<Pos Limit:>** is exceeded, the setup can be repeated, skipped or stored.

Field	Option	Description
<Pos Limit:>	User input	Available for **<Pos Check: Yes>**. Sets the maximum horizontal coordinate difference accepted in the position check.
<Height Check:>	**Yes** or **No**	Allows a check to be made on the vertical difference between the existing and the measured known backsight point. If the **<Height Limit:>** is exceeded, the stakeout can be repeated, skipped or stored.
<Height Limit:>	User input	Available for **<Height Check: Yes>**. Sets the maximum vertical difference accepted in the height check.

Next step

PAGE (F6) changes to the **Logfile** page.

SETUP Configuration, Logfile page



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

PAGE (F6)
To change to another page on this screen.

SHIFT ABOUT (F5)
To display information about the program name, the version number, the date of the version, the copyright and the article number.

Description of fields

Field	Option	Description
<Write Logfile:>	**Yes** or **No**	To generate a logfile when the application program is exited. A logfile is a file to which data from an application program is written to. It is generated using the selected **<Format File:>**.
<File Name:>	Choicelist	Available for **<Write Logfile: Yes>**. The name of the file to which the data should be written. A logfile is stored in the \DATA directory of the active memory device. The data is always appended to the file.

Field	Option	Description
		Opening the choicelist accesses **Logfiles** where a name for a new logfile can be created and an existing logfile can be selected or deleted.
<Format File:>	Choicelist	Available for **<Write Logfile: Yes>**. A format file defines which and how data is written to a logfile. Format files are created using LGO. A format file must first be transferred from the CompactFlash card to the System RAM before it can be selected. Refer to "24 Tools...\Transfer Objects..." for information on how to transfer a format file. Opening the choicelist accesses **Format Files** where an existing format file can be selected or deleted.

Next step

PAGE (F6) changes to the first page on this screen.

45.4 Setup with SmartStation

Access step-by-step

	Description
1.	Access **SETUP Station Setup Begin**.
2.	**SETUP Station Setup Begin** Check the settings and ensure that a coordinate system other than <None> or WGS84 is selected and attached to the active job.
3.	**CONT (F1)** to access **SETUP Station Setup**.

4.	**SETUP Station Setup**
	• Choose one of the following setup methods:
	  • **<Method: Set Azimuth>** or
	  • **<Method: Known BS Point>** or
	  • **<Method: Ori & Ht Transfr>**.
	• These are the only methods applicable for a setup with SmartStation.
	• All setup methods are described in "45.6 Setup Methods".

	<Station Coord: From GPS>. Ensure that the SmartAntenna is connected and the interface is set. **<Station ID:>** Enter the instrument station. **<Instrument Ht:>** Enter the height of the instrument station.
5.	**CONT (F1)** to access **SETUP New Station Point**. If a coordinate system has not been selected:

	Description
	• **LOCAL (F5)** to access **SETUP SmartStation One Pt OneStep** to enter local coordinates for the setup point and a name for the local coordinate system. • **CSYS (F6)** to access **SETUP Coordinate Systems** to select an existing coordinate system. In this screen the creating and editing of coordinate systems is also available.
6.	**SETUP New Station Point** • **OCUPY (F1)** To start the point occupation. • **STOP (F1)** To end the point occupation. • **STORE (F1)** To store the point information.

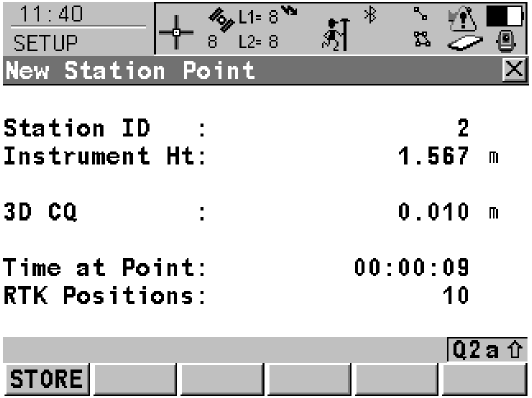
SETUP New Station Point

Overview of the screen

Important feaures about this screen:

- Upon entering **SETUP New Station Point** SmartStation switches into GPS mode.
- The display mask for **SETUP New Station Point** is fixed and is not configurable.
- A coordinate system for the setup is required and should be attached to the active job.
- If not already on, SmartAntenna is automatically turned on upon entry to the screen.
- Some of the screen icons change from TPS specific to GPS specific.
- The occupation/storing behaviour is dependent on the configuration settings.

Screen display



OCUPY (F1)
To start logging of static observations. The position mode icon changes to the static icon. **(F1)** changes to **STOP**.

STOP (F1)
To end logging of static observations when enough data is collected. When **<Auto STOP: Yes>** in **CONFIGURE Point Occupation Settings**, logging of static observations ends automatically as defined by the stop criteria. The position mode icon changes to the moving icon. **(F1)** changes to **STORE**.

STORE (F1)
To store the measured point. When **<Auto STORE: Yes>** in **CONFIGURE Point Occupation Settings**, the measured point is stored automatically. **(F1)** changes to **OCUPY**.
It may happen that a point with the same point ID exists in the job.

SHIFT CONEC (F3) and **SHIFT DISCO (F3)**
To dial the number of the reference station configured in the active configuration set and to hang up immediately after the survey is completed. Available for GPS real-time devices of type digital cellular phone or modem. Available for **<Auto CONEC: No>** in **CONFIGURE GSM Connection**.

SHIFT INIT (F4)
To select an initialisation method and to force a new initialisation. Available for configuration sets allowing phase fixed solutions.

Description of fields

Field	Option	Description
<Station ID:>	Output	Station ID as entered in **SETUP Station Setup**.
<Instrument Ht:>	Output	Instrument height as entered in **SETUP Station Setup**. SmartAntenna offset is automatically added but not displayed.
<3D CQ:>	Output	The current 3D coordinate quality of the computed position.
<Time at Point:>	Output	The time from when the point is occupied until point occupation is stopped.
<RTK Positions:>	Output	The number of GPS real-time positions recorded over the period of point occupation.
<Msd PP Obs:>	Output	The number of static observations recorded over the period of point occupation. Available only when the recording of static observations is configured. Refer to "22.6 Logging of Raw Obs" for details.

Next step

STOP (F1) to end the point occupation,
STORE (F1) to store the point and then return to **SETUP Set Stn & Ori - Setup Method**.

45.5 Setup with SmartPole

Access step-by-step

	Description
1.	Access **SETUP Station Setup Begin**.
2.	**SETUP Station Setup Begin** Check the settings and ensure that a coordinate system other than <None> or WGS84 is selected and attached to the active job.
3.	**CONT (F1)** to access **SETUP Station Setup**.

4.	**SETUP Station Setup**
	• Choose one of the following setup methods:
	  • **<Method: Known BS Point>** or
	  • **<Method: Ori & Ht Transfr>**, or
	  • **<Method: Resection>** or
	  • **<Method: Resection Helmert>**.
	• These are the only methods applicable for a setup with SmartPole.
	• All setup methods are described in "45.6 Setup Methods".

5.	**<Station Coord:>** If available, select the source for the instrument station coordinates **<Station ID:>** Enter/Select the instrument station **<Instrument Ht:>** Enter the height of the instrument station **<Fixpoint Job:>** Select the fixpoint job of the control/target points
6.	**<Fixpoints:>** If available, select the method for measuring the control/target points. Select **Meas All Now** if a "Standard" setup is required.

	Description
	Select **Add Points Later** if an "On-the-Fly" setup is required.
	Steps 7. and 8. do not relate to **<Method: Known BS Point>**.
7.	**CONT (F1)** to access **SETUP Measure Target 1**.
8.	**SETUP Measure Target 1** Refer to "45.6.4 Orientation and Height Transfer" for details on all fields and keys.
9.	**GPS (F4)** to access **SETUP Survey Survey**.
10.	**SETUP Survey Survey** This is the GPS Survey screen within the Setup program. The target points can be measured with GPS, which can then be used as fixpoints for the station setup. • **OCUPY (F1)** To start the point occupation. • **STOP (F1)** To end the point occupation. • **STORE (F1)** To store the point information.

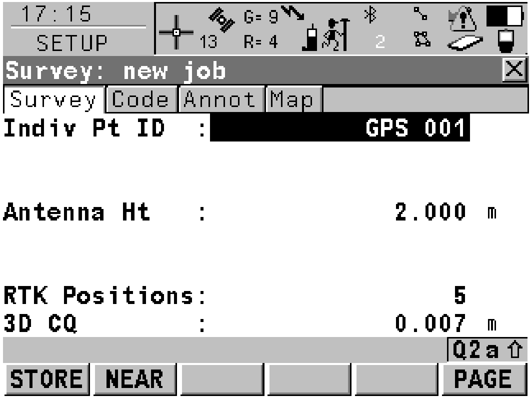
SETUP Survey Survey

Overview of the screen

Important feaures about this screen:

- Upon entering **SETUP** Survey Survey SmartPole switches into GPS mode.
- The display mask for **SETUP** Survey Survey is configurable.
- A coordinate system for the setup is required and should be attached to the active job.
- If not already on, SmartAntenna is automatically turned on upon entry to the screen.
- Some of the screen icons change from TPS specific to GPS specific.
- The occupation/storing behaviour is dependent on the configuration settings.

Screen display



OCUPY (F1)
Refer to "45.4 Setup with SmartStation".

STOP (F1)
Refer to "45.4 Setup with SmartStation".

STORE (F1)
Refer to "45.4 Setup with SmartStation".

NEAR (F2)
To find the nearest reference station with the connected device. Coordinates of these stations must be known.

SHIFT CONEC (F3) and **SHIFT DISCO (F3)**
Refer to "45.4 Setup with SmartStation".

SHIFT INIT (F4)
Refer to "45.4 Setup with SmartStation".

Description of fields

Field	Option	Description
<Indiv Pt ID:>	User input	An Individual Pt ID is used by default. This enables the user to give the target point a different point ID.
<Antenna Ht:>	User input	The antenna height.
<RTK Positions:>	Output	The number of GPS real-time positions recorded over the period of point occupation.

Field	Option	Description
<3D CQ:>	Output	The current 3D coordinate quality of the computed position.
<Msd PP Obs:>	Output	The number of static observations recorded over the period of point occupation. Available only when the recording of static observations is configured. Refer to "22.6 Logging of Raw Obs" for details.

Next steps

- **STORE (F1)** to store the point and then return to SETUP Measure Target.
  Refer to "45.6.4 Orientation and Height Transfer" for details on all fields and keys.
    - **ALL (F1)** to measure and store this same point with the TPS station. (The GPS target point which was previously stored, is automatically suggested as the target point to measure with the TPS station. This is then the first target point for the station setup).
    - **GPS (F4)** to measure additional target points with GPS.
    - **DONE (F5)** to temporarily exit the Setup program. (This is applicable when Add Points Later is set. In this state, this type of setup is regarded as an incomplete setup. The setup can be continued and completed at a later time). This key is replaced by CALC (F5) when sufficient data is available.
    - **CALC (F5)** to compute the setup results (This is applicable when at least two target points have been measured and stored).
    - **SET (F1)** to set the TPS station and TPS orientation in the SETUP Results screen. This setup is now complete. It is still possible to add additional points to the setup to improve the setup results. Refer to "45.7.2 Additional Information".

45.6 Setup Methods

45.6.1 Setup Reminder

Description

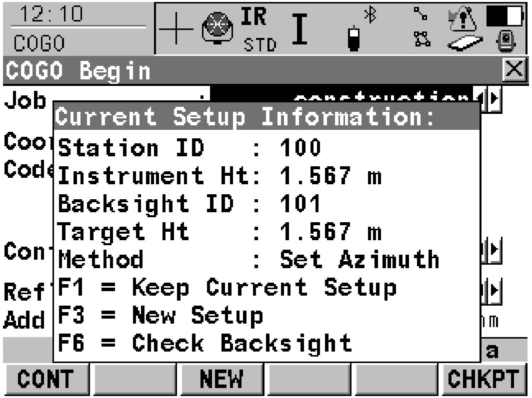
- When activated, the setup reminder function displays a screen which enables the user to check the current station setup details before proceeding with the survey. When this screen appears, three options are available to the user:
  - 1. To keep the current station setup and proceed with the survey.
  - 2. To create a new station setup.
  - 3. To check the backsight point.
- The setup reminder function is available to every application program, except:
  - Alignment Tool Kit
  - Determine Coordinate System
  - Setup
  - Traverse

Access

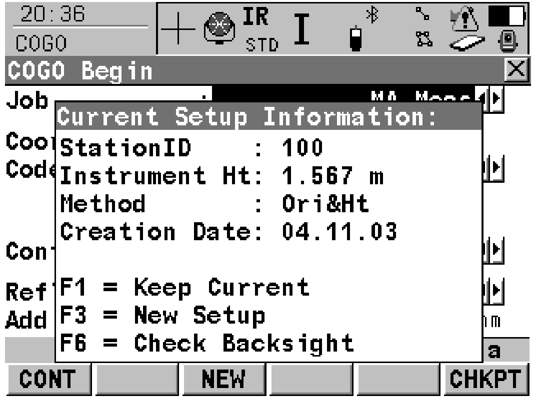
When the setup reminder function is activated (refer to "45.3 Configuring Setup"), the current station setup details are displayed whenever **CONT (F1)** is pressed in a **Begin** screen in an application program.

Setup Reminder screen

Reminder for setup method
- Set Azimuth
- Known BS Point



Reminder for setup method
- Ori & Ht Transfer
- Resection
- Resection Helmert
- Local Resection



Description of softkeys

Softkey	Description
CONT (F1)	To continue with the existing program.
NEW (F3)	To start the Setup program and create a new station setup.
CHKPT (F6)	To open the Check Recorded Pt/Backsight Pt screen.

45.6.2 Set Azimuth

Requirements

- For TPS1200 the position coordinates of the station point are required. The instrument is set up and oriented to either a known or unknown target point, to which a true or assumed azimuth is set.
- For SmartStation the position coordinates of the station are unknown and are determined with GPS real-time. The instrument is set and oriented to either a known or unknown target point, to which a true or assumed azimuth is set.

Updating Hz measurements

- A station setup using this setup method is always automatically flagged with an 'update later' attribute. Therefore, all angle measurements taken from that station are always automatically updated.

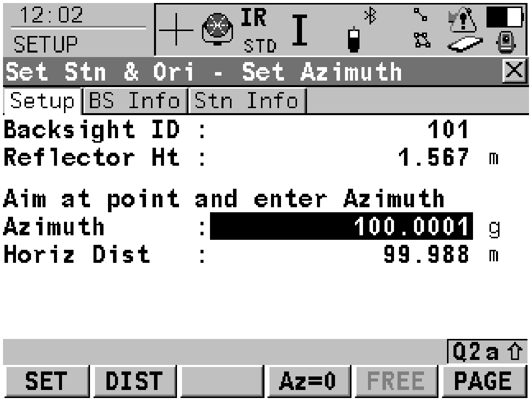
Access step-by-step

- This screen can be accessed from the **SETUP Station Setup** screen or by pressing **SETAZ (F5)** in the **SURVEY Survey** screen. The step-by-step description is for access from the **SETUP Station Setup** screen.
- Refer to the stated chapter for more information on screens.

	Description	Refer to chapter
1.	Press **PROG** to access the **Programs** menu.	
2.	Select and activate **Setup** to move to the first screen.	
3.	Press **CONT (F1)** to access **SETUP Station Setup**.	
4.	**<Method:>** Ensure that **Set Azimuth** is selected. **<Station Coord:>** Select the source for the instrument station coordinates. **<Station ID:>** Enter/Select the instrument station.	

	Description	Refer to chapter
	<Instrument Ht:> Enter the height of the instrument station. **<Fixpoint Job:>** Select the fixpoint job of the control/target points.	
5.	The geometric scale correction is displayed. The correction displayed depends upon the options chosen in **CONFIGURE TPS Corrections, GeoPPM** page: • if **<Calc Scale: Automatically>**, **<Computd Scale:>** is displayed. • if **<Calc Scale: Manually>**, **<Current Scale:>** is displayed.	17.4
6.	Press **CONT (F1)** to access **SETUP Set Stn & Ori - Set Azimuth**.	

SETUP Set Stn & Ori - Set Azimuth, Setup page



SET (F1)
To set the station and orientation and exit the Setup application program.

DIST (F2)
To measure a distance to the point being used to set the azimuth.
A distance measurement is **NOT** required when setting the Station and the Orientation **SET (F1)**. Checking is **NOT** performed on the distance measurement when setting the Station and the Orientation **SET (F1)**.

Az=0 (F4)
Available on the **Setup** page. To set **<Azimuth: 0>** and running. This value is not set to the system until **SET (F1)** is pressed.

HOLD (F5) or **FREE (F5)**
Available on the **Setup** page and if **<ATR: Off>**. **HOLD (F5)** freezes the current **<Azimuth:>** value, making it possible to set the **<Azimuth:>** value first, turn the instrument to the desired direction and release the **<Azimuth:>** value using **FREE (F5)**.

PAGE (F6)
To change to another page on this screen.

SHIFT INDIV (F5) and **SHIFT RUN (F5)**
Available on the **Setup** page. To change between entering an individual backsight point ID different to the defined ID template and the running point ID according to the ID template. Refer to "16.1 ID Templates" for more information on point ID templates.

Description of fields

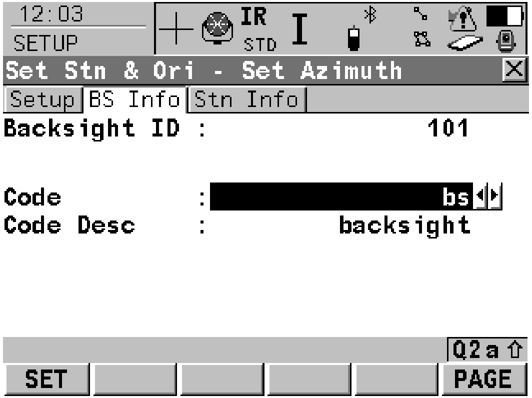
Field	Option	Description
<Backsight ID:>	User input	Point ID of the backsight point according to the point ID template.
<Reflector Ht:>	User input	The default reflector height as defined in the active configuration set is suggested.

Field	Option	Description
<Azimuth:>	User input	The current system azimuth value. If a different azimuth is typed in and **ENTER** is pressed or if **Az=0 (F4)** is pressed, this azimuth value is displayed in the field and updated with the telescope movement. The value is not set to the system until **SET (F1)** is pressed.
<Horiz Dist:>	Output	Press **(F2)** to measure a distance to the target point being used to set the azimuth.

Next step

IF	THEN
the next page is to be accessed	**PAGE (F6)** changes to the **BS Info** page.
the station and orientation is to be set	**SET (F1)** to set the station and orientation.

SETUP
Set Stn & Ori - Set Azimuth, BS Info page



SET (F1)
To set the station and orientation and exit the Setup application program.

PAGE (F6)
To change to another page on this screen.

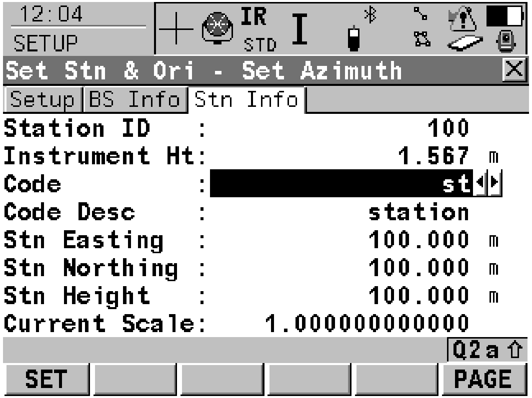
Description of fields

Field	Option	Description
<Backsight ID:>	Output	Backsight ID as entered in **SETUP Station Setup**.
<Code:>	Choicelist	The code for the backsight point.
<Code Desc:>	Output	A short description of the code.

Next step

IF	THEN
the next page is to be accessed	**PAGE (F6)** changes to the **Stn Info** page.
the station and orientation is to be set	**SET (F1)** to set the station and orientation.

SETUP
Set Stn & Ori -
Set Azimuth,
Stn Info page



SET (F1)
To set the station and orientation and exit the Setup application program.

PAGE (F6)
To change to another page on this screen.

Description of fields

Field	Option	Description
<Station ID:>	Output	Station ID as selected in **SETUP Station Setup**.
<Instrument Ht:>	User input	The instrument height.
<Code:>	Choicelist	The code for the station point.
<Code Desc:>	Output	A short description of the code.
<Stn Easting:>	Output	The easting coordinate for the setup station.
<Stn Northing:>	Output	The northing coordinate for the setup station.
<Stn Height:>	Output	The height of the setup station.

Field	Option	Description
<Current Scale:>	Output	The geometric scale correction is displayed. The correction displayed depends upon the options chosen in **CONFIGURE TPS Corrections, GeoPPM** page. Refer to "17.4 TPS Corrections" for details.

Next step

IF	THEN
the next page is to be accessed	**PAGE (F6)** changes to the **Setup** page.
the station and orientation is to be set	**SET (F1)** to set the station and orientation.

Set azimuth step-by-step

Application: Set up the instrument over a known point with orientation to a point with known azimuth.

Settings: Set **<Automation: ATR>** in **CONFIGURE EDM & ATR Settings**.

- The following table explains the most common settings.
- Refer to the stated chapter for more information on screens.

	Description	Refer to chapter
1.	Access **SETUP Set Stn & Ori - Set Azimuth**.	45.6.2
2.	**SETUP Set Stn & Ori - Set Azimuth, Setup** page **<Azimuth:>** The azimuth to the backsight point.	

	Description	Refer to chapter
	<Backsight ID:> The point ID of the backsight point. **<Reflector Ht:>** The current reflector height. Aim at the reflector on the backsight point.	
3.	**SET (F1)** to set the station and orientation and return to **Main Menu**.	

45.6.3 Known Backsight Point

Requirements

- For TPS1200 the position coordinates of the station point are required. The instrument is set up and oriented to a known backsight target.
- For SmartStation the position coordinates of the station are unknown and are determined with GPS real-time. The instrument is set up and oriented to a known backsight target.

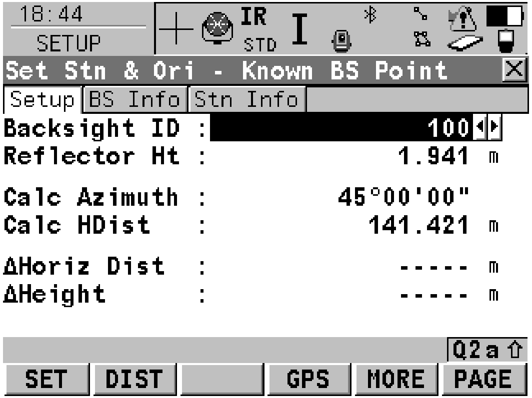
Access step-by-step

Refer to the stated chapter for more information on screens.

	Description	Refer to chapter
1.	Press **PROG** to access the **Programs** menu.	
2.	Select and activate **Setup** to move to the first screen.	
3.	Press **CONT (F1)** to access **SETUP Station Setup**.	
4.	**<Method:>** Ensure that **Known BS Point** is selected. **<Station Coord:>** Select the source for the instrument station coordinates. **<Station ID:>** Enter/Select the instrument station. **<Instrument Ht:>** Enter the height of the instrument station. **<Fixpoint Job:>** Select the fixpoint job of the control/target points.	
5.	The geometric scale correction is displayed. The correction displayed depends upon the options chosen in **CONFIGURE TPS Corrections, GeoPPM** page: • if **<Calc Scale: Automatically>**, **<Computd Scale:>** is displayed. • if **<Calc Scale: Manually>**, **<Current Scale:>** is displayed.	17.4

	Description	Refer to chapter
6.	Press **CONT (F1)** to access **SETUP Set Stn & Ori - Known BS Point.**	

SETUP Set Stn & Ori - Known BS Point, Setup page



SET (F1)
To set the station and orientation and exit the Setup application program.

DIST (F2)
To measure the distance to the backsight point.

GPS (F4) (Applicable when using **SmartPole**)
To enter the GPS Survey screen (the same screen as for SmartRover) and measure a point with GPS. The antenna height is automatically converted from the reflector height.

Press **STORE (F1)** to store the point and leave the GPS Survey screen. The point is stored to the **<Job:>** and copied to the **<Fixpoint Job:>**, where it can be used as a backsight.

Press **ESC** or **SHIFT QUIT (F6)** to leave the GPS Survey screen.

MORE (F5)

Available on the **Setup** page. Toggles between the displayed values. As default the Δ values for azimuth, horizontal distance and height are shown. If **MORE (F5)** is pressed, the display changes to the measured values of azimuth, horizontal distance and height.

PAGE (F6)

To change to another page on this screen.

Description of fields

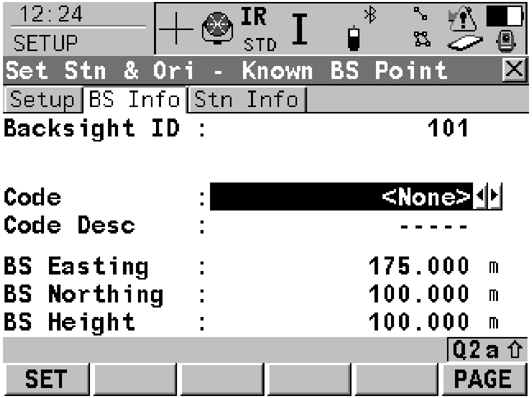
Field	Option	Description
<Backsight ID:>	Choicelist	Backsight point ID. All 3D and 2D points from **<Fixpoint Job:>** can be selected.
<Reflector Ht:>	User input	The default reflector height as defined in the active configuration set is suggested.
<Calc Azimuth:>	Output	Displays the calculated azimuth from the selected station to the backsight point.
<Calc HDist:>	Output	Displays the calculated horizontal distance between the selected station and backsight point.
<ΔHoriz Dist:>	Output	The difference between the calculated horizontal distance from station to backsight point and the measured distance.

Field	Option	Description
<ΔHeight:>	Output	The difference between the coordinate height of the backsight point and the measured height of the backsight point. If the backsight point is a 2D point, this field shows -----.
<Horiz Dist:>	Output	Displayed after a distance was measured with **DIST (F2)** and after **MORE (F5)** was pressed. The measured horizontal distance to the backsight point. Shows ----- before **DIST (F2)**.
<Height:>	Output	Displayed after a distance was measured with **DIST (F2)** and after **MORE (F5)** was pressed. The measured height of the backsight point. Shows ----- before **DIST (F2)**

Next step

IF	THEN
the next page is to be accessed	**PAGE (F6)** changes to the **BS Info** page.
the station and orientation is to be set	**SET (F1)** to set the station and orientation.

SETUP
Set Stn & Ori - Known BS Point, BS Info page



SET (F1)
To set the station and orientation and exit the Setup application program.

PAGE (F6)
To change to another page on this screen.

Description of fields

Field	Option	Description
<Backsight ID:>	Output	Backsight ID as entered in **SETUP Station Setup**.
<Code:>	Choicelist	The code for the backsight point.
<Code Desc:>	Output	A short description of the code.
<BS Easting:>	Output	The easting coordinate for the backsight point.
<BS Northing:>	Output	The northing coordinate for the backsight point.
<BS Height:>	Output	The height of the backsight point.

Next step

IF	THEN
the next page is to be accessed	**PAGE (F6)** changes to the **Stn Info** page.
the station and orientation is to be set	**SET (F1)** to set the station and orientation.

SETUP Set Stn & Ori - Known BS Point, Stn Info page

This screen has the same functionality as **SETUP Set Stn & Ori - Set Azimuth, Stn Info page**. Refer to "45.6.2 Set Azimuth" for further information. Refer to "7.5.3 Editing a Code" for further information on coding.

Next step

IF	THEN
the next page is to be accessed	**PAGE (F6)** changes to the **Setup** page.
the station and orientation is to be set	**SET (F1)** to set the station and orientation.

45.6.4 Orientation and Height Transfer

Requirements

- For TPS1200 the position coordinates of the station point are required. The instrument is set up and oriented to one or more known backsight targets.
- For SmartStation the position coordinates of the station are unknown and are determined with GPS real-time. The instrument is set up and oriented to one or more known backsight targets.
- For TPS1200 and SmartStation the orientation is determined by sighting to one or more known target points (maximum of ten target points). Only angles or both angles and distances may be measured. The height of the station point can also be derived from the target points.

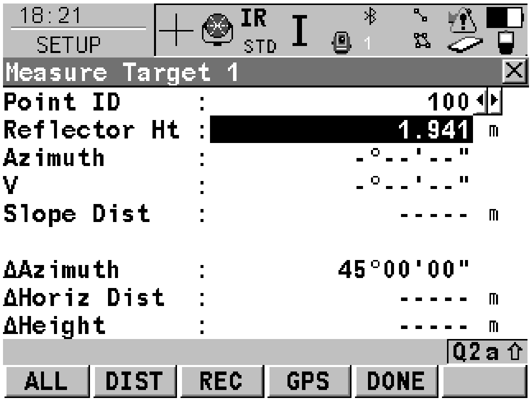
Access step-by-step

- Refer to the stated chapter for more information on screens.

	Description	Refer to chapter
1.	Press **PROG** to access the **Programs** menu.	
2.	Select and activate **Setup** to move to the first screen.	
3.	Press **CONT (F1)** to access **SETUP Station Setup**.	
4.	**<Method:>** Ensure that **Ori & Ht Transfr** is selected. **<Station Coord:>** Select the source for the instrument station coordinates. **<Station ID:>** Enter/Select the instrument station. **<Instrument Ht:>** Enter the height of the instrument station. **<Fixpoint Job:>** Select the fixpoint job of the control/target points.	
5.	**<Fixpoints:>** Select the method for measuring the control/target points.	

	Description	Refer to chapter
	Select **Meas All Now** if a "Standard" setup is required. Select **Add Points Later** if an “On-the-Fly” setup is required.	45.2 45.2
6.	The geometric scale correction is displayed. The correction displayed depends upon the options chosen in **CONFIGURE TPS Corrections, GeoPPM** page: • if **<Calc Scale: Automatically>**, **<Computd Scale:>** is displayed. • if **<Calc Scale: Manually>**, **<Current Scale:>** is displayed.	17.4
7.	Press **CONT (F1)** to access **SETUP Measure Target**.	

SETUP
Measure Target



ALL (F1)
To measure and store the distances and angles made to the control points. After storing the measurement data to the <Job:>, the next <Point ID:> in the job is displayed. The instrument positions to the point if enough data is available.

DIST (F2)
To measure and display distances.

REC (F3)

Records displayed values to the current job. A distance measurement is not necessary before pressing **REC (F3)**. After storing the measurement data to the <Job:>, the next <Point ID:> in the job is displayed. The instrument positions to the point if enough data is available.

GPS (F4) (Applicable when using **SmartPole**)

To enter the GPS Survey screen (the same screen as for SmartRover) and measure a point with GPS. The antenna height is automatically converted from the reflector height.

Press **STORE (F1)** to store the point and leave the GPS Survey screen. The point is stored to the **<Job:>** and copied to the **<Fixpoint Job:>**, where it can be used as a target for the setup.

Press **ESC** or **SHIFT QUIT (F6)** to leave the GPS Survey screen.

CALC (F5)

Available when sufficient data (when two or more points have been measured) is available for calculation. Runs the setup calculation and accesses **SETUP Results**.

DONE (F5) (Applicable to **Add Points Later**)

To temporarily exit the Setup program. The station setup will be incomplete but can be continued and completed at a later time. This softkey is replaced by **CALC (F5)** when sufficient data is available.

SHIFT FIND (F2)
Available once sufficient data is available for calculation. Accesses **SETUP Find Target** to guide the reflector to the selected target point. Refer to "45.8 Finding a Target Point" for information on this screen.

SHIFT POSIT (F4)
Available once sufficient data is available for calculation. To position the instrument to the selected target point.

Description of fields

Field	Option	Description
<Point ID:>	Choicelist	The point ID of the target point to be measured. All points from **<Fixpoint Job:>** can be selected, except class **NONE**.
<Reflector Ht:>	User input	The default reflector height as defined in the active configuration set is suggested.
<Azimuth:>	Output	The current horizontal angle.
<V:>	Output	The current vertical angle.
<Slope Dist:>	Output	The measured slope distance after **DIST (F2)** was pressed.

Field	Option	Description
<ΔAzimuth:>	Output	Displays the difference between the calculated azimuth and the current horizontal angle. If **<Method: Resection>,** displays ----- until sufficient data for calculation is available.
<ΔHoriz Dist:>	Output	The difference between the calculated and the measured horizontal distance.
<ΔHeight:>	Output	The difference between the given and the measured height of the target point.

Next steps

IF	THEN
more target points are to be measured	**ALL (F1)** to measure and store distances and angles, or **REC (F3)** to store the current measurement, or **GPS (F4)** to measure a point with GPS.
the program is to be temporarily exited	**DONE (F5)** to temporarily exit the Setup program. The station setup will be incomplete but can be continued and completed at a later time.
sufficient target points were measured	**CALC (F5)** to access **SETUP Results**. Refer to "45.7 Setup Results" for more information.

A maximum of ten target points can be measured and used for the calculation. When the maximum number of points was measured, the **SETUP Results** screen is accessed automatically after **ALL (F1)**. In the **SETUP Additional Information** screen measured target points can be deleted and the **SETUP Measure Target** screen can be reaccessed to measure new target points.

45.6.5 Resection/Resection Helmert

Requirements

For TPS1200 the coordinates of the station point are unknown. The coordinates and orientation are determined by sighting to one or more known target points (maximum of ten target points). Only angles or both angles and distances may be measured. For a resection, least squares or robust calculations are used. For a resection Helmert, Helmert calculations are used.

Access step-by-step

Refer to the stated chapter for more information on screens.

	Description	Refer to chapter
1.	Press **PROG** to access the **Programs** menu.	
2.	Select and activate **Setup** to move to the first screen.	
3.	Press **CONT (F1)** to access **SETUP Station Setup**.	
4.	**<Method:>** Select either **Resection** or **Resection Helmert**. **<Station ID:>** Enter the instrument station. **<Instrument Ht:>** Enter the height of the instrument station. **<Fixpoint Job:>** Select the fixpoint job of the control/target points.	
5.	**<Fixpoints:>** Select the method for measuring the control/target points. Select **Meas All Now** if a "Standard" setup is required. Select **Add Points Later** if an “On-the-Fly” setup is required.	 45.2 45.2
6.	Press **CONT (F1)** to access **SETUP Measure Target**.	
7.	**SETUP Measure Target**	45.6.4

	Description	Refer to chapter
8.	**ALL (F1)** or **REC (F3)** or **GPS (F4)** (to measure a point with GPS).	
9.	Refer to "45.6.4 Orientation and Height Transfer" for details on fields/keys.	

45.6.6 Local Resection

Description

- This method can be used to calculate the two or three-dimensional local coordinates for the instrument station and the orientation of the horizontal circle from distance and angular measurements to two target points.
- The first target point always defines the origin of the local coordinate system. The second target point, in conjunction with the first target point, always defines the local direction of North or East (depending on the configuration settings).
- For Resection and/or Resection Helmert, refer to "45.6.5 Resection/Resection Helmert".

Requirements

Important features:

- all coordinates calculated are local coordinates.
- the first target point always defines the origin of the local coordinate system (North=0, East=0, Height=0 (optional))
- The second target point, in conjunction with the first target point, always defines the local direction of North or East.

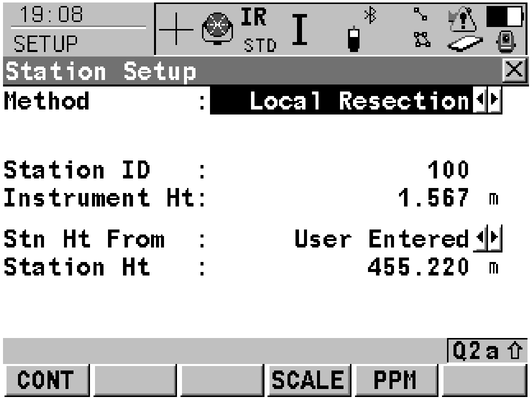
Access step-by-step

- The following table explains the most common settings.
- Refer to the stated chapter for more information on screens.

	Description	**Refer to chapter**
1.	Press **PROG** to access the **Programs** menu.	
2.	Select and activate **Setup** to move to the first screen.	
3.	Press **CONT (F1)** to access **SETUP Station Setup**.	
4.	**<Method:>** Ensure that **Local Resection** is selected.	

	Description	Refer to chapter
	<Station ID:> Enter the instrument station. **<Instrument Ht:>** Enter the height of the instrument station. **<Stn Ht From:>** Select the source for the instrument station height. **<Station Ht:>** Enter the elevation of the instrument station.	
5.	Press **CONT (F1)** to access **SETUP Measure Target**.	

SETUP
Station Setup



CONT (F1)
To accept all settings and continue. The chosen settings are activated and the next screen **SETUP Measure Target** is displayed.

SCALE (F4)
To display the geometric corrections used with the measurements. Refer to "17.4 TPS Corrections".

PPM (F5)
To display the atmospheric corrections used with the measurements. Refer to "17.4 TPS Corrections".

SHIFT CONF (F2)
To configure the application program SETUP. The screen **SETUP Configuration** is displayed. Refer to "45.3 Configuring Setup".

SHIFT INDIV (F5) and **SHIFT RUN (F5)**
To change between successive numbering **<Station ID>** and individual numbering **<Indiv Pt ID>**. entering an individual backsight point ID different to the defined ID template and the running point ID according to the ID template. Refer to "16.1 ID Templates" for more information on point ID templates.

Description of fields

Field	Option	Description
<Method:>	Choicelist	**<Method: Local Resection>**
<Station ID:>	User input	The station ID of the instrument station.
<Instrument Ht:>	User input	Instrument height.
<Stn Ht From:>	Choicelist **User Entered** or **Target 1 Ht Diff**	Only available when **<Method: Local Resection>**. For **<Stn Ht From: User Entered>** the height value of the station will be entered by the user and used to calculate the height of the measured points. For **<Stn Ht From: Target 1 Ht Diff>** the first measured point will be given Height=0 and the height of the station will be calculated relative to this point.
<Station Ht:>	Output	Only available when **<Stn Ht From: User Entered>**. The elevation of the instrument station.

Local resection step-by-step

- The following table explains the most common settings.
- Refer to the stated chapter for more information on screens.

	Description	Refer to chapter
6.	**CONT (F1)** to access **SETUP Measure Target 1**.	
7.	**SETUP Measure Target 1** Choose a target point and type in a reflector height. Aim correctly at the reflector.	45.6.4
8.	**ALL (F1)** to record the measurement.	
9.	**SETUP Measure Target 2** Choose a target point and type in a reflector height. Aim correctly at the reflector.	45.6.4
10.	**ALL (F1)** to record the measurement and to access **SETUP Results**.	
11.	**SETUP Results, Stn Coords** page	45.7
12.	**SET (F1)** to store the selected setup data and exit the application program.	

45.7 Setup Results

45.7.1 Least Square and Robust Calculation

Description

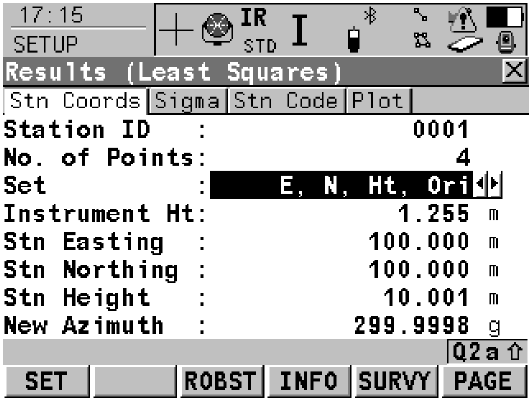
- This screen is displayed after a resection or orientation and height transfer calculation.
- For the calculations the least square or the robust method can be used. After the station is set, all following measurements will be related to this new station and orientation.

Access

Press **CALC (F5)** in the **SETUP Measure Target** screen.

SETUP Results, Stn Coords page

The screen described consists of the **Stn Coords**, **Sigma**, **Stn Code** and **Plot** page. The explanations for the softkeys given below are valid for the **Stn Coords** and **Sigma** page. Refer to "6.3.2 Creating a New Point" for information on the keys on the **Stn Code** page refer to "34.6 Plot Mode - MapView Screen Area" for information on the keys on the **Plot** page.



SET (F1)
To set data selected in **<Set:>** and to store all setup data and exit the application program.

COORD (F2)
To view other coordinate types.

ROBST (F3) or **LSQRS (F3)**
To display the results for the robust or the least squares calculation method.

INFO (F4)
To display additional information about the accuracy of the measured target points and to delete inconsistent measurements in the **SETUP Additional Information** screen.

DONE (F5) (Applicable to **Add Points Later**)
To temporarily exit the Setup program. The station setup will be incomplete but can be continued and completed at a later time.

SURVY (F5) (Applicable to **Meas All Now**)
To access **SETUP Measure Target** and to measure more target points.

PAGE (F6)
To change to another page on this screen.

SHIFT ELL H (F2) or **SHIFT ORTH (F2)**
Changes between the ellipsoidal and the orthometric height.

SHIFT 3 PAR (F2) or **SHIFT 4 PAR (F2)**
Switches between a 3 parameter and 4 parameter helmert calculation. The results are immediately updated.

SHIFT OTHER (F5)
Available if two solutions were calculated. Changes between these solutions.

Description of fields

Field	Option	Description
<Station ID:>	User input	Station ID of the current station set up.

Field	Option	Description
<No. of Points:>	Output	Number of points used in calculation.
<Set:>	Choicelist	The selected options are set and stored in the system. All other values are taken from the current system setup.
	E, N, Ht, Ori, **E, N, Ht** or **E, N, Ori**	Available for **<Method: Resection>** and **<Method: Resection Helmert>**.
	Ht,Ori, **Ht** or **Ori**	Available for **<Method: Ori & Ht Transfr>**.
<Instrument Ht:>	Output	The current instrument height.
<Stn Easting:>	Output	For **<Method: Ori & Ht Transfr>** Easting is displayed either from fixpoint job or system, as selected. For **<Method: Resection>** and **<Method: Resection Helmert>** the calculated Easting is displayed.
<Stn Northing:>	Output	For **<Method: Ori & Ht Transfr>** Northing is displayed either from fixpoint job or system, as selected. For **<Method: Resection>** and **<Method: Resection Helmert>** the calculated Northing is displayed.
<Stn Height:>	Output	The calculated Height is displayed.
<New Azimuth>	Output	New oriented azimuth with running angle as telescope moves.

Next step
PAGE (F6) changes to the **Sigma** page.

SETUP Results, Sigma page

Description of fields

Field	Option	Description
<σEasting:>	Output	Available for **<Method: Resection>** and **<Method: Resection Helmert>**. Standard deviation of the calculated station Easting.
<σNorthing:>	Output	Available for **<Method: Resection>** and **<Method: Resection Helmert>**. Standard deviation of the calculated station Northing.
<σHeight:>	Output	Standard deviation of the calculated station Height.
<σHz Orient.:>	Output	Standard deviation of the calculated orientation.
<Calc Scale:>	Output	Calculated scale factor from resection or orientation and height transfer.
<Calc ppm:>	Output	Available for **<Use Scale: Yes>**. ppm from calculated scale. ppm=(scale*1000000)-1.
<Current Scale:>	Output	The geometric scale correction is displayed. The correction displayed depends upon the options chosen in **CONFIGURE TPS Corrections, GeoPPM** page. Refer to "17.4 TPS Corrections" for details.

Next step
PAGE (F6) changes to the **Stn Code** page.

SETUP Results, Stn Code page

The functionality of the **Stn Code** page is similar to **MANAGE New Point, Code** page. Refer to "6.3.2 Creating a New Point" for more information on keys.

Description of fields

Field	Option	Description
<Point Code:>		The thematical code for the point.
	Choicelist	Available for **<Thematc Codes: With Codelist>**. All point codes from the job codelist can be selected. The attributes are shown as output, input or choicelist fields depending on their definition.
	User input	Available for **<Thematc Codes: Without Codelist>**. Codes can be typed in but not selected from a codelist. A check is performed to see if a point code of this name already exists in the job. If so, the according attributes are shown.
<Code Desc:>	Output	Available for **<Thematc Codes: With Codelist>**. The description of the code.
<Attribute n:>	User input	Available for **<Thematc Codes: Without Codelist>**. Up to eight attribute values are available.

Next step

PAGE (F6) changes to the **Plot** page.

45.7.2 Additional Information

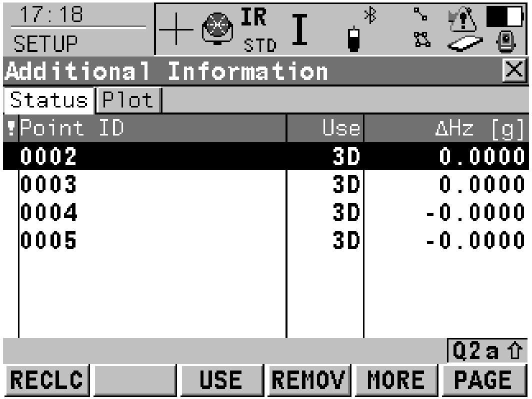
Description

- The **SETUP Additional Information** screen displays information about the accuracy of the measured target points and allows exclusion of measurements that are not to be used in the calculation.
- Additional measurements can be made and measurements can be deleted.

Access

Press **INFO (F4)** in the **SETUP Results** screen.

SETUP Additional Information, Status page



RECLC (F1)
To recalculate the station data and update all values after target points have been deleted or excluded from the calculation. Returns to the **SETUP Results** screen.

USE (F3)
To decide whether or not to use a target point in the calculation. Changes the value in the **Use** column.

REMOV (F4)
To delete a point from the list of measured target points and exclude it from the Setup calculation.

MORE (F5)
To change between displaying **ΔHz**, **ΔDist**t, **ΔHeight**, **ΔEast** and **ΔNorth** in the fourth column.

SHIFT SURVY (F5)
Accesses the **SETUP Measure Target** screen to measure more target points.

PAGE (F6)
To change to an other page on the screen. Refer to "34 MapView Interactive Display Feature" for more information.

Description of columns

Column	Description
!	The **!** indicates that the delta value of either measured horizontal angle, distance or height exceeds the calculation limit.
Point ID	The point ID of the measured target points.
Use	Indicates if and how a target point is used in the station calculation. Choices are **3D**, **2D, 1D** and **NO**.
ΔHz	Can be displayed by pressing **MORE (F5)**. Difference between calculated and measured horizontal angle for the target points. If a target point does not have coordinates, ----- are displayed. Differences exceeding the defined limit are indicated by a *.

Column	Description
ΔDist	Can be displayed by pressing **MORE (F5)**. Difference between calculated and measured distance from the station to the target points. If a target point does not have coordinates, ----- are displayed. Differences exceeding the defined limit are indicated by a *.
ΔHeight	Can be displayed by pressing **MORE (F5)**. Difference between calculated and measured height of the target points. If a target point does not have a height coordinate, ----- are displayed. Differences exceeding the defined limit are indicated by a *.
ΔEast	Can be displayed by pressing **MORE (F5)**. Difference between fixpoint and measured point, calculated from new station coordinates.
ΔNorth	Can be displayed by pressing **MORE (F5)**. Difference between fixpoint and measured point, calculated from new station coordinates.

Next step

PAGE (F6) changes to the **Plot** page.

SETUP Results, Plot page

Refer to "34.6 Plot Mode - MapView Screen Area" for details on the keys on the **Plot** page.

Next step

PAGE (F6) changes to the first page on this screen.

Next steps

IF	THEN
more target points are to be measured	**SHIFT SURVY (F5)** to access the **SETUP Measure Target** screen.
point measurements are to be accepted	**RECLC (F1)** to recalculate the station data and return to the **SETUP Results** screen.

45.7.3 Local Resection Calculation

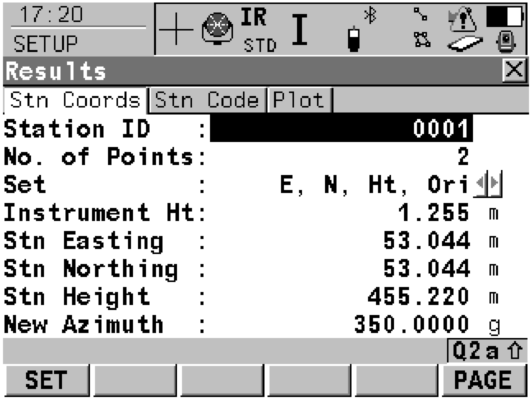
Description

- This screen is displayed after the local resection calculation.
- After the station is set, all following measurements will be related to this new station and orientation.

Access

Press **ALL (F1)** in the **SETUP Measure Target 2** screen.

SETUP Results, Stn Coords page



SET (F1)
To set data selected in **<Set:>** and to store all setup data and exit the application program.

PAGE (F6)
To change to an other page on the screen.

Description of fields

Field	Option	Description
<Station ID:>	User input	Station ID of the current station set up.
<No. of Points:>	Output	Number of points used in calculation.

Field	Option	Description
<Set:>	Output	The displayed options are set and stored in the system. All other values are taken from the current system setup.
<Instrument Ht:>	Output	The current instrument height.
<Stn Easting:>	Output	The calculated Easting.
<Stn Northing:>	Output	The calculated Northing.
<Stn Height:>	Output	The calculated Height.
<New Azimuth>	Output	New oriented azimuth with running angle as telescope moves.

Next step

PAGE (F6) changes to the **Stn Code** page.

SETUP Results, Stn Code page

The functionality of the **Stn Code** page is similar to **MANAGE New Point, Code** page. Refer to "6.3.2 Creating a New Point" for more information on keys.

Description of fields

Field	Option	Description
<Point Code:>		The thematical code for the offset point.
	Choicelist	Available for **<Thematc Codes: With Codelist>**. All point codes from the job codelist can be selected. The attributes are shown as output, input or choicelist fields depending on their definition.

Field	Option	Description
	User input	Available for **<Thematc Codes: Without Codelist>**. Codes can be typed in but not selected from a codelist. A check is performed to see if a point code of this name already exists in the job. If so, the according attributes are shown.
<Code Desc:>	Output	Available for **<Thematc Codes: With Codelist>**. The description of the code.
<Attribute n:>	User input	Available for **<Thematc Codes: Without Codelist>**. Up to eight attribute values are available.

Next step

PAGE (F6) changes to the **Stn Plot** page.

SETUP Results, Stn Plot page

Refer to "34.6 Plot Mode - MapView Screen Area" for information on the keys on the **Plot** page.

Next step

PAGE (F6) changes to the first page on this screen.

45.8 Finding a Target Point

Description

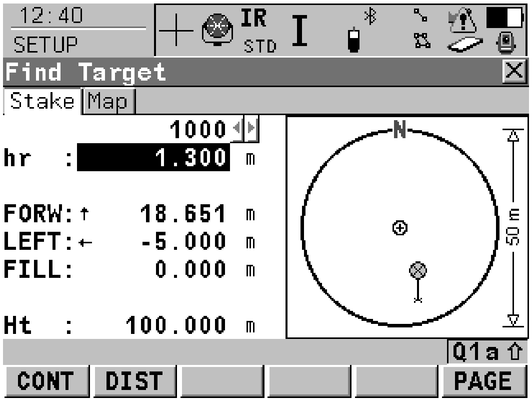
- The **SETUP Find Target** screen can be accessed, to guide the reflector to the selected target point.
- The screen is only available if the Stakeout application is available on the instrument.
- The functionality of this screen is similar to a stakeout routine and is intended to help find hidden survey bench marks or reference points.

Access

Press **SHIFT FIND (F2)** in **SETUP Measure Target** once enough data is available to roughly calculate the new orientation.

SETUP Find Target

This screen is shown with **<Stake Mode: Ortho from Stn>.** For graphics/symbols being displayed the settings are **<Symbols: From Station>** and **<Graphics: From Station>**. Refer to "46.4.1 Elements of the Graphical Display in the Stakeout" for information on elements of the graphic.



CONT (F1)
Exits **SETUP Find Target** and returns to **SETUP Measure Target**.

DIST (F2)
To measure and display distances. Updates all output fields in the screen.

Description of fields

Field	Option	Description
<Point ID:>	Output	The point ID of the target point to be measured.
<Reflector Ht:>/ <hr:>	Output	The default reflector height as defined in the active configuration set is suggested.
<Go FORWARD:>/ <FORW:> or **<Go BACWARD:>/ <BACK:>**	Output	The horizontal distance from the current reflector position to the target point along the line from the station to the current reflector position. Field is **<Go FORWARD:>** when the reflector has to be moved towards the instrument and **<Go BACKWARD:>** when the reflector has to be moved away from the instrument. Shows ----- before the first distance measurement with **DIST (F2)**.
<Go RIGHT:>/ <RGHT:> or **<Go LEFT:>/ <LEFT:>**	Output	Horizontal distance from the current reflector position to the target point orthogonal to the line from the station to the current reflector position. Field is **<Go RIGHT:>** when the target point is to the right of that line and **<Go LEFT:>** when the reflector is to the left of that line. Shows ----- before the first distance measurement with **DIST (F2)**.

Field	Option	Description
<FILL:> or **<CUT:>**	Output	The height difference between the target point and the measured point. Field is **<CUT:>** when the measured point is higher than the target point and **<FILL:>** if the measured point is lower than the target point. Shows ----- before the first distance measurement with **DIST (F2)** or if the target point is a 2D point.
<Height> or <Ht:>	Output	The measured height of the current position. Shows ----- before the first distance measurement with **DIST (F2)** or if the target point is a 2D point.

Next step
CONT (F1) to return to the **SETUP Measure Target** screen.

46 Stakeout

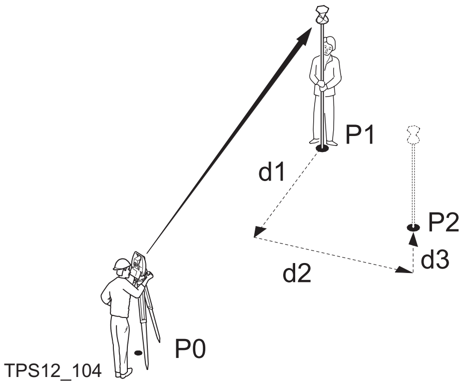
46.1 Overview

Description

The Stakeout application program is used to place marks in the field at predetermined points. These predetermined points are the points to be staked. The points to be staked may

- have been uploaded to a job on the instrument using LGO.
- already exist in a job on the instrument.
- have been uploaded from an ASCII file to a job on the instrument using **Main Menu: Convert...\Import ASCII/GSI Data to Job**.
- be typed in.

Diagram



P0	Station
P1	Current position
P2	Point to be staked
d1	Stake out element
d2	Stake out element
d3	Stake out element

Stakeout modes

Points can be staked using different modes:

- Polar mode.
- Orthogonal to station mode.
- Orthogonal from station mode.

☞ The points to be staked must exist in a job on the active memory device or can be typed in.

Coordinate system

Points cannot be staked if the active coordinate system is different to that in which the points to be staked are stored. For example, the points to be staked are stored in WGS 1984 and the active coordinate system is **<None>**.

Point types

It is possible to stake:

- Position only points.
- Height only points.
- Points with full sets of coordinates.

Height types

Height type of the point to be staked:	Orthometric OR ellipsoidal
Height type computed for current position:	Orthometric OR ellipsoidal depending on the • configured transformation, • availability of a geoid model, • height type of the point to be staked. If possible, the height type of the point to be staked is computed for the current position.

Height source

Heights can be taken into account from

- the vertical component of a coordinate triplet.
- a **D**igital **T**errain **M**odel.

DTM Stakeout must be activated via a licence key. Refer to "28 Tools...\Licence Keys" for information on how to type in or upload the licence key.
If activated, the height of the points to be staked can be edited in the field.

Coding of staked points

Codes can be attached to staked points. Refer to "8 Coding" for information on coding. The behaviour of the coding functionality depends on the

- selected **<Stakeout Job:>** as the job with the points to be staked.
- selected **<Job:>** as the active job.
- definition of a display mask with input fields for coding and attributes.

IF <Stakeout Job:> and <Job:>	AND a display mask for point codes and attributes	THEN
are identical	is used	the point code and attributes attached to the point to be staked are suggested for the staked point. They can be changed.
are identical	is not used	the staked point is stored with the point code and attributes attached to the point to be staked.
are not identical	is used	**<Point Code: <None>>** is suggested. It can be changed and attributes can be entered. After a point has been stored with a code different to **<Point Code: <None>>** then the last used point code is suggested the next time.
are not identical	is not used	the staked point is stored with **<Point Code: <None>>**.

It may happen that the codes and/or attributes of the staked point and the point to be staked do not match. In this case, a screen opens where they can be corrected. Refer to "8.6 Code and Attribute Mismatch" for information on solving a code and/or attribute mismatch.

Properties of staked points

The properties stored with staked points are:

- Class: **MEAS**
- Sub class: **Stakeout**
- Source: **Stakeout**
- Instrument source: **TPS**

Averaging of staked points

The principles for averaging are identical to those of the Survey application program. Refer to "6.3.4 Mean Page" for information on averaging.

46.2 Accessing Stakeout

Access

Select **Main Menu: Programs...\Stakeout.**

OR

Press **PROG**. Highlight **Stakeout**. **CONT (F1).** Refer to "35.2 Accessing the Programs Menu" for information on the **PROG** key.

OR

Press a hot key configured to access the screen **STAKEOUT Stakeout Begin**. Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

OR

Press **STAKE (F5)** from another application program, for example COGO.

STAKEOUT Stakeout Begin

CONT (F1)
To accept changes and access the subsequent screen. The chosen settings become active.

CONF (F2)
To configure Stakeout application program. Accesses **STAKEOUT Configuration**. Refer to "46.3 Configuring Stakeout".

SETUP (F3)
To set up station. Accesses **SETUP Station Setup**.

CSYS (F6)
To select a different coordinate system.

Description of fields

Field	Option	Description
<Stakeout Job:>	Choicelist	The job containing the points to be staked. All jobs from **Main Menu: Manage...\Jobs** can be selected.
<Job:>	Choicelist	The active job. All jobs from **Main Menu: Manage...\Jobs** can be selected. Determines the active coordinate system. Points which are staked out are stored in this job. The original points to be staked are not copied to this job. The data from this job is shown in **MANAGE Data: Job Name**.
<Coord System:>	Output	The coordinate system currently attached to the selected **<Job:>**.
<Codelist:>	Choicelist	No codes are stored in the selected job. All codelists from **Main Menu: Manage...\Codelists** can be selected.
	Output	Codes have already been stored in the selected **<Job:>**. If codes had been copied from a System RAM codelist, then the name of the codelist is displayed. If codes have not been copied from a System RAM codelist but typed in, then the name of the active job is displayed.

Field	Option	Description
<DTM Job:>	Choicelist	Available for **<Use DTM: DTM only>** and **<Use DTM: DTM & Stake Job>** in **STAKEOUT Configuration**, **Heights** page. To select a DTM to be staked and to select the active DTM layer to be used. Heights are then staked out relative to the selected DTM. Refer to "46.4.5 Staking Out a DTM".
<Config Set:>	Choicelist	The active configuration set. All configuration sets from **Main Menu: Manage...\Configuration Sets** can be selected.
<Reflector:>	Choicelist	The reflector currently set in the selected configuration set. All reflectors from **Main Menu: Manage...\Reflectors** can be selected.
<Add. Constant:>	Output	The additive constant stored with the chosen reflector.

Next step

IF the Stakeout application program	THEN
is to be accessed	**CONT (F1)** accepts the changes and accesses Stakeout application program. Refer to "46.4 Staking Out".
is to be configured	**CONF (F2)**. Refer to "46.3 Configuring Stakeout".

46.3 Configuring Stakeout

Access

Select **Main Menu: Programs...\Stakeout**. In **STAKEOUT Stakeout Begin** press **CONF (F2)** to access **STAKEOUT Configuration**.

OR

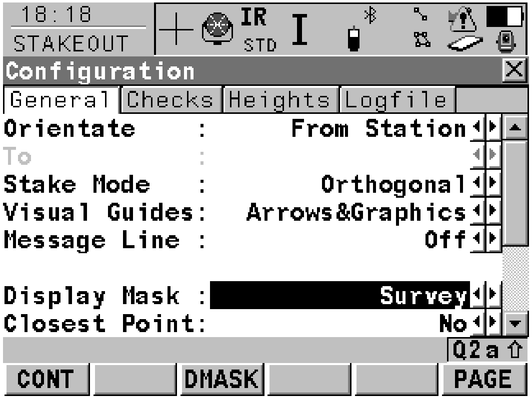
Press **PROG**. Highlight **Stakeout**. **CONT (F1)**. In **STAKEOUT Stakeout Begin** press **CONF (F2)** to access **STAKEOUT Configuration**.

OR

Press **SHIFT CONF (F2)** in **STAKEOUT XX Stakeout**.

STAKEOUT Configuration, General page

This screen consists of the **General** page, the **Checks** page, the **Heights** page and the **Logfile** page. The explanations for the softkeys given below are valid for all pages, unless otherwise stated.



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

DMASK (F3)
Accesses **CONFIGURE Define Display Mask n**. Available for **<Display Mask:>** being highlighted on **General** page. Refer to "16.2 Display Settings".

PAGE (F6)
To change to another page on this screen.

SHIFT ABOUT (F5)
To display information about the program name, the version number, the date of the version, the copyright and the article number.

Description of fields

Field	Option	Description
<Orientate:>		The reference direction to be used to stakeout points. The stakeout elements and the graphical display shown in the Stakeout application program are based on this selection.
	From Station	The direction of the orientation is from the instrument to the point to be staked.
	To Station	The direction of the orientation is from the point to be staked to the instrument.
	From North	The direction of the orientation is from the North direction to the point to be staked.
	To North	The direction of the orientation is from the point to be staked to the North direction.
	To Arrow	The direction of the orientation is from the current position to the point to be staked. The graphical display shows an arrow pointing in the direction of the point to be staked.

Field	Option	Description
	To Last Point	Timewise the last recorded point. If no points are yet staked, **<Orientate: To North>** is used for the first point to be staked.
	To Point(Stake)	A point from **<Stakeout Job:>** selected in **STAKEOUT Stakeout Begin**.
	To Point(Store)	A point from **<Job:>** selected in **STAKEOUT Stakeout Begin**.
	To Line(Stake)	The direction of the orientation is parallel to a reference line from **<Stakeout Job:>** selected in **STAKEOUT Stakeout Begin**. Open the listbox to create, edit or delete a reference line.
	To Line(Store)	The direction of the orientation is parallel to a reference line from **<Job:>** selected in **STAKEOUT Stakeout Begin**. Open the listbox to create, edit or delete a reference line.
<To:>	Choicelist	Available for **<Orientate: To Point(Stake)>**, **<Orientate: To Point(Store)>**, **<Orientate: To Line(Stake)>** and **<Orientate: To Line(Store)>**. To select the point or line to be used for orientation. Refer to "6.2 Accessing Data Management" for information on creating, editing and deleting a known point. Refer to "42.4 Starting Reference Line" for information on creating, editing and deleting a line.
<Stake Mode:>		The method of staking out.

Field	Option	Description
	Polar	The direction from the orientation reference, the horizontal distance and the cut/fill is displayed.
	Orthogonal	The distance forwards to/backwards from the point, the distance right/left to the point and the cut/fill is displayed.
<Visual Guides:>		Arrows and/or a graphical display in **STAKEOUT XX Stakeout**. help finding the point to be staked.
	Off	Neither arrows nor a graphical display are shown.
	Arrows	Upon pressing **DIST (F2)** arrows are shown.
	Graphics	A graphical display is shown. Refer to "46.4.1 Elements of the Graphical Display in the Stakeout"..
	Arrows&Graphics	Upon pressing **DIST (F2)** arrows are shown. A graphical display is always shown.
<Message Line:>		For each point which is selected for staking, angle and distance information is momentarily displayed in the message line.
	Off	No information is displayed in the message line.
	Dist From Stn	The delta Hz angle that the instrument should turn to the point and the distance from the instrument to the point is momentarily displayed in the message line.
	Dist Frm Last Pt	The delta Hz angle that the instrument should turn to the point and the distance from the last staked point is momentarily displayed in the message line.

Field	Option	Description
<Display Mask:>	Choicelist	The user defined display mask to be shown in **STAKEOUT XX Stakeout**. All display masks of the active configuration set defined in **CONFIGURE Display Settings** can be selected.
<Closest Point:>		The order of the points suggested for staking out.
	Yes	After staking and storing a point, the next point suggested for staking out is the point closest to the point which was staked. If there are many points in **<Stakeout Job:>**, the search may take a few seconds.
	No	After staking and storing one point, the next point suggested for staking out is the subsequent one in **<Stakeout Job:>**.
<Auto Position:>	**2D**	Instrument positions horizontally to the point to be staked.
	3D	Instrument positions horizontally and vertically to the point to be staked.
	Off	Instrument does not position to the point to be staked.
<Update Angle:>	**Yes**	Angles are updated with telescope movement after a distance was measured.

Field	Option	Description
	No	Angles and stakeout values are updated after a distance measurement. Then all values are frozen until the next distance is taken. When **<Automation: LOCK:>** and locked to a target the values do not change.
<Store Pt ID:>	**Same as Stake Pt**	The manually occupied staked points are stored with the same point ID's as the points to be staked.
	Prefix	Adds the setting for **<Prefix/Suffix:>** in front of the original point ID's.
	Suffix	Adds the setting for **<Prefix/Suffix:>** at the end of the original point ID's.
<Prefix/Suffix:>	User input	Available for **<Store Pt ID: Prefix>** and **<Store Pt ID: Suffix>**. The identifier with up to four characters is added in front of or at the end of the ID of the manually occupied staked point.

Next step

PAGE (F6) changes to the **Checks** page. Refer to paragraph "STAKEOUT Configuration, Checks page".

STAKEOUT Configuration, Checks page

Description of fields

Field	Option	Description
<Pos Check:>	**Yes** or **No**	Allows a check to be made on the horizontal coordinate difference between the staked point and the point to be staked. If the defined **<Pos Limit:>** is exceeded, the stakeout can be repeated, skipped or stored.
<Pos Limit:>	User input	Available for **<Pos Check: Yes>**. Sets the maximum horizontal coordinate difference accepted in the position check.
<Height Check:>	**Yes** or **No**	Allows a check to be made on the vertical difference between the staked point and the point to be staked. If the defined **<Height Limit:>** is exceeded, the stakeout can be repeated, skipped or stored.
<Height Limit:>	User input	Available for **<Height Check: Yes>**. Sets the maximum vertical difference accepted in the height check.
<Beep near Pt:>	**Yes** or **No**	The instrument beeps when the horizontal radial distance from the current position to the point to be staked is equal to or less than defined in **<Dist from Pt:>**.
<Dist from Pt:>	User input	Available for **<Beep near Pt: Yes>**. The horizontal radial distance from the current position to the point to be staked when a beep should be heard.

Next step

PAGE (F6) changes to the **Heights** page. Refer to paragraph "STAKEOUT Configuration, Heights page".

STAKEOUT Configuration, Heights page

Description of fields

Field	Option	Description
<Height Offset:>	User input	Allows a constant height offset to be applied to the height of the points or DTM being staked.
<Edit Height:>	**Yes**	The field **<D Ht:>** for the design height is displayed in **STAKEOUT Orthogonal Stakeout**, **Stake** page and **STAKEOUT Polar Stakeout**, **Stake** page. The design height is the height of the point to be staked. The value for **<D Ht:>** can be changed.
	No	The field **<Ht:>** for the height of the current position is displayed in **STAKEOUT Orthogonal Stakeout**, **Stake** page and **STAKEOUT Polar Stakeout**, **Stake** page. The value for **<Ht:>** cannot be changed.
<Use DTM:>		Available if DTM Stakeout has been activated via a licence key. Refer to "28 Tools...\Licence Keys" for information on how to type in or upload the licence key. Available unless **STAKEOUT Configuration, Heights** page was accessed while being within the Stakeout application program.
	No	No DTM file is used. The positions and heights of points in the selected **<Stakeout Job:>** are staked out.

Field	Option	Description
	DTM only	Activates the stakeout of heights without positions. Heights relative to the selected **<DTM Job:>** are staked out.
	DTM & Stake Job	The positions of points in the selected **<Stakeout Job:>** are staked out. Heights to be staked out are taken from **<DTM Job:>**.

Next step

PAGE (F6) changes to the **Logfile** page. Refer to paragraph "STAKEOUT Configuration, Logfile page".

STAKEOUT Configuration, Logfile page

Description of fields

Field	Option	Description
<Write Logfile:>	**Yes** or **No**	To generate a logfile when the application program is exited. A logfile is a file to which data from an application program is written to. It is generated using the selected **<Format File:>**.
<File Name:>	Choicelist	Available for **<Write Logfile: Yes>**. The name of the file to which the data should be written. A logfile is stored in the \DATA directory of the active memory device. The data is always appended to the file.

Field	Option	Description
		Opening the choicelist accesses **XX Logfiles** where a name for a new logfile can be created and an existing logfile can be selected or deleted.
<Format File:>	Choicelist	Available for **<Write Logfile: Yes>**. A format file defines which and how data is written to a logfile. Format files are created using LGO. A format file must first be transferred from the CompactFlash card to the System RAM before it can be selected. Refer to "24 Tools...\Transfer Objects..." for information on how to transfer a format file. Opening the choicelist accesses **XX Format Files** where an existing format file can be selected or deleted.

Next step

PAGE (F6) changes to the first page on this screen.

46.4 Staking Out

46.4.1 Elements of the Graphical Display in the Stakeout

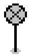
Description

A graphical display provides a guide to find the point to be staked out. The elements of the graphical display used within the Stakeout application program screens are explained in this chapter. Some of the elements depend on the selection for **<Visual Guides:>** in **STAKEOUT Configuration**, **General** page. Other elements are commonly displayed.

The **Map** page provides an interactive display of the data. Refer to "34.5 Map Mode" for information on the functionality and softkeys available.

Elements of graphical display

 Theodolite

 Reflector

 Point to be staked

 North

 North arrow

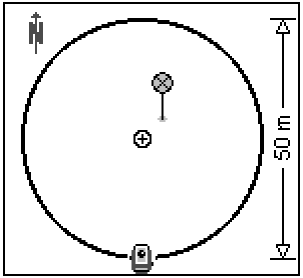
Current scale

For **<Visual Guides: Off>** no graphical display is shown on the screen.

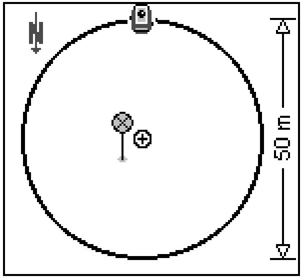
Graphical display

For scale >1000 m the circle is displayed in grey.

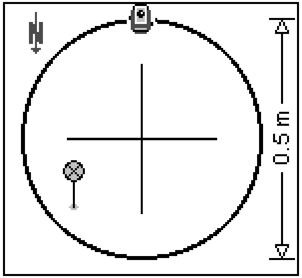
From Station or North



To Station or North



For scale 0.5 m



46.4.2 Manual Entry of Points to be Staked

Description

Manual entry of points to be staked can be used to input angle and distance values.

☞ It is possible to type in angles and distances independent of the used **<Stake Mode:>**.

Manual entry of points step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Set up and orient the instrument.	45
2.	Start the Stakeout application program.	
3.	**STAKEOUT Stakeout Begin** Check the settings.	
4.	**CONT (F1)** to access **STAKEOUT XX Stakeout**.	46.4
5.	**STAKEOUT XX Stakeout** **SHIFT MSTAK (F3)** to access **STAKEOUT Manual Entry**.	
6.	**STAKEOUT Manual Entry** Enter the values of the point to be staked.	
7.	**STAKE (F1)** to access **STAKEOUT XX Stakeout**.	
☞	The point is created and the coordinates of the point are remembered allowing the point to be staked out.	
8.	**STAKEOUT XX Stakeout**	

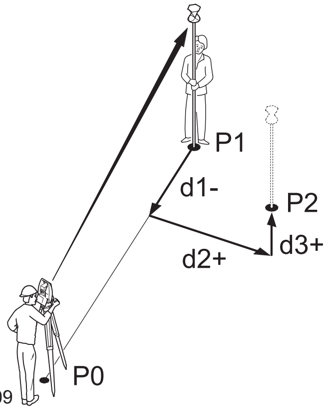
Step	Description	Refer to chapter
	Check the reflector height.	
9.	Continue with step 9. from paragraph "Stake out in orthogonal from station mode step-by-step".	

46.4.3 Staking Out in Orthogonal Mode

Description

Points can be staked out using orthogonal values to guide to the point to be staked. Values are relative to the line defined by station and current position. The stakeout elements are a horizontal distance forwards/backwards, a horizontal distance right/left and a cut/fill. The values are calculated between the current position and the point to be staked. The values are calculated either from the station to the point or from the point to the station depending on the setting of **<Stake Mode:>**.

Orthogonal from and to station



TPS12_109

P0	Station
P1	Current position
P2	Point to be staked
d1	**<Go FORWARD:> ↓ ↑** or **<Go BACK:> ↑ ↓**
d2	**<Go RIGHT:> →** or **<Go LEFT:> ←**
d3	**<CUT:>** or **<FILL:>**

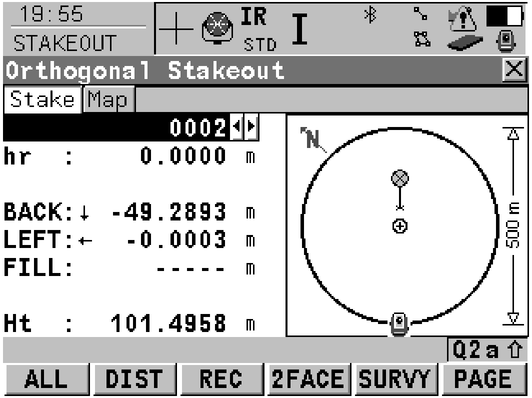
☞ **<Stake Mode: Ortho from Stn>** is configured in **STAKEOUT Configuration**, **General** page. Refer to "46.3 Configuring Stakeout".

Access

Refer to "46.2 Accessing Stakeout" to access **STAKEOUT Orthogonal Stakeout**.

STAKEOUT Orthogonal Stakeout, Stake page

The pages shown are those from a typical configuration set. An additional page is available when a user defined display mask is used.



ALL (F1)
To measure a distance and store distance and angles.

DIST (F2)
To measure a distance.

REC (F3)
To store angles and distance. Distance must be measured before.

2FACE (F4)
To take a measurement in Face I and Face II. The point stored is an average of the two measurements.
When using instruments fitted with ATR, the point is automatically measured in both faces, the resulting point is stored and the instrument is returned to the first face.
This hotkey is only available for <**EDM Mode**: **Standard**> and <**EDM Mode**: **Fast**> and in the Survey, Reference Line and Stakeout programs.

SURVY (F5)
To access Survey application program to measure points independent from the Stakeout application program. To return to Stakeout application program, press **SHIFT QUIT (F6)** or **ESC**.

PAGE (F6)
To change to another page on this screen.

SHIFT CONF (F2)
To configure stakeout. Refer to "46.3 Configuring Stakeout".

SHIFT POS2D (F3)
To position the telescope (X,Y) onto the point to be staked.

SHIFT POS3D (F4)
To position the telescope (X,Y,Z) onto the point to be staked.

SHIFT MSTAK (F5)
To enter angle and distance values to stake out a point. Refer to "46.4.2 Manual Entry of Points to be Staked".

Description of fields

Field	Option	Description
<Point ID:>	Choicelist	The point ID of the point to be staked. Accesses **STAKEOUT Data: Job Name** where points are shown according to sort and filter settings and staked points are indicated by .

Field	Option	Description
<Reflector Ht:> or **<hr:>**	User input	The default reflector height as defined in the active configuration set is suggested.
<Go FORWARD:> or **<FORW:>**	Output	The horizontal distance along the line defined by station and reflector from the current position to the point to be staked. ↓ or ↑ to move towards the station depending on **<Symbols:>**.
<Go BACK:> or **<BACK:>**	Output	The horizontal distance in reverse direction from the line defined by station and reflector from the current position to the point to be staked. ↑ or ↓ to move away from the station depending on **<Symbols:>**.
<Go RIGHT:> or **<RGHT:>**	Output	The direction depends on **<Stake Mode:>**. The horizontal distance orthogonal to the right of the line defined by station and reflector from the current position to the point to be staked. → to move to the right of the line defined in **<Symbols:>**, ← to move to the left of the line defined in **<Symbols:>**.
<Go LEFT:> or **<LEFT:>**	Output	The direction depends on **<Stake Mode:>**. The horizontal distance from the current position to the point to be staked orthogonal to the left of the line defined by station and reflector. ← to move to the left of the line defined in **<Symbols:>**, → to move to the right of the line defined in **<Symbols:>**.

Field	Option	Description
<CUT:>	Output	The negative height difference from the height of the current position to the height of the point to be staked. The value for **<Height Offset:>** configured in **STAKEOUT Configuration**, **Heights** page is taken into account. Move down.
<FILL:>	Output	The positive height difference from the height of the current position to the height of the point to be staked. The value for **<Height Offset:>** configured in **STAKEOUT Configuration**, **Heights** page is taken into account. Move up.
<Height:> or **<Ht:>**	Output	Available for **<Edit Height: No>** in **STAKEOUT Configuration**, **Heights** page. The height of the current position is displayed as orthometric height. If the orthometric height cannot be displayed, the local ellipsoidal height is displayed. If it is not possible to display the local ellipsoidal height, the WGS 1984 height is displayed. The value for **<Height Offset:>** configured in **STAKEOUT Configuration**, **Heights** page is taken into account.

Field	Option	Description
<Design Ht:> or **<D Ht:>**	User input	Available for **<Edit Height: Yes>** in **STAKEOUT Configuration**, **Heights** page. The design height, which is the height of the point to be staked, is displayed as orthometric height. If the orthometric height cannot be displayed, the local ellipsoidal height is displayed. If it is not possible to display the local ellipsoidal height, the WGS 1984 height is displayed. The value for **<Height Offset:>** configured in **STAKEOUT Configuration**, **Heights** page is not taken into account. Changing the value for **<D Ht:>** changes the values displayed for **<CUT:>** and **<FILL:>**.

Next step

PAGE (F6) changes to the **Map** page. Refer to paragraph "STAKEOUT Orthogonal Stakeout, Map page".

STAKEOUT Orthogonal Stakeout, Map page

The **Map** page provides an interactive display of the data. Refer to "34 MapView Interactive Display Feature" for information on the functionality and softkeys available.

Next step

PAGE (F6) changes to the first page on this screen.

Stake out in orthogonal from station mode step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Set up and orient the instrument.	45
	<Automation: LOCK> and **<EDM Mode: Tracking>** are configured in **CONFIGURE EDM & ATR Settings**.	17.1
2.	Start the Stakeout application program.	46.2
3.	**STAKEOUT Stakeout Begin** Check the settings.	46.2
4.	**CONF (F2)** to access **STAKEOUT Configuration, General** page.	
5.	**STAKEOUT Configuration**, **General** page **<Stake Mode: Ortho from Stn>**	46.3
	This step-by-step instruction uses typical settings in all other fields on all pages in **STAKEOUT Configuration**.	46.3
6.	**CONT (F1)** to access **STAKEOUT Stakeout Begin**.	
7.	**CONT (F1)** to access **STAKEOUT Orthogonal Stakeout**.	
8.	**STAKEOUT Orthogonal Stakeout**, **Stake** page Check the suggested point ID and the reflector height.	
9.	**DIST (F2)**.	
10.	Move to the point to be staked either by following the range information in the fields **<FORW:>**, **<BACK:>**, **<RGHT:>** and **<LEFT:>** or the graphical display.	

Step	Description	Refer to chapter
	When the value is at or nearly zero, the current position is the point to be staked.	
11.	Hold the reflector steady over the marker.	
12.	**REC (F1)** stores distance and angles.	
	For **<Pos Check: Yes>** and/or **<Height Check: Yes>** in **STAKEOUT Configuration**, **Checks** page, a check is made on the horizontal and/or vertical coordinate distance from the staked point to the point to be staked. If either of the configured difference limits are exceeded, **STAKEOUT Difference Limit Exceeded** is accessed.	46.4.6
13.	Are more points to be staked? • If **yes**, continue with step 14. • If **no**, continue with step 16.	
14.	**STAKEOUT Orthogonal Stakeout**, **Stake** page According to sort and filter settings, the subsequent point in **<Stakeout Job:>** is suggested for staking out.	
15.	Repeat steps 8. to 13.	
16.	**SHIFT QUIT (F6)** to return to the screen from where **STAKEOUT Stakeout Begin** was accessed.	

Stake out in orthogonal to station mode step-by-step

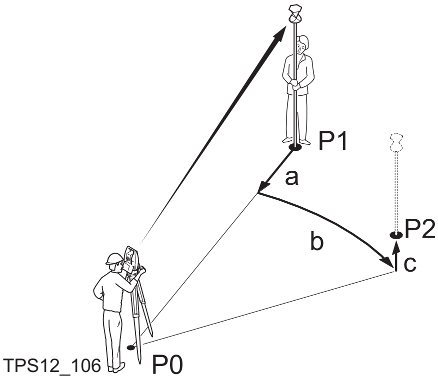
The steps are identical to those of staking out in orthogonal from station mode. Follow the instructions in paragraph "Stake out in orthogonal from station mode step-by-step" using **<Stake Mode: Ortho to Stn>**. The values are calculated from the point to the station.

46.4.4 Staking Out in Polar Mode

Description

The stakeout elements are a direction from the station, a horizontal distance and a cut/fill. The range information is calculated from the current position to the point to be staked in reference to the station.

Diagram



P0 Station
P1 Current position
P2 Point to be staked
a **<Δ DISTANCE:>**
b **<Δ HZ:>**
c **<CUT:>** or **<FILL:>**

☞ **<Stake Mode: Polar>** is configured in **STAKEOUT Configuration**, **General** page. Refer to "46.3 Configuring Stakeout".

Access

Refer to "46.2 Accessing Stakeout" to access **STAKEOUT Polar Stakeout**.

STAKEOUT Polar Stakeout, Stake page

The pages shown are those from a typical configuration set. An additional page is available when a user defined display mask is used.
The keys are identical with those in **STAKEOUT Orthogonal Stakeout**, **Stake** page. Refer to "46.4.3 Staking Out in Orthogonal Mode" for information on the keys.

Description of fields

Field	Option	Description
<Point ID:>	Choicelist	The point ID of the point to be staked. Accesses **STAKEOUT Data: Job Name** where points are shown according to sort and filter settings and staked points are indicated by .
<Reflector Ht:> or **<hr:>**	User input	The default reflector height as defined in the active configuration set is suggested.
<Δ HZ:>	Output	The difference of the horizontal angle from the point to be staked to the current position.
<Δ DISTANCE:> or **<Δ D:>**	Output	The difference of the horizontal distance from the point to be staked to the current position along the line defined by current position and station.
<CUT:>	Output	The negative height difference from the height of the current position to the height of the point to be staked. The value for **<Height Offset:>** configured in **STAKEOUT Configuration**, **Heights** page is taken into account. Move down.
<FILL:>	Output	The positive height difference from the height of the current position to the height of the point to be staked. The value for **<Height Offset:>** configured in **STAKEOUT Configuration**, **Heights** page is taken into account. Move up.

Field	Option	Description
<Height:> or **<Ht:>**	Output	Available for **<Edit Height: No>** in **STAKEOUT Configuration**, **Heights** page. The height of the current position is displayed as orthometric height. If the orthometric height cannot be displayed, the local ellipsoidal height is displayed. If it is not possible to display the local ellipsoidal height, the WGS 1984 height is displayed. The value for **<Height Offset:>** configured in **STAKEOUT Configuration**, **Heights** page is taken into account.
<Design Ht:> or **<D Ht:>**	User input	Available for **<Edit Height: Yes>** in **STAKEOUT Configuration**, **Heights** page. The design height, which is the height of the point to be staked, is displayed as orthometric height. If the orthometric height cannot be displayed, the local ellipsoidal height is displayed. If it is not possible to display the local ellipsoidal height, the WGS 1984 height is displayed. The value for **<Height Offset:>** configured in **STAKEOUT Configuration**, **Heights** page is not taken into account. Changing the value for **<D Ht:>** changes the values displayed for **<CUT:>** and **<FILL:>**.

Next step

PAGE (F6) changes to the **Map** page. Refer to paragraph "STAKEOUT Orthogonal Stakeout, Map page".

STAKEOUT Polar Stakeout, Map page

The **Map** page provides an interactive display of the data. Refer to "34 MapView Interactive Display Feature" for information on the functionality and softkeys available.

Next step

PAGE (F6) changes to the first page on this screen.

Stake out in polar mode step-by-step

The steps are identical to those of staking out in orthogonal mode. Refer to "46.4.3 Staking Out in Orthogonal Mode". Follow the instructions in paragraph "Stake out in orthogonal from station mode step-by-step" using **<Stake Mode: Polar>**. The values are displayed as **<Δ HZ:>** and **<Δ DISTANCE:>**.

46.4.5 Staking Out a DTM

Description

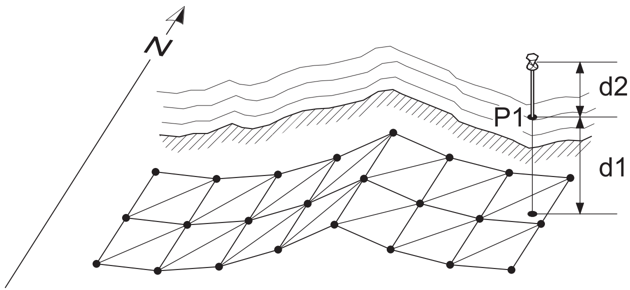
With the Stakeout application program a **D**igital **T**errain **M**odel can be staked. The heights of the current positions are compared against those of a selected DTM job. The height differences are calculated and displayed.

Staking a DTM may be used for

- staking out where the DTM represents the surface to be staked.
- quality control purposes where the DTM represents the final project surface.

DTM jobs are created in LGO. DTM jobs are stored in the \DBX directory on the active memory device.

Diagram



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P1	Point to be staked
d1	**<CUT:>** or **<FILL:>**
d2	Reflector height

Access

Refer to "46.2 Accessing Stakeout" to access **STAKEOUT XX Stakeout**.

Stake out a DTM step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
	DTM Stakeout must be activated via a licence key.	28
	The DTM job to be used must be stored in the \DBX directory on the active memory device.	
1.	Start the Stakeout application program.	46.2
2.	**STAKEOUT Stakeout Begin** **CONF (F2)** to access **STAKEOUT Configuration**.	
3.	**PAGE (F6)** until the **Heights** page is active.	
4.	**STAKEOUT Configuration**, **Heights** page **<Use DTM: DTM only>**	46.3
	<Use DTM: DTM & Stake Job> is not covered in this step-by-step instruction. The stake out procedure is identical as described for the selected **<Stake Mode:>**. The heights to be staked are taken from the selected **<DTM Job:>** defined in **STAKEOUT Stakeout Begin**.	46.3
	This step-by-step instruction uses typical settings in all other fields on all pages in **STAKEOUT Configuration**. The selection for **<Stake Mode:>** is irrelevant since no positions are staked.	46.3
5.	**CONT (F1)** to access **STAKEOUT Stakeout Begin**.	
6.	**STAKEOUT Stakeout Begin** **<DTM Job:>** Select a DTM job.	46.2

Step	Description	Refer to chapter
	Check the other settings.	
7.	**CONT (F1)** to access **STAKEOUT DTM Stakeout**.	
8.	**STAKEOUT DTM Stakeout**, **Stake** page Check the suggested reflector height.	
9.	**DIST (F2)**.	
10.	**STAKEOUT DTM Stakeout**, **Stake** page **<CUT:>** or **<FILL:>** The negative or positive height difference from the current position to the equivalent point in the selected DTM job is calculated and displayed. Height offsets apply for whole DTM.	
11.	Mark the current position.	
12.	**REC (F1)** to store distance and angles.	
☞	For **<Height Check: Yes>** in **STAKEOUT Configuration**, **Checks** page, a check is made on the vertical coordinate distance from the staked point to the point to be staked. If the configured difference limit is exceeded, **STAKEOUT Difference Limit Exceeded** is accessed.	46.4.6
13.	Are more heights to be staked? • If **yes**, move to the next position and repeat steps 8. to 13. • If **no**, continue with step 14.	
14.	**SHIFT QUIT (F6)** to return to the screen from where **STAKEOUT Stakeout Begin** was accessed.	

46.4.6 Stakeout Difference Limit Exceeded

Description

If configured a check is made on the horizontal and/or vertical coordinate distance from the staked point to the point to be staked when storing a staked point. Refer to "46.3 Configuring Stakeout" for information on configuring the check and the limits.

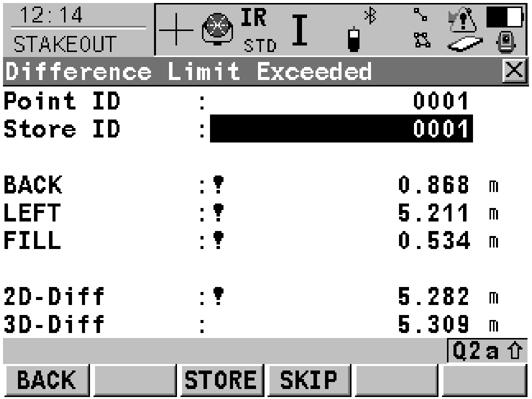
Access

The screen shown below is accessed automatically when the staked point is stored if either of the configured difference limits are exceeded.

STAKEOUT Difference Limit Exceeded

The availability of the fields depends on the configured **<Stake Mode:>** and **<Use DTM:>**. For example for **<Use DTM: DTM only>**, position relevant fields are unavailable.

The limits that have been exceeded are shown in bold and indicated by a !.



BACK (F1)
To return to **STAKEOUT XX Stakeout** without storing the point. Staking out of the same point continues.

STORE (F3)
To accept the coordinate differences, store the point information and return to **STAKEOUT XX Stakeout**.

SKIP (F4)
To return to **STAKEOUT XX Stakeout** without storing the point. According to filter and sort settings the subsequent point in **<Stakeout Job:>** is suggested for staking out.

Description of fields

Field	Option	Description
<Point ID:>	Output	The point ID of the point to be staked.
<Store ID:>	User input	The unique number which is used to store the staked point. Allows a different point ID to be typed in if needed.
<Δ EASTING:>	Output	The difference of the Easting coordinate between the the point to be staked and the current position.
<Δ NORTHING:>	Output	The difference of the Northing coordinate between the point to be staked and the current position.
<Δ HZ:>	Output	The difference of the horizontal angle to the point to be staked and the current position.
<Δ DISTANCE:>	Output	The difference of the horizontal distance to the point to be staked and the current position.
<FORWARD:>	Output	The horizontal distance from the current position to the point to be staked along the line defined by station and reflector.
<BACK:>	Output	The horizontal distance from the current position to the point to be staked in the reverse direction of the line defined by station and reflector.
<RIGHT:>	Output	Horizontal distance from the current position to the point to be staked orthogonal to the right of the line defined by station and reflector.

Field	Option	Description
<LEFT:>	Output	Horizontal distance from the current position to the point to be staked orthogonal to the left of the line defined by station and reflector.
<CUT:>	Output	The negative height difference from the height of the staked point to the height of the point to be staked.
<FILL:>	Output	The positive height difference from the height of the staked point to the height of the point to be staked.
<2D-Diff:>	Output	Displays the horizontal difference from the staked point to the point to be staked.
<3D-Diff:>	Output	Displays the spatial difference from the staked point to the point to be staked.

Next step

IF the exceeded difference limit	THEN
is not to be accepted	**BACK (F1)** to stake the same point again.
is to be accepted	**STORE (F3)** to store the point and to stake out the next point.
is not to be accepted but cannot be improved	**SKIP (F4)** to skip staking this point and to stake out the next point.

47 Survey - General

47.1 Accessing Survey

Access

Select **Main Menu: Survey**.

OR

Select **Main Menu: Programs...\Survey**

OR

Press a hot key configured to access the screen **SURVEY Survey Begin**.
Refer to "2.1 Hot Keys" for information on hot keys.

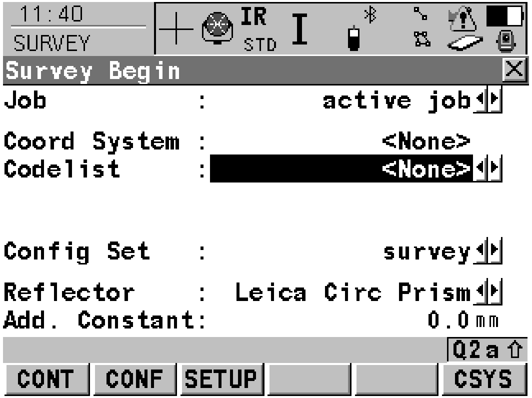
OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

OR

Press **PROG**. Highlight **Survey**. **CONT (F1)**.
Refer to "35.2 Accessing the Programs Menu" for details on the **PROG** key.

SURVEY
Survey Begin



CONT (F1)
To accept changes and access the subsequent screen. The chosen settings become active.

CONF (F2)
To configure SmartCodes,auto points and remote point measurements. Accesses **SURVEY Configuration**. Refer to "48 Survey - Auto Points" and to "49 Survey - Remote Point" for information on the fields and keys.

SETUP (F3)
To set up station. Accesses **SETUP Station Setup**.

CSYS (F6)
To select a different coordinate system.

Description of fields

Field	Option	Description
<Job:>	Choicelist	The active job. All jobs from **Main Menu: Manage...\Jobs** can be selected.
<Coord System:>	Output	The coordinate system currently attached to the selected **<Job:>**.
<Codelist:>	Choicelist	No codes are stored in the selected job. All codelists from **Main Menu: Manage...\Codelists** can be selected.

Field	Option	Description
	Output	Codes have already been stored in the selected **<Job:>**. If codes had been copied from a System RAM codelist, then the name of the codelist is displayed. If codes have not been copied from a System RAM codelist but typed in, then the name of the active job is displayed.
<Config Set:>	Choicelist	The active configuration set. All configuration sets from **Main Menu: Manage...\Configuration Sets** can be selected.
<Reflector:>	Choicelist	The active reflector. All reflectors from **Main Menu: Manage...\Reflectors** can be selected.
<Add. Constant:>	Output	The additive constant stored with the chosen reflector.

Next step

CONT (F1) to access **SURVEY Survey: Job Name**, where measurements can be performed with **ALL (F1)** or **DIST (F2)** and/or **REC (F3)**.

47.2 Surveying Points

Description

The Survey application program is used for point measurement. Coordinates for points can be measured and stored using **ALL (F1)**, **DIST (F2)** and **REC (F3)**. Refer to "TPS1200 System Field Manual" for an example on surveying with default settings.

Access step-by-step

The table describes the main access to **SURVEY Survey: Job Name**.

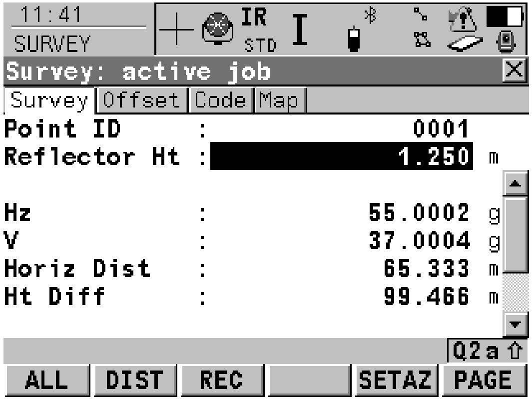
Access is possible from other screens where individual point measurements are needed, for example from **COGO Inverse** with **SURVY (F5)**.

Step	Description
1.	Refer to "47.1 Accessing Survey" to access **SURVEY Survey Begin**.
2.	**SURVEY Survey Begin** **CONT (F1)** to access **SURVEY Survey: Job Name**.

SURVEY Survey: Job Name, Survey page

The fields shown are those from a typical configuration set.The screen described consists of the **Survey** page and the **Map** page. The explanations for the softkeys given below are valid for the **Survey** page. Refer to "34 MapView Interactive Display Feature" for information on the keys on the **Map** page.

The fields and functionality of this screen vary slightly when accessed from other application programs where individual point measurements are needed.



ALL (F1)
To measure and store distances and angles.

STOP (F1)
Available if **<EDM Mode: Tracking>** and **DIST (F2)** was pressed. Stops the distance measurements. **(F1)** changes back to **ALL**.

DIST (F2)
To measure and display distances. Available unless **<EDM Mode: Tracking>** and/or **<Log Auto Pts: Yes>**, after the tracking or logging is started.

REC (F3)
To record data.
If **<EDM Mode: Tracking>** and/or **<Log Auto Pts: Yes>**, records measured point and continues tracking.

REMOT (F4)
Available if **<Use Remote Pt: Yes>** is set in the **SURVEY Configuration, Remote Pt** page. To access **SURVEY Survey Remote Point**.

SETAZ (F5)
To access the **SETUP Set Stn & Ori - Set Azimuth** screen to set the horizontal angle. Refer to "45.6.2 Set Azimuth" for information on the **SURVEY Set Stn & Ori - Set Azimuth** screen.

SETUP (F5) (Applicable to **Add Points Later**)
Available when the setup is incomplete.

TEST (F5)

To access the **SURVEY EDM Test Signal/Frequency** screen. Available for **<EDM Mode: Tracking>** and/or **<Log Auto Pts: Yes>**, after the tracking or logging is started.

SHIFT CONF (F2)

To configure auto points and remote point measurements. Accesses **SURVEY Configuration**. When **SHIFT AVGE (F2)** or **SHIFT ABS (F2)** are active, this key is not available. Refer to "48 Survey - Auto Points" and to "49 Survey - Remote Point" for information on the fields and keys.

SHIFT AVGE (F2)

To check the residuals for the averaged point. Available for **<Averaging Mode: Average>** and for more than one measured coordinate triplet recorded for the same point. Refer to "6.3.4 Mean Page".

SHIFT ABS (F2)

To check the absolute difference between the measurements. Available for **<Averaging Mode: Absolute Diffs>** and for more than one measured coordinate triplet recorded for the same point. Refer to "6.3.4 Mean Page".

SHIFT 2FACE (F4)

To take a measurement in Face I and Face II. The point stored is an average of the two measurements.

When using instruments fitted with ATR, the point is automatically measured in both faces, the resulting point is stored and the instrument is returned to the first face.

This hotkey is only available for <**EDM Mode**: **Standard**> and <**EDM Mode**: **Fast**> and in the Survey, Reference Line and Stakeout programs.

SHIFT INDIV (F5) and **SHIFT RUN (F5)**

To change between entering an individual point ID different to the defined ID template and the running point ID according to the ID template. Refer to "16.1 ID Templates".

Description of fields

Field	Option	Description
<Point ID:>	User input	The identifier for measured points. The configured point ID template is used. The ID can be changed: • To start a new sequence of point ID's overtype the point ID. • For AN individual number independent of the ID template **SHIFT INDIV (F5)**. **SHIFT RUN (F5)** changes back to the next ID from the configured ID template. Refer to "16.1 ID Templates".

Field	Option	Description
<Reflector Ht:>	User input	The last used reflector height is suggested when accessing the Survey application program. An individual reflector height can by typed in.
<Hz:>	Output	The current horizontal angle.
<V:>	Output	The current vertical angle.
<Horiz Dist:>	Output	The horizontal distance after **DIST (F2)** was pressed. No distance is displayed when accessing the screen and after **REC (F3)** or **ALL (F1)**.
<Ht Diff:>	Output	The height difference between station and measured point after **DIST (F2)**. Displays ----- when accessing the screen and after **REC (F3)** or **ALL (F1)**.
<Easting:>	Output	Easting coordinate of the measured point.
<Northing:>	Output	Northing coordinate of the measured point.
<Height:>	Output	Elevation of the measured point.

Next step

PAGE (F6) changes to another page on this screen.

48 Survey - Auto Points

48.1 Overview

Description

- Auto points is used to automatically measure and store points at a specific rate. Additionally, individual auto points can be stored outside the defined rate. Auto points logged between starting and stopping logging of auto points form one chain. A new chain is formed each time logging of auto points is started.
- Auto points can be collected in the Survey application program. An **Auto** page is visible when logging of auto points is active.
- Up to two offset points related to one auto point can be logged. The offset points can be both to the left or right and they can be coded independently of each other and of the auto points. Refer to "48.4 Offset Points of Auto Points".

Coding of auto points

Coding of auto points is similar to coding of measured points. Refer to "8 Coding" for information on coding.
The differences are:

- Thematical coding: Always available.
- Free coding: Always available.
- Quick coding: Not available.
- Codes of auto points overwrite the codes of points existing in the active job with the same point ID but with a different code as the auto point.
- Codes of auto points can be changed when no auto points are being logged.
- Up to three attributes can be stored with a code

Properties of auto points

The properties stored with auto points are:

- Class: **MEAS**
- Sub class: **TPS**
- Source: **Survey (Auto)** or **Survey (Auto Of)**
- Instrument source: **TPS**

Averaging of auto points

An average is never calculated for auto points even if a measured point of class **MEAS** already exists with the same point ID.

48.2 Configuring Auto Points

Access

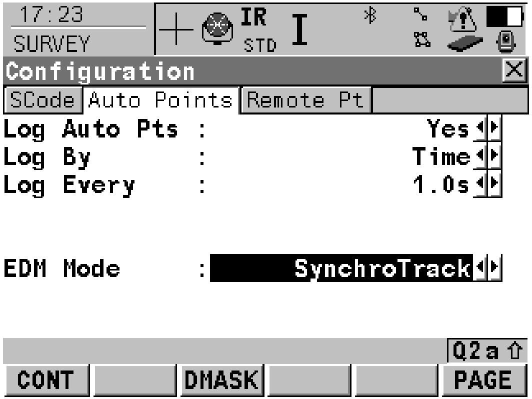
Select **Main Menu: Survey**. In **SURVEY Survey Begin** press **CONF (F2)** to access **SURVEY Configuration**.

OR

In **SURVEY Survey: Job Name** press **SHIFT CONF (F2)** to access **SURVEY Configuration**.

SURVEY Configuration, Auto Points page

The settings on this page activate the logging of auto points and define the method of logging.



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

DMASK (F3)
Available for **<Log Auto Pts: Yes>**. To configure what is viewed in the **Auto** page in the Survey application program. Refer to paragraph "SURVEY Configure Auto Pts Display Mask".

PAGE (F6)
To change to another page on this screen.

Description of fields

Field	Option	Description
<Log Auto Pts:>	**Yes**	Activates logging of auto points. ☞ All other fields on the screen are active and can be edited with this setting.
	No	Deactivates logging of auto points and all fields on this screen.
<Log By:>	**Time**	Auto points are stored according to a time interval.
	Distance	The difference in distance from the last stored auto point, which must be reached before the next auto point is measured. The auto point is stored with the next available measured position.
	Height Diff	The height difference from the last stored auto point, which must be reached before the next auto point is measured. The auto point is stored with the next available measured position.
	Dist or Ht	Before the next auto point is measured, either the difference in distance or the difference in height must be reached. The auto point is stored with the next available measured position.

Field	Option	Description
	Stop & Go	An auto point is stored when the position of the reflector does not move more than the distance configured in **<Stop Position:>** within the **<Stop Time:>**. Once a point has been stored, the position from the point just stored must change more than the distance configured in **<Stop Position:>** before he routine starts again.
	User Decides	An auto point is stored uppon pressing **REC (F3)** in **SURVEY Survey: Job Name, Auto** page. In the beginning, the chain to which the auto points should be assigned must be started with **START (F1)**. In the end, the chain must be closed with **STOP (F1)**.
<Log Every:>		Available when: • **<Log By: Time>** • **<Log By: Distance>** • **<Log By: Height Diff>**.
	User input	User input when: • **<Log By: Distance>** • **<Log By: Height Diff>** • **<Log By: Dist or Ht>** • **<Log By: Stop & Go>**.

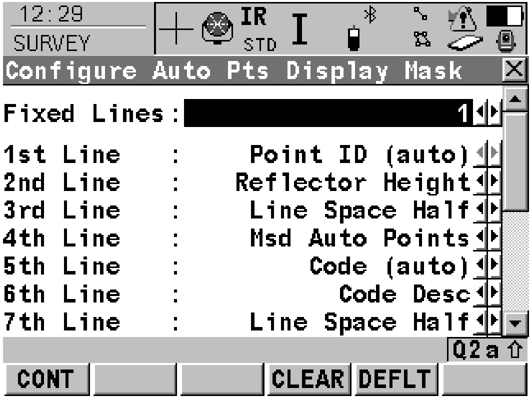
Field	Option	Description
	For **<Log By: Time>** from **0.1s** to **60.0s**	For **<Log By: Time>**. The time interval before the next auto point is logged.
<Min Distance:>	User input	Available for **<Log By: Dist or Ht>**. The value for the difference in distance before the next auto point is logged.
<Min Height:>	User input	Available for **<Log By: Dist or Ht>**. The value for the height difference before the next auto point is logged.
<Stop Position:>	User input	Available for **<Log By: Stop & Go>**. The maximum distance within which the position is considered stationary.
<Stop Time:>	User input	Available for **<Log By: Stop & Go>**. The time while the position must be stationary until an auto point is stored.
<EDM Mode:>	**Tracking**	Continuous distance measurement with 0.3 s measuring time and 5 mm + 2 ppm accuracy. When the logging of auto points has started, **TRK** is displayed as an icon.
	SynchroTrack	Available only for **<EDM Type: Reflector (IR)>**.

Field	Option	Description
		This is the measurement mode for the interpolation of angle measurements in IR LOCK Tracking mode. In difference to normal IR LOCK Tracking mode, where angle measurements are only assigned to certain distance measurements, SynchroTrack will perform a linear interpolation between the previous and following angle measurement, based upon the timestamp of the EDM measurement. When the logging of auto points has started, **SYNC** is displayed as an icon.

Next step

IF the display mask	THEN
is not to be configured	**CONT (F1)** closes the screen and returns to the screen from where **SURVEY Configuration, Auto Points** page was accessed.
is to be configured	**DMASK (F3)**. Refer to paragraph "SURVEY Configure Auto Pts Display Mask".

SURVEY
Configure Auto Pts Display Mask



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

CLEAR (F4)
To set all fields to **<XX. Line: Line Space Full>**.

DEFLT (F5)
Available if the active configuration set is a default configuration set. To recall the default settings.

Description of fields

Field	Option	Description
<Fixed Lines:>	From **0** to **5**	Defines how many lines do not scroll in **SURVEY Survey: Job Name, Auto** page when that display mask is used.
<1st Line:>	Output	Fixed to **<1st Line: Point ID (auto)>**.
<2nd Line:> to **<16th Line:>**	**Add. Constant**	Output field for the additive constant of the currently selected reflector.
	Angle Right	Output field for the angle right.
	Annotation 1-4	Input field for comments to be stored with the point.

Field	Option	Description
	Attrib (free) 01-20	Output field for attributes for free codes.
	Attrib (pt) 01-03	Input field for attributes for point codes.
	Azimuth	Output field for the azimuth.
	Code (auto)	Choicelist or input field for auto point codes.
	Code (free)	Output field for free codes.
	Code Desc	Output field for the description of codes.
	Code Desc (free)	Output field for the description of free codes.
	Code Type	Output field for the description of point codes.
	EDM Mode	Output field displaying the current EDM mode.
	EDM Type	Output field displaying the current EDM type.
	Easting	Output field for the Easting coordinate of the measured point.
	Height	Output field for the height coordinate of the measured point
	Height Diff	Output field for the height difference between station and reflector.
	Horiz Dist	Output field for the horizontal distance calculated from the measured slope distance and the vertical angle.

Field	Option	Description
	Hz-Angle	Output field for the horizontal angle.
	Line Space Full	Insert full line space.
	Line Space Half	Insert half line space.
	Linework	Choicelist with instructions how the software should flag a line/area. Refer to "9 Linework".
	Msd Auto Points	Output field for the number of auto points logged after pressing **START (F1)** in **SURVEY Survey: Job Name, Auto** page. Counting starts from 0 every time **START (F1)** is pressed.
	Northing	Output field for the North coordinate of the measured point.
	Offset Cross	Input field for the horizontal distance offset for the measured point, perpendicular to the line of sight.
	Offset Height	Input field for the height offset of the measured point.
	Offset Length	Input field for the horizontal distance offset, in the direction of line of sight.
	Reflector	Output field for the chosen reflector.
	Reflector Height	Input field for the reflector height.
	SD-Last Rec	Output field for the last recorded distance.

Field	Option	Description
	Slope Dist	Output field for the measured slope distance.
	Time at Point	Output field for the time from when the point is occupied until point occupation is stopped. Appears in the display mask during the point occupation.
	V-Angle	Output field for the vertical angle.

Next steps

Step	Description
1.	**CONT (F1)** closes the screen and returns to **SURVEY Configuration, Auto Points** page.
2.	**CONT (F1)** returns to the screen from where **SURVEY Configuration, Auto Points** page was accessed.

48.3 Auto Points

Requirements

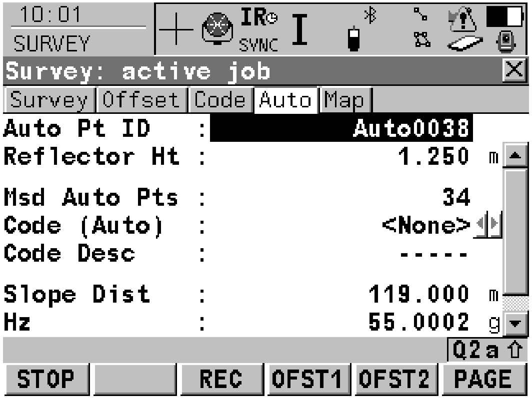
<Log Auto Pts: Yes> in **SURVEY Configuration, Auto Points** page.

Access step-by-step

Step	Description
1.	Refer to "47.1 Accessing Survey" to access **SURVEY Survey Begin**.
2.	**SURVEY Survey Begin** Check the settings.
3.	**CONT (F1)** to access **SURVEY Survey: Job Name**.
4.	**PAGE (F6)** until the **Auto** page is visible.

SURVEY Survey: Job Name, Auto page

The **Auto** page of a typical configuration set is explained. Before logging of auto points has started, the page appears as shown below:



START (F1)

To start logging of auto points and offset points if configured or, for **<Log By: User Decides>** to start the chain to which the auto points should be assigned. The first auto point is stored..

<EDM Mode: Tracking> becomes active. For **<EDM Type: Reflector (IR)>** instrument locks onto reflector. For **<EDM Type: Long Range (LO)>** **<EDM Type: Reflector (IR)>** is set and instrument locks onto the reflector.

STOP (F1)

To end recording of auto points and offset points if configured or, for **<Log By: User Decides>**, to end the chain to which the auto points are assigned..

REC (F3)

Available for **STOP (F1)**. To store an auto point at any time.

OFST1 (F4)

To configure recording of the first type of offset points. Refer to "48.4 Offset Points of Auto Points".

OFST2 (F5)

To configure recording of a second type of offset points. Refer to "48.4 Offset Points of Auto Points".

PAGE (F6)

To change to another page on this screen.

SHIFT CONF (F2)

To configure auto points. Refer to "48.2 Configuring Auto Points".

SHIFT QUIT (F6)

To exit the Survey application program. Point information logged until pressing **SHIFT QUIT (F6)** is saved in the database.

Description of fields

Field	Option	Description
<Auto Pt ID:>	User input	Available unless **<Auto Pts: Time & Date>** in **CONFIGURE ID Templates**. The identifier for auto points. The configured ID template for auto points is used. The ID can be changed. To start a new sequence of point ID's overtype the point ID.
	Time and Date	Available for **<Auto Pts: Time & Date>** in **CONFIGURE ID Templates**. The current local time and date is used as identifier for auto points.
<Reflector Ht:>	User input	The default reflector height as defined in the active configuration set is suggested.
<Msd Auto Pts:>	Output	Available after pressing **START (F1)** and before pressing **STOP (F1)**. The number of auto points measured since **START (F1)** has been pressed.
<Code (Auto):>		The thematical code for the auto point. • If a point code is selected then any open line/area is closed. The occupied point is stored with the selected code idependently of any line/area.

Field	Option	Description
		• If a line code is selected then any open line is closed and a new line with the selected code is created. The line ID is defined by the configured line ID template. The occupied point is assigned to that line. The line stays open until it is closed manually or another line code is selected. • If an area code is selected then the behaviour is as for lines.
	Choicelist	Available for **<Thematc Codes: With Codelist>**. The setting for **<Show Codes:>** in **CONFIGURE Coding & Linework** determines if either all codes or only point codes are available. The attributes are shown as output, input or choicelist fields depending on their definition.
	User input	Available for **<Thematc Codes: Without Codelist>**. Codes can be typed in but not selected from a codelist. A check is performed to see if a code of this name already exists in the job. If so, the according attributes are shown. Configure a display mask with a choicelist for code types to define if a point, line or area code is typed in.
<Code Desc:>	Output	The description of the code.

Field	Option	Description
<Slope Dist:>	Output	The measured slope distance. When **START (F1)** is pressed, **<EDM Mode: Tracking>** is set and the slope distance is constantly updated.
<Hz:>	Output	The current horizontal angle.
<V:>	Output	The current vertical angle.

Next step

IF	THEN
auto points are to be logged	**START (F1)**. Then, for <Log By: User Decides>, **REC (F3)** whenever an auto point is to be stored.
offset points are to be configured	**OFST1 (F4)** or **OFST2 (F5)**. Refer to "48.4 Offset Points of Auto Points".

48.4 Offset Points of Auto Points

48.4.1 Overview

Description

Offset points

- can be created with auto points when auto points are stored to the DB-X.
- can be to the left or to the right of auto points.
- are automatically computed with the logging of auto points, if configured.
- form a chain relative to the chain of auto points to which they are related. Subsequently computed chains are independent from each other.
- can be coded independently of auto points.
- have the same time of when they were stored as the auto points to which they are related.
- have the same coding functionality, properties and averaging functionality as auto points. Refer to "48.1 Overview".

Up to two offset points can be related to one auto point.
The screens for the configuration of offset points are identical except for the title **Auto Points - Offset 1** and **Auto Points - Offset 2**. For simplicity, the title **Auto Points - Offset** is used in the following description.

Computation of offset points

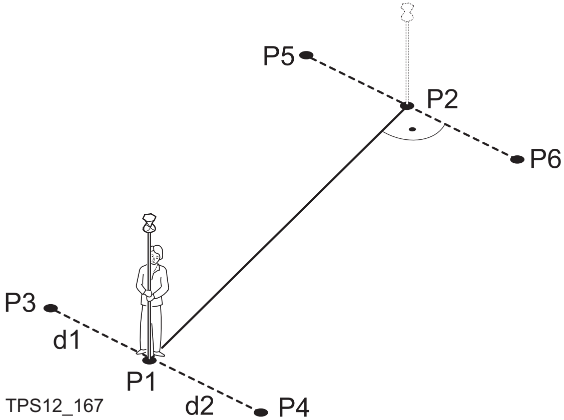
The computation of offset points depends on the number of auto points in one chain.

One auto point

No offset points are computed or stored.

Two auto points

The configured offsets are applied perpendicular to the line between two auto points.



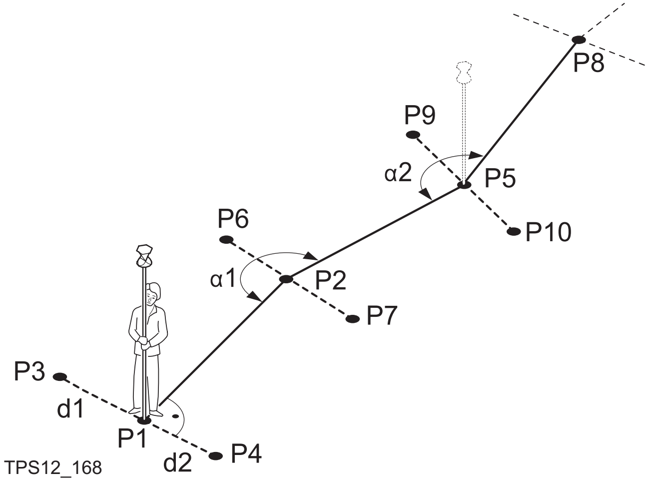
P1	First auto point
P2	Second auto point
P3	First offset point for P1
P4	Second offset point for P1
P5	First offset point for P2
P6	Second offset point for P2
d1	Horizontal offset to the left
d2	Horizontal offset to the right

Three or more auto points

The first offset points are computed perpendicular to the line between the first and the second auto point.

The last offset point is computed perpendicular to the line between the last auto point and the one before.

All other offset points are computed on a bearing. The bearing is half of the angle between the last and the next measured auto point.



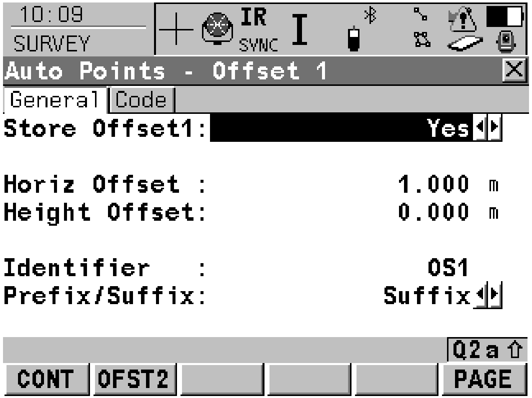
P1 First auto point
P2 Second auto point
P3 First offset point for P1
P4 Second offset point for P1
P5 Third auto point
P6 First offset point for P2
P7 Second offset point for P2
P8 Fourth auto point
P9 First offset point for P5
P10 Second offset point for P5
d1 Horizontal offset to the left
d2 Horizontal offset to the right
α1 Angle between P1 and P5
α2 Angle between P2 and P8

48.4.2 Configuring Offset Points

Access step-by-step

Step	Description
1.	Refer to "47.2 Surveying Points" to access **SURVEY Survey: Job Name**.
2.	**PAGE (F6)** until the **Auto** page is active.
3.	**OFST1 (F4)** or **OFST2 (F5)** to access **SURVEY Auto Points - Offset**.

SURVEY
Auto Points - Offset,
General page



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

OFST2 (F2) and **OFST1 (F2)**
To switch between configuring offset point type one and two.

PAGE (F6)
To change to another page on this screen.

Description of fields

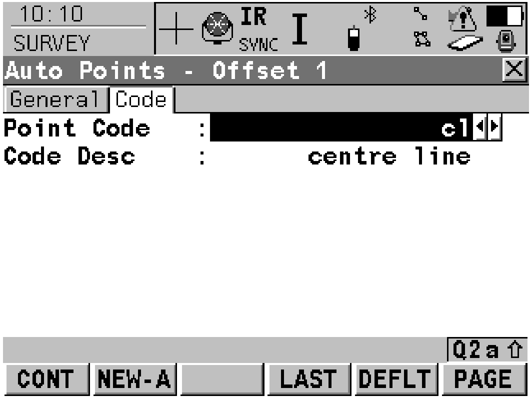
Field	Option	Description
<Store Offset1:> and **<Store Offset2:>**	**Yes**	Activates logging of offset points. ☞ All other fields in the screen are active and can be edited with this setting.
	No	Deactivates logging of offset points and all fields in this screen.
<Horiz Offset:>	User input	The horizontal offset between -1000 m and 1000 m at which the offset point is collected.
<Height Offset:>	User input	The height offset between -100 m and 100 m from the related auto point.
<Identifier:>	User input	The identifier with up to four characters is added in front of or at the end of the ID of the auto point. This ID is then used as the point ID for the related offset point. This could support an automatic workflow into CAD packages including setting symbols and stringing lines.
<Prefix/Suffix:>	**Prefix**	Adds the setting for **<Identifier:>** in front of the auto point ID.
	Suffix	Adds the setting for **<Identifier:>** at the end of the auto point ID.

Next step

PAGE (F6) changes to the **Code** page.

SURVEY
Auto Points - Offset, Code page

The setting for **<Thematc Codes:>** in **CONFIGURE Coding & Linework** determines the availability of the fields and softkeys.



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

NEW-A (F2)
Available for **<Thematc Codes: With Codelist>**. To create additional attributes for the selected **<Point Code:>**.

NAME (F3) or **VALUE (F3)**
Available for **<Thematc Codes: With Codelist>**. Available for attributes for which an attribute name can be typed in. To highlight **<Attribute n:>** or the field for the attribute value. The name of **<Attribute n:>** can be edited and an attribute value can be typed in.

LAST (F4)
Available for **<Thematc Codes: With Codelist>**. To recall the last used attribute values for the selected code.

DEFLT (F5)
Available for **<Thematc Codes: With Codelist>**. To recall the default attribute values for the selected code.

PAGE (F6)
To change to another page on this screen.

Description of fields

Field	Option	Description
<Point Code:>	Choicelist	The thematical code for the offset point. Available for **<Thematc Codes: With Codelist>**. The setting for **<Show Codes:>** in **CONFIGURE Coding & Linework** determines if either all codes or only point codes are available. The attributes are shown as output, input or choicelist fields depending on their definition.
<Code:>	User input	The thematical code for the offset point. Available for **<Thematc Codes: Without Codelist>**. Codes can be typed in but not selected from a codelist. A check is performed to see if a point code of this name already exists in the job. If so, the according attributes are shown.
<Code Desc:>	Output	Available for **<Thematc Codes: With Codelist>**. The description of the code.
<Attribute n:>	User input	Available for **<Thematc Codes: Without Codelist>**. Up to three attribute values can be stored.

Next step

IF	THEN
offset point configu-ration is finished	**CONT (F1)** to return to **SURVEY Survey: Job Name**.
a second offset point is to be configured	**PAGE (F6)** and then **OFST2 (F2)** or **OFST1 (F2)** to change to **SURVEY Auto Points - Offset** for the second point.

Example for offset point ID's

The offset point ID is a combination of the auto point ID and an identifier as prefix or suffix.

The right most part of the auto point ID is incremented within the point ID. The auto point ID is truncated from the left if the length of the auto point ID plus identifier prefix or suffix is greater than 16 characters.

Auto point ID	Identifier	Prefix/Suffix	Offset point ID
Auto1234 Auto1235	OS1	Prefix	OS1Auto1234 OS1Auto1235 …
Auto1234 Auto1235	OS1	Suffix	Auto1234OS1 Auto1235OS1 …

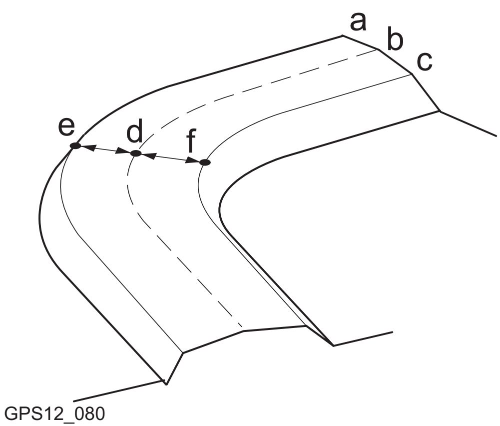
☞ Refer to "16.1 ID Templates" for more information on point ID's.

48.4.3 Working Example

Description

Application:	Pick up points along the centre line, to the right and to the left of a road.
Goal:	Points are to be picked up automatically every 5 m while walking along the centre line. The points to the right and to the left of the road are to be picked up automatically with those of the centre line. The auto point ID's are CL0001, CL0002,.... The offset point ID's are OSCL0001, OSCL0002,... for the right side of the road and CL0001OS, CL0002OS,... for the left side. The offset to the right and to the left is 3 m. The height difference is -0.3 m to the right and 0.3 m to the left.

Diagram



a) Left side of the road
b) Centre line
c) Right side of the road
d) CL0001
e) OSCL0001
f) CL0001OS

☞

- The default display mask for **SURVEY Survey: Job Name**, **Auto** page is used.
- **<Distance Unit: Metres (m)>** in **CONFIGURE Units & Formats**, **Units** page.
- An ID template for the auto points is configured. Refer to "16.1.6 Working Example" for information on how to configure ID templates.

Field procedure step-by-step

Step	Description
1.	**Main Menu: Survey**.
2.	**SURVEY Survey Begin** Select a job, a reflector and a configuration set with the settings mentioned above.
3.	**CONF (F2)** to access **SURVEY Configuration**.
4.	**SURVEY Configuration**, **Auto Points** page

Step	Description
	<Log Auto Pts: Yes>
	<Log By: Distance>
	<Log Every: 5.0000>
5.	**CONT (F1)** to return to **SURVEY Survey Begin**.
6.	**CONT (F1)** to access **SURVEY Survey: Job Name**.
7.	**PAGE (F6)** until the **Auto** page is active.
8.	**OFST1 (F4)** to configure the offset points for the right side of the road.
9.	**SURVEY Auto Points - Offset 1, General** page
	<Store Offset1: Yes>
	<Horiz Offset: 3.0000>
	<Height Offset: -0.3000>
	<Identifier: OS>
	<Prefix/Suffix: Prefix>
10.	**OFST2 (F2)** to configure the offset points for the left side of the road.
11.	**SURVEY Auto Points - Offset 2, General** page
	<Store Offset2: Yes>
	<Horiz Offset: -3.0000>
	<Height Offset: 0.3000>
	<Identifier: OS>
	<Prefix/Suffix: Suffix>

Step	Description
12.	**CONT (F1)** closes the screen and returns to **SURVEY Survey: Job Name**, **Auto** page.
13.	**SURVEY Survey: Job Name**, **Auto** page **START (F1)** starts logging of auto points and offset points.
14.	Walk along the centre line of the road as far as points need to be picked up.
	OFST1 (F4) to change the offset or the height difference between the auto points on the centre line and the right side of the road.
	OFST2 (F5) to change the offset or the height difference between the auto points on the centre line and the left side of the road.
15.	**STOP (F1)** ends recording of auto points and offset points.
	The stopping measuring auto points is indicated in the EDM icon.
16.	After finishing the survey, import the data into a CAD package. If the offset point ID's or codes fulfill the requirements of the CAD package, the offset points to the right and to the left of the road are automatically strung together.

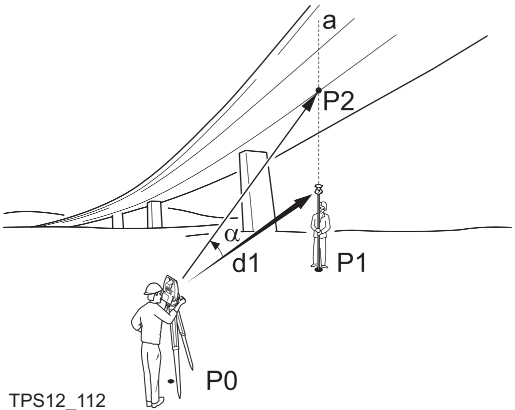
49 Survey - Remote Point

49.1 Overview

Description

Remote point is used to determine the 3D coordinates of inaccessible points, for example on bridges. The horizontal distance to a base point directly underneath or above the remote point is measured. Then the instrument is aimed at the remote point. The coordinates of the remote point are calculated with the distance measured to the base point and the angles measured to the remote point.

Diagram



TPS12_112

P0	Instrument station
P1	Base point
P2	Remote point
d1	Horizontal distance to the base point
α	Vertical angle between base point and remote point
a	Vertical axis from P1 to P2

☞ To ensure correct results, the remote point and the reflector must be lined up vertically. If it is not possible to maintain an exactly vertical line, the acceptable **<Hz Dist Tol:>** must be chosen. The horizontal distance to the remote point and to the base point should coincide.

Properties of remote points

The properties stored with auto points are:

- Class: **MEAS**
- Sub class: **TPS**
- Source: **Survey (Rem Pt)**
- Instrument source: **TPS**

Averaging of remote points

An average can be calculated for remote points if a measured point of class MEAS already exists with the same point ID. The average flag for the point is **AUTO**.

49.2 Accessing Remote Point

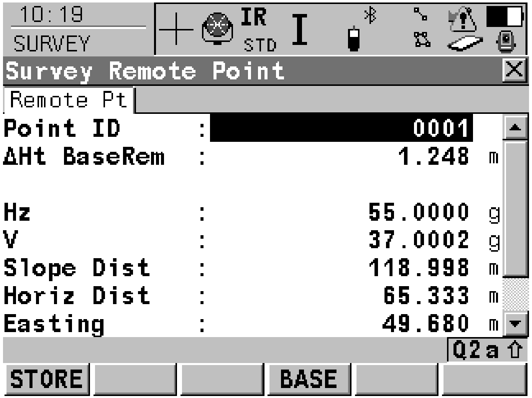
Remote point measurements are possible from the Survey application program when **<Use Remote Pt: Yes>** is set in the **SURVEY Configuration, Remote Pt** page and a valid distance measurement is available. Refer to "49.3 Configuring Remote Point".

Unless **<Display Mask: None>** in **SURVEY Configuration, Remote Pt** page, this screen contains an additional, user defined display mask.

Access

REMOT (F4) in **SURVEY Survey: Job Name** after one point is measured.

SURVEY Survey Remote Point, Remote Pt page



STORE (F1)
Stores the remote point. Stays in the **SURVEY Survey Remote Point** screen.

BASE (F4)
Returns to **SURVEY Survey: Job Name**. The distance measurement is cleared.

Description of fields

Field	Option	Description
<Point ID:>	User input	Displays the point ID for the remote point. The point ID in **SURVEY Survey Remote Point** is always identical to the point ID in **SURVEY Survey: Job Name**.
<ΔHt BasRem:>	Output	The elevation difference between the base point and the remote point.
<Hz:>	Output	The current horizontal angle.
<V:>	Output	The current vertical angle.
<Slope Dist:>	Output	The current slope distance to the remote point calculated from the horizontal distance to the base point and the current vertical angle.
<Horiz Dist:>	Output	The horizontal distance measured to the base point.
<Easting:>	Output	Calculated Easting coordinate for the remote point.
<Northing:>	Output	Calculated Northing coordinate for the remote point.
<Height:>	Output	Calculated height for the remote point.

Next step

IF	THEN
if a remote point is to be stored	**STORE (F1)**.

IF	THEN
a new base point is to be measured	**BASE (F4)** to return to **SURVEY Survey: Job Name**.

49.3 Configuring Remote Point

Access

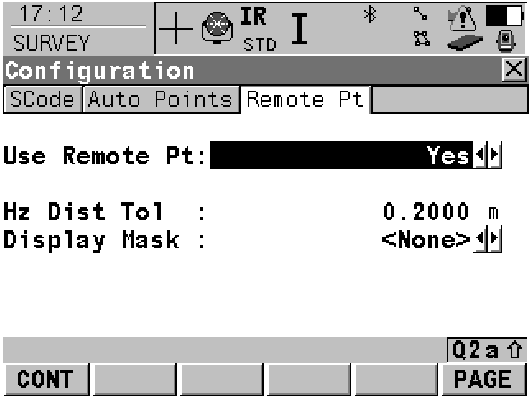
Select **Main Menu: Survey**. In **SURVEY Survey Begin** press **CONF (F2)** to access **SURVEY Configuration**. **PAGE (F6)** until the **Remote Pt** page is active.

OR

In **SURVEY Survey: Job Name** press **SHIFT CONF (F2)** to access **SURVEY Configuration**. **PAGE (F6)** until the **Remote Pt** page is active.

SURVEY Configuration, Remote Pt page

The settings on this screen activate the remote point function.



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

DMASK (F3)
Accesses **CONFIGURE Define Display Mask n**. Available for **<Display Mask:>** being highlighted. Refer to "16.2 Display Settings".

Description of fields

Field	Option	Description
<Use Remote Pt:>	**Yes**	Activates the remote point function. **REMOT (F4)** is added to the function keys in **SURVEY Survey: Job Name**.
	No	Deactivates the remote point function, **REMOT (F4)** is not available in **SURVEY Survey: Job Name**.
<Hz Dist Tol:>	User input	The horizontal distance to the remote point is equal to the horizontal distance of the base point. The value for **<Hz Dist Tol:>** is the maximum tolerated length of the chord between the base point and the remote point.
<Display Mask:>	Choicelist	Displays **<None>** until a display mask is chosen. All display masks from **Main Menu: Config...\Survey Settings...\Display Settings** can be selected.

Next step

CONT (F1) to return to the screen **SURVEY Configuration** was accessed from.

49.4 Working Example

Description

Application:	Pick up points along a bridge. The points to be measured are not directly accessible with a reflector.
Working technique:	Remote point surveying.
Settings:	**<Use Remote Pt: Yes>** in the **SURVEY Configuration, Remote Pt** page.

Measuring remote points step-by-step

Step	Description
☞	The reflector height at the base point is always applied in the calculation of the base point elevation. For the calculation of the remote point elevation the reflector height is automatically set to zero.
1.	Aim at the reflector that is placed at the base point, which is directly underneath the remote point to be measured.
2.	**SURVEY Survey: Job Name** **DIST (F2)** to measure the horizontal distance to the base point.
3.	**REMOT (F4)**.
4.	Aim at the remote point to be measured.
5.	**SURVEY Survey Remote Point, Remote Pt** page **STORE (F1)** to measure and store the angle measurements and calculated coordinates for the remote point.

Step	Description
6.	**BASE (F4)** to return to **SURVEY Survey: Job Name** and measure a new base point.

50 Survey Cross Section

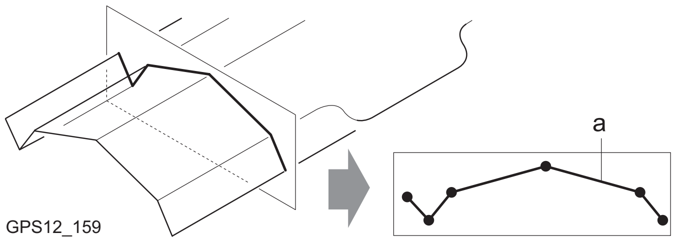
50.1 Overview

Description

The Survey Cross Section application program allows for the automatic changing of codes during a survey. This is particularly useful when surveying multiple cross sections. Examples could include surveys of railway lines, roads, small waterways, driveways and paths.

The codes for the elements in the cross section to be surveyed are all stored and pre-defined in a template. The codes are then automatically changed after each point observation.

Diagram



a) Cross section element

Template

Templates are used to pre-define the order of the codes for the survey.
A template pre-defines

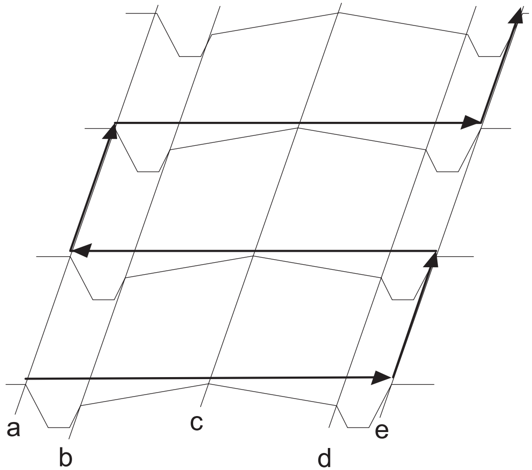
- the coding sequence of a cross section.
- the type of coding.

Cross section methods and directions

Templates can be applied

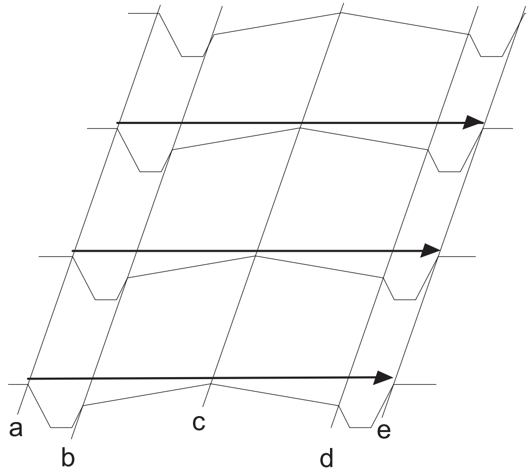
- to the ZigZag method or the Same Direction method.
- in either a forward direction or in a backward direction.

ZigZag



GPS12_168

Same Direction



GPS12_169

Coding of cross section elements	Codes can be attached to cross section elements. Refer to "8 Coding" for information on coding. • Thematical coding: Available • Free coding: Available • Quick coding: Not available Refer to "8.6 Code and Attribute Mismatch" for information on solving a code and/or attribute mismatch.
Properties of cross section points	The properties stored with cross section points are: • Class: **MEAS**. • Sub class: **TPS**. • Source: **Cross Section**. • Instrument source: **TPS**.
Averaging of cross section elements	The principles for averaging are identical to those of the Survey application program. Refer to "6.3.4 Mean Page" for information on averaging.
Exporting data	The points and lines are recorded as for all other application programs. The data can be exported as normal.

50.2 Accessing Survey Cross Section

Access

Select **Main Menu: Programs...\Survey Cross Section**.

OR

Press **PROG**. Highlight **Survey Cross Section**. **CONT (F1)**.

Refer to "35.2 Accessing the Programs Menu" for details on the **PROG** key.

OR

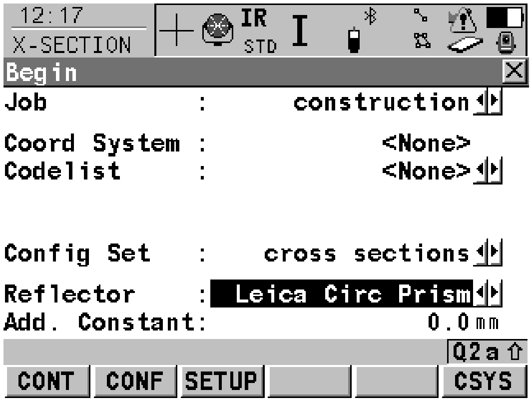
Press a hot key configured to access the screen **X-SECTION Begin**.

Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

X-SECTION Begin



CONT (F1)
To accept changes and access the subsequent screen. The chosen settings become active.

CONF (F2)
To configure Survey Cross Section application program. Accesses **X-SECTION Configuration**. Refer to "50.3 Configuring Survey Cross Section".

SETUP (F3)
To set up the station. Accesses **SETUP Station Setup**.

CSYS (F6)
To select a different coordinate system.

Description of fields

Field	Option	Description
<Job:>	Choicelist	The active job. All jobs from **Main Menu: Manage...\Jobs** can be selected.
<Coord System:>	Output	The coordinate system currently attached to the selected **<Job:>**.
<Codelist:>	Choicelist	No codes are stored in the selected job. All codelists from **Main Menu: Manage...\Codelists** can be selected.
	Output	Codes have already been stored in the selected **<Job:>**. If codes had been copied from a System RAM codelist, then the name of the codelist is displayed. If codes have not been copied from a System RAM codelist but typed in, then the name of the active job is displayed.
<Config Set:>	Choicelist	The active configuration set. All configuration sets from **Main Menu: Manage...\Configuration Sets** can be selected.
<Reflector:>	Choicelist	The active reflector. All reflectors from **Main Menu: Manage...\Reflectors** can be selected.
<Add. Constant:>	Output	The additive constant stored with the chosen reflector.

Next step

IF the Survey Cross Section application program	THEN
is to be accessed	**CONT (F1)** accepts the changes and accesses Survey Cross Section application program. Refer to "50.4 Surveying Cross Sections".
is to be configured	**CONF (F2)**. Refer to "50.3 Configuring Survey Cross Section".

50.3 Configuring Survey Cross Section

Access

Select **Main Menu: Programs...\Survey Cross Section**. In **X-SECTION Begin** press **CONF (F2)** to access **X-SECTION Configuration**.

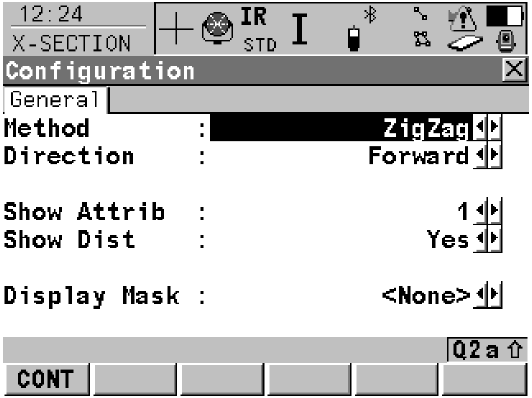
OR

Press **PROG**. Highlight **Survey Cross Section. CONT (F1)**. In **X-SECTION Begin** press **CONF (F2)** to access **X-SECTION Configuration**.

OR

Press **SHIFT CONF (F2)** in **X-SECTION Survey: Job Name**.

X-SECTION Configuration, General page



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

DMASK (F3)
To edit the display mask currently being displayed in this field. Accesses **CONFIGURE Define Display Mask n**. Available for **<Display Mask:>** being highlighted on **General** page. Refer to "16.2 Display Settings".

SHIFT ABOUT (F5)
To display information about the program name, the version number, the date of the version, the copyright and the article number.

Description of fields

Field	Option	Description
<Method:>		Method by which subsequent cross sections will be surveyed. Refer to "50.1 Overview" for a diagram.
	ZigZag	Each new cross section is started at the same end as where the previous cross section finished.
	Same Direction	Each new cross section is started at the same end as where the previous cross section started.
<Direction:>		The way of surveying the cross section. This influences in which order the elements of a template will be applied. Refer to "50.1 Overview" for a diagram.
	Forward	The cross sections will be surveyed in the same way as the elements are defined in the selected **<Template:>** in **X-SECTION Survey: Job Name**.
	Backward	The cross sections will be surveyed in the reverse way as the elements are defined in the selected **<Template:>** in **X-SECTION Survey: Job Name**.
<Show Attrib:>		Defines which attribute field is displayed in **X-SECTION Survey: Job Name**. Useful if the surveyor is stringing - can then see that the correct string attribute value is being used.
	Do Not Show	No attribute field is displayed in **X-SECTION Survey: Job Name**.

Field	Option	Description
	From **1** to **20**	The attribute field which is displayed in **X-SECTION Survey: Job Name**.
<Show Dist:>	**Yes** or **No**	Activates an output field in **X-SECTION Survey: Job Name.** The horizontal grid distance from the current position to the point last surveyed for the same cross section will be displayed.
<Display Mask:>	Choicelist	The user defined display mask is shown in **X-SECTION Survey: Job Name**. All display masks of the active configuration set defined in **CONFIGURE Display Settings** can be selected.

Next step

CONT (F1) returns to the screen from where this screen was accessed.

50.4 Surveying Cross Sections

Description

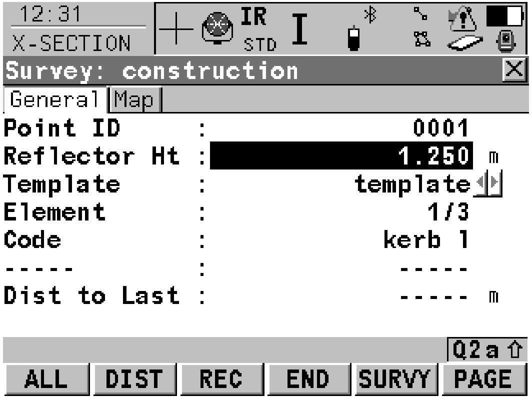
The fields on this screen indicate which cross section element is to be surveyed next.

Access step-by-step

Step	Description
1.	Refer to "50.2 Accessing Survey Cross Section" to access **X-SECTION Begin**.
2.	In **X-SECTION Begin** select a job.
3.	Select an appropriate configuration set.
4.	Select a reflector.
5.	**CONT (F1)** to access **X-SECTION Survey: Job Name**, **General** page.

X-SECTION Survey: Job Name, General page

The pages shown are those from a typical configuration set. An additional page is available when a user defined display mask is used.



ALL (F1)
To measure and store distances and angles.

DIST (F2)
To measure and display distances. Available unless **<EDM Mode: Tracking>** and/or **<Log Auto Pts: Yes>**, after the tracking or logging is started.

REC (F3)
To record data.
If **<EDM Mode: Tracking>** and/or **<Log Auto Pts: Yes>**, records measured point and continues tracking.

START (F4) and **END (F4)**
To open and close the selected cross section template. While the template is open, the elements of the cross section can be surveyed.

SURVY (F5)
To manually occupy a point that is not part of the cross section. The point is not treated as an element of the cross section. The open template remains open.
Available if a template has been opened with **START (F4)**.

PAGE (F6)
To change to another page on this screen.

SHIFT CONF (F2)

To configure the Cross Section Survey application program. Refer to "50.3 Configuring Survey Cross Section".

SHIFT PREV (F3)

To select the previous element of the cross section template. The currently measured element will not be stored.
Available for **STOP (F4)** being displayed.

SHIFT NEXT (F4)

To select the next element of the cross section template. The currently measured element will not be stored.
Available for **STOP (F4)** being displayed.

SHIFT INDIV (F5) and **SHIFT RUN (F5)**

To change between entering an individual point ID different to the defined ID template and the running point ID according to the ID template. Refer to "16.1 ID Templates".

SHIFT QUIT (F6)

To exit Cross Section Survey application program. An open template will be closed.

Description of fields

Field	Option	Description
<Point ID:>	User input	The identifier for manually occupied points. The configured point ID template is used. The ID can be changed in the following ways:

Field	Option	Description
		• To start a new sequence of point ID's type over the point ID. • For an individual point ID independent of the ID template **SHIFT INDIV (F5)**. **SHIFT RUN (F5)** changes back to the next ID from the configured ID template. Refer to "16.1 ID Templates".
<Reflector Ht:>	User input	The reflector height.
<Template:>		The active template for the cross section.
	Choicelist	The cross section template is closed. Opening the choicelist accesses **X-SECTION Templates** where a new template can be created and an existing template can be selected or deleted. Refer to "50.5 Cross Section Templates". ----- is displayed if no template is defined.
	Output	The cross section template is open.
<Element:>	Output	Displayed as x/y. x Number of next element on active template. The number increases/decreases as moving across the cross section depending on the selection for **<Method:>** in **X-SECTION Configuration**. y Total number of elements on active template.

Field	Option	Description
<Code:>	Output	The name of the code. Point codes will be stored with the measured point. Free codes will be stored, depending on the configuration, before or after the measured point.
<Stringline ID:>	Output	Available for **<String Attrib:>** being activated in **CONFIGURE Coding & Linework**, **Coding** page. Points that have the same code attached and belong to different cross sections are strung to one line.
<Dist to Last:>	Output	The horizontal grid distance from the current position to the last surveyed point. ----- is displayed for unavailable information.

Next step

IF	THEN
a cross section template is to be opened	select the desired **<Template:>**. **START (F4)**.
an element of a cross section is to be surveyed	**ALL (F1)**
a cross section template is to be closed	select the desired **<Template:>**. **END (F4)**.
data is to be viewed graphically	**PAGE (F6)**. Refer to paragraph "X-SECTION Survey: Job Name, Map page".
the screen is to be quit	**ESC**.

X-SECTION Survey: Job Name, Map page

The **Map** page provides an interactive display of the data. Refer to "34 MapView Interactive Display Feature" for information on the functionality and softkeys available.

An element of a cross section template can also be surveyed from the **Map** page.

Next step

PAGE (F6) changes to the first page on this screen.

50.5 Cross Section Templates

50.5.1 Accessing Cross Section Template Management

Description

Cross section templates
- pre-define the sequence of codes for a cross section.
- consist of elements.

Elements can be defined such that the surveyed points of a cross section are
- stored with a point code.
- stored with a free code.

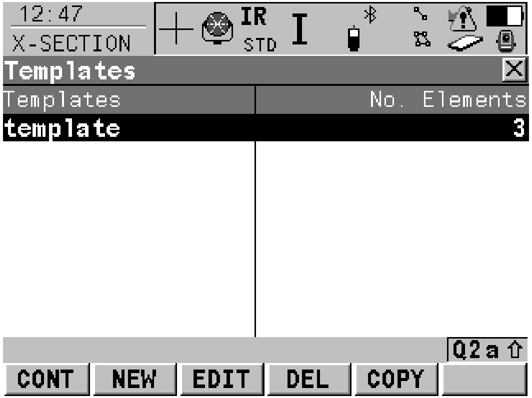
During the process of surveying a cross section, the code for the next element to be occupied is then selected and suggested automatically.

Access step-by-step

Step	Description
1.	Refer to "50.4 Surveying Cross Sections" to access **X-SECTION Survey: Job Name**.
2.	**X-SECTION Survey: Job Name**, **General** page Open the choicelist for **<Template:>**.

X-SECTION Templates

All cross section templates stored in the active job are listed in alphabetical order, including the number of elements in each cross section template.



CONT (F1)
To select the highlighted cross section template and to return to the screen from where this screen was accessed.

NEW (F2)
To create a cross section template. Refer to "50.5.2 Creating a New Cross Section Template".

EDIT (F3)
To edit the highlighted cross section template. Refer to "50.5.3 Editing a Cross Section Template".

DEL (F4)
To delete the highlighted cross section template.

COPY (F5)
To create a cross section template based on the one currently highlighted.

Next step

IF a cross section template	THEN
is to be selected	highlight the desired cross section template. **CONT (F1)** closes the screen and returns to the screen from where **X-SECTION Templates** was accessed.

IF a cross section template	**THEN**
is to be created	**NEW (F2)**. Refer to "50.5.2 Creating a New Cross Section Template".
is to be edited	highlight the cross section template and **EDIT (F3)**. Refer to "50.5.3 Editing a Cross Section Template".
is to be created based on an existing template	**COPY (F5)**. Refer to "50.5.2 Creating a New Cross Section Template".

50.5.2 Creating a New Cross Section Template

Access

Step	Description
1.	Open the choicelist for **<Template:>** in **X-SECTION Survey: Job Name**, **General** page.
2.	**X-SECTION Templates** Is a cross section template to be created from scratch? • If **yes**, **NEW (F2)** to access **X-SECTION New Template**. • If **no**, **COPY (F5)** to access **X-SECTION New Template**.

X-SECTION New Template, General page

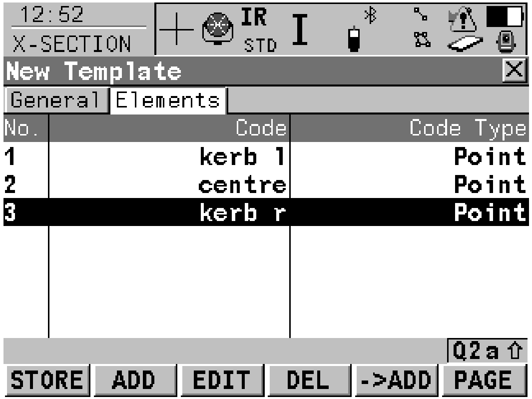
Type in a name for the new cross section template.

Next step

PAGE (F6) changes to the **Elements** page. Refer to paragraph "X-SECTION New Template, Elements page".

X-SECTION New Template, Elements page

IF this screen was accessed with	THEN
NEW (F2)	all columns are empty.
COPY (F5)	the same elements are listed as were being used for the template highlighted when **COPY (F5)** was pressed.



STORE (F1)
To store the cross section template and to return to the screen from where this screen was accessed.

ADD (F2)
To add one or several element(s) to the cross section template. Refer to paragraph "X-SECTION Add Element".

EDIT (F3)
To edit the highlighted element. Refer to paragraph "X-SECTION Add Element"

DEL (F4)
To delete the highlighted element from the cross section template.

->ADD (F5)
To insert one element before the currently highlighted element of the cross section template. Refer to paragraph "X-SECTION Add Element".

PAGE (F6)
To change to another page on this screen.

Description of columns

Field	Description
No.	The number of the element.

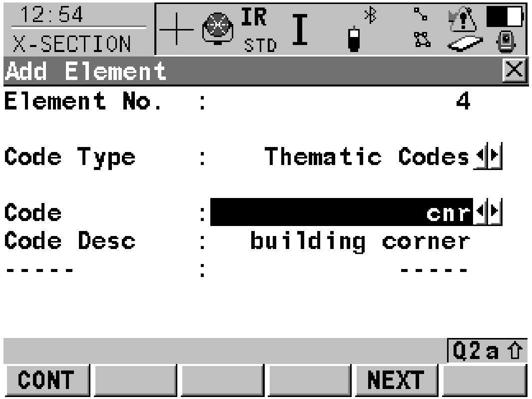
Field	Description
Code	The code assigned to the element. ----- is displayed if no code is assigned to the element.
Code Type	The type of the code assigned to the element.

Next step

IF	THEN
the creation of a template is finished	**STORE (F1)**.
an element is to be added	**ADD (F2)** or **->ADD (F5)**. Refer to paragraph "X-SECTION Add Element".
an element is to be edited	**EDIT (F3)**. Refer to paragraph "X-SECTION Add Element".

X-SECTION Add Element

The functionality of the screens **X-SECTION Insert Element** and **X-SECTION Edit Element in Template** is very similar. Differences to **X-SECTION Add Element** are outlined below.



CONT (F1)

To add the element at the end of the cross section template or to store the changes.

To return to the screen from where this screen was accessed.

NEXT (F5)

Available in **X-SECTION Add Element**.

To add the element at the end of the cross section template. To stay in this screen and create the next element.

PREV (F5)

Available in **X-SECTION Edit Element in Template**.

To store the changes. To stay in this screen and edit the previous element..

NEXT (F6)

Available in **X-SECTION Edit Element in Template**.

To store the changes. To stay in this screen and add the next element.

Description of columns

Field	Option	Description
<Element No.:>	Output	For **X-SECTION Add Element** and **X-SECTION Insert Element**: The number of the element to be added. For **X-SECTION Edit Element in Template**: Displayed as x/y. x Number of the element to be edited. y Total number of elements on the active template.
<Code Type:>		The type of code to be used with the element.
	Free Code	To store a code independent of the element as time related information.
	Thematic Codes	To store a code together with the element.
<Rec Free Code:>	**After Point** or **Before Point**	Available for **<Code Type: Free Code>**. Determines if a free code is stored before or after the point.
<Code (free):>	Choicelist	The code which will be stored before or after the point/line. Available for **<Code Type: Free Code>**.
<Code:>	Choicelist	The code which will be stored with the next point/line. Available for **<Code Type: Thematic Codes>**.

Field	Option	Description
Attribute name	Output	The attribute and the attribute value which will be stored with the point/line. Available unless **<Show Attrib: Do Not Show>** in **X-SECTION Configuration**.

Next step

CONT (F1) adds the element or stores the changes and returns to **X-SECTION New Template**, **Elements** page.

50.5.3 Editing a Cross Section Template

Access

Refer to "50.2 Accessing Survey Cross Section" to access **X-SECTION Templates**.

Edit cross section template step-by-step

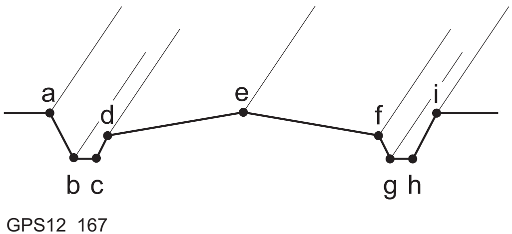
Step	Description
1.	In **X-SECTION Templates** highlight the cross section template to be edited.
2.	**EDIT (F3)** to access **X-SECTION Edit Template**, **General** page.
3.	**X-SECTION Edit Template** All the following steps are identical with the creation of a new cross section template. Refer to "50.5.2 Creating a New Cross Section Template".

50.6 Working Example

Description

Application:	Surveying a road, taking the same cross sections at particular intervals.
Goal:	The points of each cross section are to be picked up. Codes are assigned automatically. The codes are shown in the diagram. Each new cross section is started at the same end as where the previous cross section finished.

Diagram



a) Top of bank 1, TB1
b) Bottom of bank 1, BB1
c) Bottom of bank 2, BB2
d) Edge of bitumen 1, EB1
e) Center line, CL
f) Edge of bitumen 2, EB2
g) Bottom of bank 3, BB3
h) Bottom of bank 4, BB4
i) Top of bank 2, TB2

Requirements

- A codelist containing the codes TB1, BB1, BB2, EB1, CL, EB2, BB3, BB4 and TB2 has been created in LGO and loaded onto the receiver.

Field procedure step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Start the Survey Cross Section application program.	50.2
2.	**X-SECTION Begin** **<Codelist:>** The codelist containing the point codes TB1, BB1, BB2, EB1, CL, EB2, BB3, BB4 and TB2 must be displayed. Check the settings.	50.2 7.3
3.	**CONF (F2)**	
4.	**X-SECTION Configuration** **<Method: ZigZag>** **<Direction: Forward>** **<Show Dist: Yes>**	50.3
5.	**CONT (F1)**	
6.	Have cross section templates been defined yet? • If **yes**, continue with step 18. • If **no**, continue with step 7.	
7.	**OK (F4)** to confirm the information message and to access **X-SECTION New Template**.	
8.	**X-SECTION New Template**, **General** page **<Template Name:>** Type in a name for the new cross section template.	50.5.2
9.	**PAGE (F6)** to access **X-SECTION New Template**, **Elements** page	

Step	Description	Refer to chapter
10.	**ADD (F2)** to access **X-SECTION Add Element**.	
11.	**X-SECTION Add Element** **<Code Type: Thematic Codes>** **<Code: TB1>**	50.5.2
12.	**NEXT (F5)** adds the element to the cross section template and stays in this screen to create the next element.	
13.	Repeat steps 11. and 12. for the next seven elements.	
14.	Repeat step 11. for the last element.	
15.	**CONT (F1)** to add the element to the cross section template and to return to **X-SECTION New Template**.	
16.	**STORE (F1)** to store the new cross section template and to return to **X-SECTION Templates**.	
17.	**X-SECTION Templates** The newly created template is highlighted.	
18.	**CONT (F1)** to access **X-SECTION Survey: Job Name**.	
19.	**X-SECTION Survey: Job Name** **<Element: 1/5>** **<Code: TB1>**	50.4
	Open the choicelist for **<Templates:>** to create a new cross section template or to select or delete an existing template.	

Step	Description	Refer to chapter
20.	**START (F4)** to open the template.	
21.	Go to the beginning of the first cross section.	
22.	**ALL (F1)** to measure and store the element.	
23.	Repeat steps 22. for the remaining four elements.	
24.	Go to the position for the next cross section. **<Dist To Last:>** displays the interval.	
	Since working in ZigZag mode, the next cross section starts "at the end", this means with TB2.	
25.	Continue until all cross sections are surveyed.	
26.	**END (F4)** to close the template.	
27.	**SHIFT QUIT (F6)** to quit the screen.	

51 Traverse

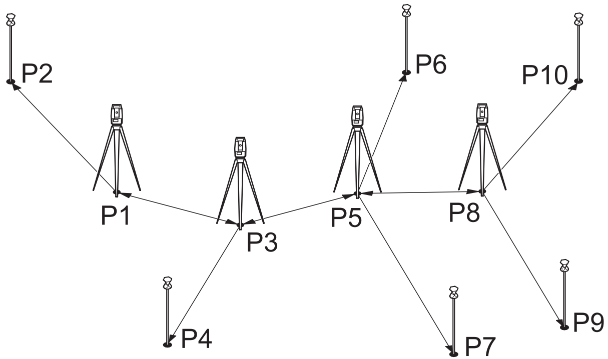
51.1 Overview

Description

The Traverse application is to fulfill one of the most common operations done by surveyors to establish a control point base system to be used as a skeleton for other survey operations for example topographic survey, point stakeout, line stakeout or road stakeout.

Types of traverse

- External reference & closed loop
- Internal reference & position check
- Open end & position check
- Closed end traverse



TPS12_140

P1	Traverse point
P2	Backsight point
P3	Traverse point
P4	Sideshot point
P5	Traverse point
P6	Sideshot point
P7	Sideshot point
P8	Closing point
P9	Sideshot point
P10	Closing angle point

Properties of Traverse points

The properties stored with the Traverse points are:

- Class: **MEAS**
- Sub class: **TPS**
- Source: **Traverse**
- Instrument: **TPS**

Averaging of Traverse points

An average point of class **MEAS** is calculated by the Traverse application program.

51.2 Accessing Traverse

Access

Select **Main Menu: Programs...\Traverse**.

OR

Press **PROG**. Highlight Traverse. **CONT (F1)**.

Refer to "35.2 Accessing the Programs Menu" for details on the **PROG** key.

OR

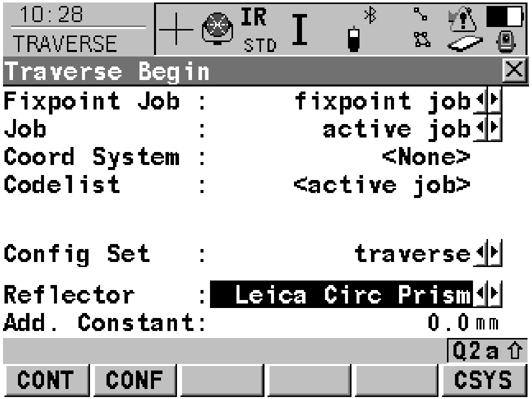
Press a hot key configured to access the screen **TRAVERSE Traverse Begin**.

Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

TRAVERSE Traverse Begin



CONT (F1)
To accept changes and to access the subsequent screen. The chosen settings become active.

CONF (F2)
To configure the Traverse application program. Refer to "51.3 Configuring Traverse".

CSYS (F6)
To select a different coordinate system.

Description of fields

Field	Option	Description
<Fixpoint Job:>	Choicelist	The job containing points for the control points, to begin, to check and to end the traverse. Points are searched in **<Fixpoint Job:>**, if not found in **<Fixpoint Job:>**, the active job will be searched.
<Job:>	Choicelist	The active job. All jobs from **Main Menu: Manage...\Jobs** can be selected.
<Coord System:>	Output	The coordinate system currently attached to the selected **<Job:>**.
<Codelist:>	Choicelist	No codes are stored in the selected job. All codelists from **Main Menu: Manage...\Codelists** can be selected.
	Output	Codes have already been stored in the selected **<Job:>**. If codes had been copied from a System RAM codelist, then the name of the codelist is displayed. If codes have not been copied from a System RAM codelist but typed in, then the name of the active job is displayed.
<Config Set:>	Choicelist	The active configuration set. All configuration sets from **Main Menu: Manage...\Configuration Sets** can be selected.
<Reflector:>	Choicelist	The active reflector. All reflectors from **Main Menu: Manage...\Reflectors** can be selected.

Field	Option	Description
<Add. Constant:>	Output	The additive constant stored with the chosen reflector.

Next step

CONT (F1) accepts changes and accesses Traverse application program.

51.3 Configuring Traverse

Access

Select **Main Menu: Programs...\Traverse**. In **TRAVERSE Traverse Begin** press **CONF (F2)** to access **TRAVERSE Configuration**.

OR

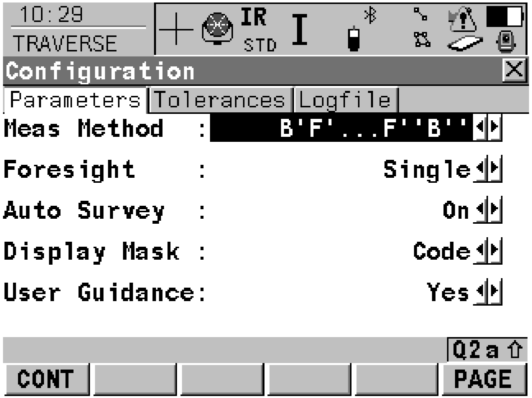
Press **PROG**. Highlight Traverse. **CONT (F1)**. In **TRAVERSE Traverse Begin** press **CONF (F2)** to access **TRAVERSE Configuration**.

OR

Press **SHIFT CONF (F2)** in **TRAVERSE Traverse Information**.

TRAVERSE Configuration, Parameters page

This screen consists of the **Parameters** page, the **Tolerances** page and the **Logfile** page. The explanations for the softkeys given below are valid for all pages, unless otherwise stated.



CONT (F1)
To accept changes and to return to the screen from where this screen was accessed.

DMASK (F3)
To edit the display mask currently being displayed in this field. Accesses **CONFIGURE Define Display Mask n**. Available for **<Display Mask:>** being highlighted on **Parameters** page.

PAGE (F6)
To change to another page on this screen.

Description of fields

Field	Option	Description
<MeasMethod:>	**B’F’...F’’B’’**	All points are measured in face I, then measured in face II in reverse sequential order.
	B’F’...B’’F’’	All points are measured in face I, then measured in face II.
	B’B’’F’F’’	Backsight point is measured in face **I** immediately followed by face **II**. Other points are measured in face I, face II order.
	B’B’’F’’F’	Backsight point is measured in face **I** immediately followed by face **II**. Other points are measured in alternating face order.
	B’F’...	All points are measured in face I only.
<Foresight:>	**Single** or **Multiple**	Option to define if only one foresight point or multiple points are used during the sets.
<Auto Survey:>	**On** or **Off**	For instruments with ATR and **<Auto Survey: On>** ATR search and ATR measurements are done to specified targets and subsequent sets.
<Display Mask:>	Choicelist	The user defined display mask to be shown in **TRAVERSE XX, Set:X/X**. All display masks of the active configuration set defined in **CONFIGURE Display Settings** can be selected.

Next step

PAGE (F6) changes to **Tolerances** page. Refer to paragraph "TRAVERSE Configuration, Tolerances page".

TRAVERSE Configuration, Tolerances page

Description of fields

Field	Option	Description
<Use Tolerance:>	**Yes** or **No**	The entered horizontal, vertical and distance tolerances are checked during the measurements to verify accurate pointing and measurements.
<Hz Tolerance:>	User input	Tolerance for horizontal directions.
<V Tolerance:>	User input	Tolerance for vertical directions.
<Dist Tol:>	User input	Tolerance for distance.
<BS Ht Tol:>	User input	Tolerance for the backsight height.

Next step

PAGE (F6) changes to **Logfile** page. Refer to paragraph "TRAVERSE Configuration, Logfile page".

TRAVERSE Configuration, Logfile page

Description of fields

Field	Option	Description
<Write Logfile:>	**Yes** or **No**	To generate a logfile when the application program is exited. A logfile is a file to which data from an application program is written to. It is generated using the selected **<Format File:>**.

Field	Option	Description
<File Name:>	Choicelist	Available for **<Write Logfile: Yes>**. The name of the file to which the data should be written. A logfile is stored in the \DATA directory of the active memory device. The data is always appended to the file. Opening the choicelist accesses **XX Logfiles** where a name for a new logfile can be created and an existing logfile can be selected or deleted.
<Format File:>	Choicelist	Available for **<Write Logfile: Yes>**. A format file defines which and how data is written to a logfile. Format files are created using LGO. A format file must first be transferred from the CompactFlash card to the System RAM before it can be selected. Refer to "24 Tools...\Transfer Objects..." for information on how to transfer a format file. Opening the choicelist accesses **XX Format Files** where an existing format file can be selected or deleted.

Next step

PAGE (F6) changes to the first page on this screen.

51.4 Traverse Methods

51.4.1 Starting Traverse

Start traverse step-by-step

The quickest setup method is described.

Step	Description	Refer to chapter
1.	Start the Traverse application program.	51.2
2.	**TRAVERSE Traverse Begin** Check the settings.	
	CONF (F2) to change the configuration settings.	51.3
3.	**CONT (F1)** to access **TRAVERSE Traverse Information**.	
4.	**TRAVERSE Traverse Information** **<Traverse ID:>** The name of the new traverse.	
	SHIFT CONF (F2) to change the configuration settings.	51.3
5.	**CONT (F1)** to access **SETUP Station Setup**. **<Method: Set Azimuth>** **<Station Coord: Frm Fixpoint Job>**	45.6
6.	**CONT (F1)** to access **SETUP Select Station**	
7.	**SETUP Select Station** Enter **<Station ID:>** and **CONT (F1)**.	
8.	**SET (F1)** to set the station and orientation and to access **TRAVERSE Foresight, Set X/X**	

Step	Description	Refer to chapter
9.	**TRAVERSE Foresight, Set:X/X** **<Foresight ID:>** The name of the foresight point. **<Reflector Ht:>** The reflector height of the foresight point. **<No. of Sets:>** The number of sets to be measured.	
☞	**DONE (F4)** available for **<Foresight: Multiple>** to stop measuring further foresight points.	
☞	**SURVY (F5)** to measure sideshot points.	
☞	**SHIFT GETPT (F4)** to get a point from the **<Fixpoint Job:>** to be used as closing point, check point or normal foresight point.	
10.	**ALL (F1)** to measure and record. The measurement settings for the first measurement to each point are used for all further sets.	
11.	Repeat step 10. until all sets are measured.	
12.	**TRAVERSE Point Statistics, Pt: X/X**	51.5
13.	**CONT (F1)** to choose to move to the next station, to measure a side-shot point, to view traverse data or to end traverse.	
☞	**SURVY (F3)** to measure a sideshot point.	
☞	**DATA (F5)** to view traverse data.	51.5
☞	**END T (F6)** to end traverse.	
14.	**MOVE (F1)** to move to the next station.	

51.4.2 Measuring Traverse

Measure traverse step-by-step

Step	Description	Refer to chapter
1.	Refer to paragraph "Start traverse step-by-step" to start a traverse.	51.4.1
2.	Start the Traverse application program.	51.2
3.	**TRAVERSE Traverse Begin** Check the settings.	
4.	**CONT (F1)** to access **TRAVERSE Traverse Information**.	
5.	**TRAVERSE Traverse Information** The existing traverse is shown	
☞	**DATA (F5)** to view data of the active traverse.	51.5
☞	**END T (F6)** to end the existing traverse.	
☞	**SHIFT CONF (F2)** to change the configuration settings.	51.3
6.	**CONT (F1)** to access **TRAVERSE Backsight, Set:X/X**. Enter **<Instrument Ht:>**	
7.	**ALL (F1)** to measure and record the backsight point.	
8.	**TRAVERSE Foresight, Set:X/X** **<Foresight ID:>** The name of the foresight point. **<Reflector Ht:>** The reflector height of the foresight point. **<No. of Sets:>** The number of sets to be measured.	
☞	**SURVY (F5)** to measure sideshot points.	

Step	Description	Refer to chapter
☞	**SHIFT GETPT (F4)** to get a point from the **<Fixpoint Job:>** to be used as closing point, check point or normal foresight point.	
9.	**ALL (F1)** to measure and record the foresight points. The measurement settings for the first measurement to each point are used for all further sets.	
10.	Repeat step 9. until all sets are measured.	
11.	**TRAVERSE Point Statistics, Pt:X/X**	51.5
12.	**CONT (F1)** to choose to move to the next station, to measure a sideshot point, to view traverse data or to end traverse.	
☞	**SURVY (F3)** to measure a sideshot point.	
☞	**DATA (F5)** to view traverse data.	51.5
☞	**END T (F6)** to end traverse.	
13.	**MOVE (F1)** to move to the next station.	
14.	Repeat steps 3. to 13. until traverse is ready to be closed.	

51.4.3 Closing Traverse

Close traverse without angular closure step-by-step

Step	Description	Refer to chapter
1.	Refer to paragraph "Measure traverse step-by-step" to measure a traverse.	51.4.2
2.	Start the Traverse application program.	51.2
3.	**TRAVERSE Traverse Begin** Check the settings.	
4.	**CONT (F1)** to access **TRAVERSE Traverse Information**.	
5.	**TRAVERSE Traverse Information** The existing traverse is shown	
☞	**DATA (F5)** to view data of the active traverse.	51.5
☞	**END T (F6)** to end the existing traverse.	
☞	**SHIFT CONF (F2)** to change the configuration settings.	51.3
6.	**CONT (F1)** to access **TRAVERSE Backsight, Set:X/X**. Enter **<Instrument Ht:>**	
7.	**ALL (F1)** to measure and record the backsight point.	
8.	**TRAVERSE Foresight, Set:X/X** **SHIFT GETPT (F4)** to get a point from the **<Fixpoint Job:>** which can be used to close the traverse.	
9.	**CONT (F1)** to select the highlighted point.	

Step	Description	Refer to chapter
☞	**CHECK (F3)** to check the point. The fields are the same as in **TRAVERSE Traverse Results**.	51.6
☞	**NRMAL (F5)** to measure a foresight point.	
10.	**CLOSE (F1)** to use the point as closing point	
11.	**TRAVERSE Foresight, Set:X/X**	
12.	**ALL (F1)** to measure and record the closing point.	
13.	Repeat step 12. until all sets are measured.	
14.	**TRAVERSE Point Statistics, Pt:X/X**	51.5
15.	**CONT (F1)** to view traverse Results.	
16.	**TRAVERSE Traverse Results** **CONT (F1)** to choose to close angle, to measure sideshot point, to view traverse data or to end traverse.	51.6
17.	**END T (F6)** to end the traverse without angular closure.	

Close traverse with angular closure step-by-step

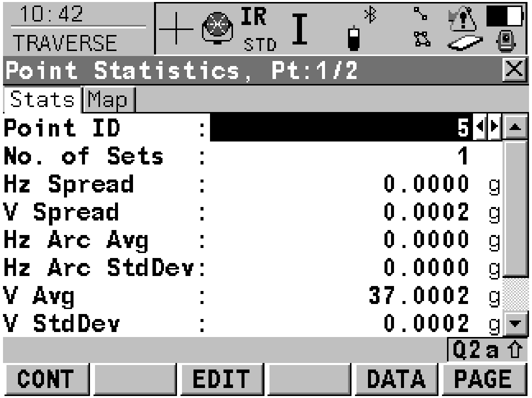
Step	Description	Refer to chapter
1.	Repeat steps 1. to 16. from paragraph "Close traverse without angular closure step-by-step".	51.4.3
2.	**C ANG (F1)** to close the traverse with angular closure.	
3.	Move to the closure point and start Traverse application program.	51.2

Step	Description	Refer to chapter
4.	**TRAVERSE Traverse Begin** Check the settings.	
5.	**CONT (F1)** to access **TRAVERSE Traverse Information**.	
6.	**TRAVERSE Traverse Information** The existing traverse is shown	
☞	**DATA (F5)** to view data of the active traverse.	51.5
☞	**END T (F6)** to end the existing traverse.	
☞	**SHIFT CONF (F2)** to change the configuration settings.	51.3
7.	**CONT (F1)** to access **TRAVERSE Close Angle**.	
8.	**TRAVERSE Close Angle** **<FS Type:>** To measure onto a known point or a known azimuth. **<Foresight ID:>** The point ID of the foresight point. **<FS Azimuth:>** Available for **<FS Type: Known Azimuth>**. Known azimuth for foresight point.	
9.	**CONT (F1)** to access **TRAVERSE Backsight, Set:X/X**.	
10.	Repeat steps 7. to 9. from paragraph "Measure traverse step-by-step". until all sets are measured.	
11.	**TRAVERSE Point Statistics, Pt:X/X** **CONT (F1)** to view traverse results.	51.5
12.	**TRAVERSE Traverse Results**	51.6

Step	Description	Refer to chapter
	CONT (F1) to exit viewing traverse results.	
13.	**END T (F6)** to end traverse.	

51.5 Traverse Point Statistics

TRAVERSE
Point Statistics, Pt:X/X



CONT (F1)
To access the subsequent screen.

EDIT (F3)
To edit point code and annotations.

DATA (F5)
To display traverse data. Refer to paragraph "TRAVERSE Traverse Data" for more information.

Description of fields

Field	Option	Description
<Point ID:>	Choicelist	Selected point ID.
<No. of Sets:>	Output	The number of sets the point was measured in.
<Hz Spread:>	Output	Spread of horizontal angle.
<V Spread:>	Output	Spread of vertical angle.
<Hz Arc Avg:>	Output	Average horizontal angle.
<Hz Arc StdDev:>	Output	Standard deviation of horizontal angle.

Field	Option	Description
<V Avg:>	Output	Average vertical angle.
<V StdDev:>	Output	Standard deviation of vertical angle
<Dist Avg:>	Output	Average distance.
<Dist StdDev:>	Output	Standard deviation of distance.

Next step

CONT (F1) allows to move to next station, to measure a sideshot point, to measure a foresight point or to end the traverse.

TRAVERSE Traverse Data

Description of columns

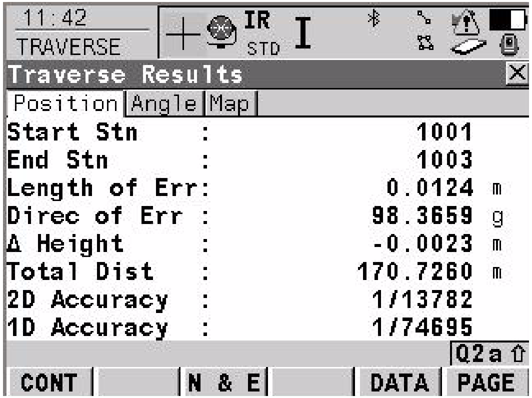
Column	Description
Station ID	Point ID of the station ID.
Backsight ID	The backsight point measured from the current station ID.
No Sets	Number of measured sets.
No FS	Number of measured foresight points.

Next step

CONT (F1) allows to move to next station, to measure a sideshot point, to measure a foresight point or to end the traverse.

51.6 Traverse Results

TRAVERSE
Traverse Results,
Position page



CONT (F1)
To access the subsequent screen.
N & E (F3) or **L & D (F3)**
To view misclosure error in north/east or length/direction.
DATA (F5)
To display traverse data.
PAGE (F6)
To change to another page on this screen.

Description of fields

Field	Option	Description
<Start Stn:>	Output	The point ID of the traverse start point.
<End Stn:>	Output	The point ID of the traverse end point.
<Length of Err:>	Output	The length of the misclosure error.
<Direc. of Err:>	Output	The direction of the misclosure error.
<Δ North:>	Output	Error in north.
<Δ East:>	Output	Error in east.

Field	Option	Description
<Δ Height:>	Output	Error in height.
<Total Dist:>	Output	Total length of the traverse.
<2D Accuracy:>	Output	Position ratio of misclosure.
<1D Accuracy:>	Output	Height ratio of misclosure.

Next step

PAGE (F6) changes to the Angle page. Refer to paragraph "TRAVERSE Traverse Results, Angle page".

TRAVERSE Traverse Results, Angle page

Description of fields

Field	Option	Description
<Foresight ID:>	Output	Point ID of the closing angle point. Displays ----- if no values are available.
<FS Azimuth:>	Output	Defined azimuth of closing line. Displays ----- if no values are available.
<Azimuth Avg:>	Output	Mean value of the measured azimuth closing line. Displays ----- if no values are available.
<Angular Misc:>	Output	Angular misclosure of traverse. Displays ----- if no values are available.

Next step

CONT (F1) allows to close angle, to measure sideshot point, to view traverse data or to end traverse.

52 Volume Calculations

52.1 Overview

Description

The Volume Calculations application program allows surfaces to be measured and volumes (and other information) to be computed from these surfaces.

Calculation tasks

The Volume calculations application program can be used for the following tasks:

- Measuring points (surface points and boundary points) defining a new surface or extending existing surfaces from the active job.
- Calculating the triangulation of the measured surface points to establish the surface.
- Calculating volumes from a reference (3D point, entered elevation) or by a stockpile method.

The surface calculation can be made from:

- existing point data in the job.
- manually measured points.
- entered coordinates.

Activating the application program

The Volume Calculations application program must be activated via a licence key. Refer to "28 Tools...\Licence Keys" for information on how to activate the application program.

Point types

Heights and positions are always taken into account. Points must have full coordinate triplets.

Properties of measured points

The properties stored with staked points are:

- Class: **MEAS**
- Sub class: **TPS**
- Source: **Survey**
- Instrument source: **TPS.**

52.2 Accessing Volume Calculations

Access

Select **Main Menu: Programs...\Volume Calculations.**

OR

Press **PROG**. Highlight **Volume Calculations. CONT (F1)**.

Refer to "35.2 Accessing the Programs Menu" for information on **PROG** key.

OR

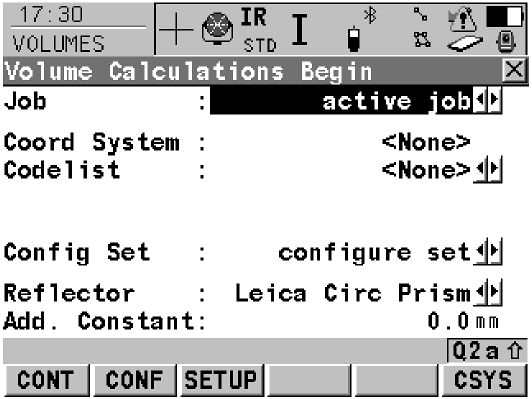
Press a hot key configured to access **VOLUMES Volume Calculations Begin**.

Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

VOLUMES
Volume Calculations
Begin



CONT (F1)
To accept changes and access the subsequent screen. The chosen settings become active.

CONF (F2)
To access **VOLUMES Configuration**.

SETUP (F3)
To set up station. Accesses **SETUP Station Setup**.

CSYS (F6)
To select a different coordinate system.

Description of fields

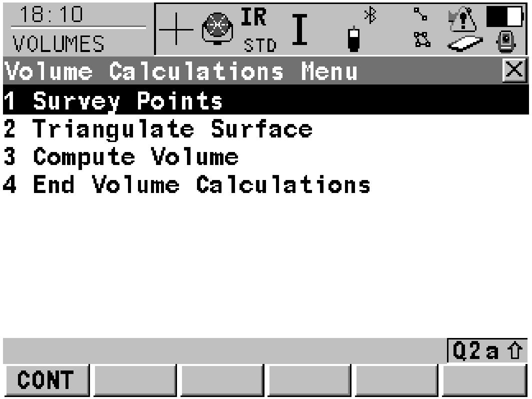
Field	Option	Description
<Job:>	Choicelist	The active job. All jobs from **Main Menu: Manage...\Jobs** can be selected.
<Coord System:>	Output	The coordinate system currently attached to the selected **<Job:>**.
<Codelist:>	Choicelist	No codes are stored in the selected **<Job:>**. All codelists from **Main Menu: Manage...\Codelists** can be selected.
	Output	Codes have already been stored in the selected **<Job:>**. If codes had been copied from a System RAM codelist, then the name of the codelist is displayed. If codes have not been copied from a System RAM codelist but typed in manually, then the name of the active job is displayed.
<Config Set:>	Choicelist	The active configuration set. All configuration sets from **Main Menu: Manage...\Configuration Sets** can be selected.
<Reflector:>	Choicelist	The reflector currently set in the selected configuration set. All reflectors from **Main Menu: Manage...\Reflectors** can be selected.
<Add. Constant:>	Output	The additive constant stored with the chosen reflector.

Next step

CONT (F1) accepts changes and accesses **VOLUMES Volume Calculations Menu**.

VOLUMES Volume Calculations Menu

The **Volume Calculations Menu** lists all of the necessary steps and the option to close the program.



CONT (F1)
To select the highlighted option and to continue with the subsequent screen.

SHIFT CONF (F2)
To access **VOLUMES Configuration**.

Description of the items in the Volume Calculations Menu

Volume Calculations menu options	Description	Refer to chapter
Step 1) Survey Points	To measure points defining a new surface or extending existing surfaces currently stored in the active job.	52.4.1
Step 2) Triangulate Surface	To triangulate (delauny triangulation) the measured surface points to establish the surface.	52.4.2

Volume Calculations menu options	Description	Refer to chapter
Step 3) Compute Volume	To compute the volume of a surface by a reference (3D point, entered elevation) or by the stockpile method.	52.4.3
Step 4) End Volume Calculations	To end Volume Calculations and return to the screen from where Volume Calculations was accessed.	

Next step

IF	THEN
to start the program	highlight the relevant option and press **CONT (F1)**. Refer to the chapters stated above.
to configure the program	press **SHIFT CONF (F2)**. Refer to "52.3 Configuring Volume Calculations".
to close the program	highlight **End Volume Calculations** and press **CONT (F1)**.

52.3 Configuring Volume Calculations

Access

Select **Main Menu: Programs...\Volume Calculations**. In **VOLUMES Volume Calculations Begin** press **CONF (F2)** to access **VOLUMES Configuration**.

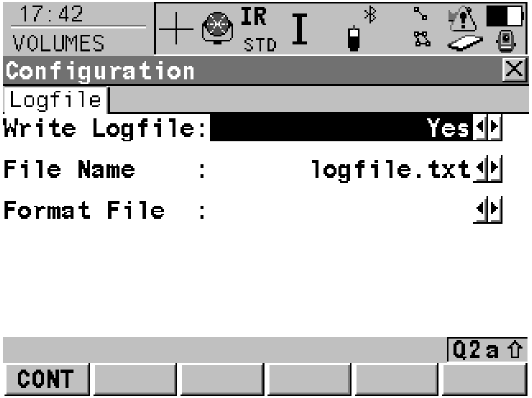
OR

Press **PROG**. Highlight **Volume Calculations**. **CONT (F1)**. In **VOLUMES Volume Calculations Begin** press **CONF (F2)** to access **VOLUMES Configuration**.

OR

Press **SHIFT CONF (F2)** in **Volume Calculations XX VOLUMES**.

VOLUMES Configuration, Logfile page



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

SHIFT ABOUT (F5)
To display information about the program name, the version number, the date of the version, the copyright and the article number.

Description of fields

Field	Option	Description
<Write Logfile:>	**Yes** or **No**	To generate a logfile when the application program is exited.
		A logfile is a file to which data from an application program is written to. It is generated using the selected **<Format File:>**.
<File Name:>	Choicelist	Available for **<Write Logfile: Yes>**. The name of the file to which the data should be written. A logfile is stored in the \DATA directory of the active memory device. The data is always appended to the file. Opening the choicelist accesses **XX Logfiles** where a name for a new logfile can be created and an existing logfile can be selected or deleted.
<Format File:>	Choicelist	Available for **<Write Logfile: Yes>**. A format file defines which and how data is written to a logfile. Format files are created using LGO. A format file must first be transferred from the CompactFlash card to the System RAM before it can be selected. Refer to "24 Tools...\Transfer Objects..." for information on how to transfer a format file. Opening the choicelist accesses **XX Format Files** where an existing format file can be selected or deleted.

52.4 Calculating the Volume

52.4.1 Step 1) Surveying the Points

Description

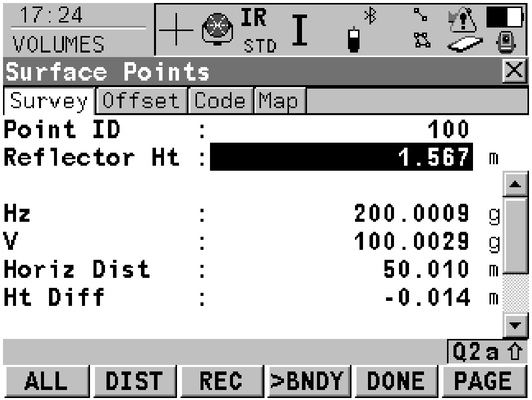
To measure points to a new surface or to an existing surface in the active job. If no surfaces currently exist in the active job, the user has to enter a **New Surface** first in **VOLUMES Choose Task & Surface**. The menu items **Triangulate Surface** and **Compute Volume** within the **VOLUMES Volumes & Surfaces Menu** are marked grey if no surface exists in the active job.

Access

Refer to "52.2 Accessing Volume Calculations" to access **VOLUMES Surface Points**.

VOLUMES Surface Points, Survey page

The pages shown are those from a typical configuration set. An additional page is available when a user defined display mask is used.



ALL (F1)
To measure and store distances and angles.

STOP (F1)
Available if **<EDM Mode: Tracking>** and **DIST (F2)** was pressed. Stops the distance measurements. **(F1)** changes back to **ALL**.

DIST (F2)
To measure and display distances. Available unless **<EDM Mode: Tracking>** and/or **<Log Auto Pts: Yes>**, after the tracking or logging is started.

REC (F3)
To record data.
If **<EDM Mode: Tracking>** and/or **<Log Auto Pts: Yes>**, records measured point and continues tracking.

>BNDY (F3) / **>SURF (F3)**
To change the class of the point to be measured between surface point and boundary point.

DONE (F5)
To finish measuring and to return to the **Volumes Calculations Menu**.

PAGE (F6)
To change to another page on this screen.

SHIFT INDIV (F5) and **SHIFT RUN (F5)**
To change between entering an individual point ID different to the defined ID template and the running point ID according to the ID template. Refer to "16.1 ID Templates".

Description of fields

Field	Option	Description
<Point ID:>	User input	The identifier for manually occupied points. The configured point ID template is used. The ID can be changed in the following ways: • To start a new sequence of point ID's type over the point ID.

Field	Option	Description
		• For an individual point ID independent of the ID template **SHIFT INDIV (F5)**. **SHIFT RUN (F5)** changes back to the next ID from the configured ID template. Refer to "16.1 ID Templates".
<Reflector Ht:>	User input	The last used reflector height is suggested when accessing the Survey application program. An individual reflector height can by typed in.
<Hz:>	Output	The current horizontal angle.
<V:>	Output	The current vertical angle.
<Horiz Dist:>	Output	The horizontal distance after **DIST (F2)** was pressed. No distance is displayed when accessing the screen and after **REC (F3)** or **ALL (F1)**.
<Ht Diff:>	Output	The height difference between station and measured point after **DIST (F2)**. Displays ----- when accessing the screen and after **REC (F3)** or **ALL (F1)**.

Next step

Press **ESC** returns to the **VOLUMES Choose Task & Surface** screen.
Press **ESC** again to return to the **VOLUMES Volume Calculations Menu** screen.

52.4.2 Step 2) Triangulating the Surface

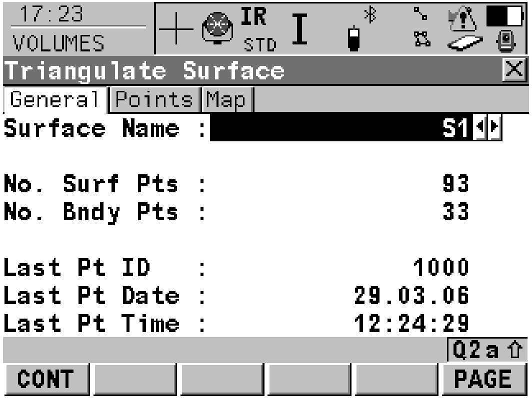
Description

To calculate a surface by establishing a triangulation (triangulation method: delauny) of the measured surface points.

Access

Refer to "52.2 Accessing Volume Calculations" to access **VOLUMES Triangulate Surface**.

VOLUMES Triangulate Surface, General page



CONT (F1)
To access **VOLUMES Boundary Definition**. **(F1)** changes to **CALC**.
PAGE (F6)
To change to another page on this screen.
SHIFT CONF (F2)
To access **VOLUMES Configuration**.
SHIFT DEL S (F4)
To delete the surface.

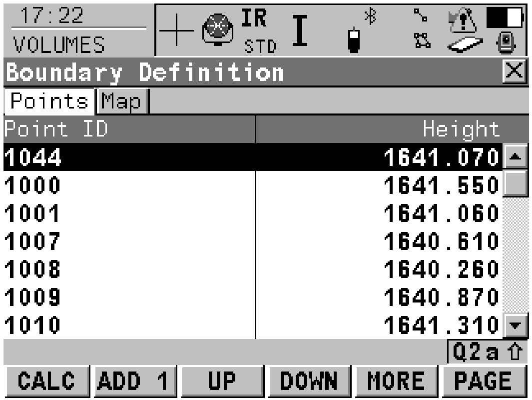
Description of fields

Field	Option	Description
<Surface Name:>	Choicelist	Name of the surface to be triangulated.
<No. Surf Pts:>	Output	Number of the measured surface points.
<No. Bndy Pts:>	Output	Number of the measured boundary points.

Field	Option	Description
<Last Pt ID:>	Output	ID of the last measured point of the chosen surface.
<Last Pt Date:>	Output	Date of the last measured point of the chosen surface.
<Last Pt Time:>	Output	Time of the last measured point of the chosen surface.

Next step
CONT (F1) continues to **VOLUMES Boundary Definition**.

VOLUMES Boundary Definition, Points page



CALC (F1)
To start calculating the triangulation and to access to the **VOLUMES Triangulation Results**.

ADD 1 (F2)
To add points from the active job to the surface.

UP (F3)
To move the focused point one step up within the boundary definition.

DOWN (F4)
To move the focused point one step down within the boundary definition.

MORE (F5)
To display information about the code group, the code type, the code description and the quick codes if available.

PAGE (F6)
To change to another page on this screen.

SHIFT HOME (F2)
To move the focus to the top of the points list.

SHIFT END (F3)
To move the focus to the bottom of the points list.

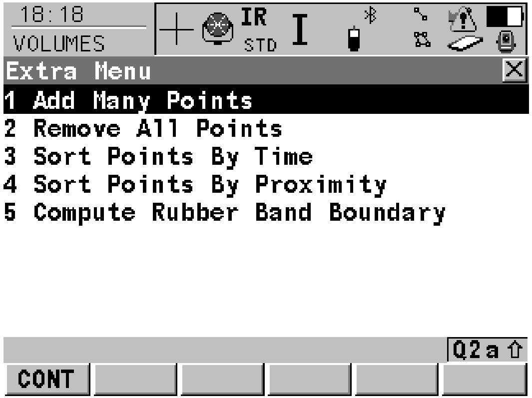
SHIFT REM 1 (F4)
To remove the marked point from the surface.

SHIFT EXTRA (F5)
To access to the **VOLUMES Extra Menu**.

Next step

SHIFT EXTRA (F5) continues to **VOLUMES Extra Menu**. Refer to"VOLUMES Extra Menu"**.**

VOLUMES
Extra Menu



CONT (F1)
To enter the highlighted option from the **VOLUMES Extra Menu**.

Description of fields

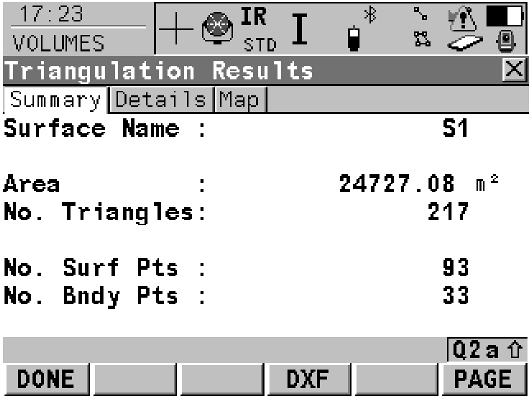
Field	Description
<Add Many Points>	Access Data Manage and all points that are in the list.
<Remove All Points>	Method to remove all points that are indicated in the **Boundary Definition** points page.
<Sort Points by Time>	Method to sort all points in the **Boundary Definition** points page by the time they were stored.
<Sort Points by Proximity>	Method to sort all points in the **Boundary Definition** points page by the closest proximity.
<Compute Rubber Band Boundary>	Method to define a new boundary as if a rubber band was placed around the points. The current list of boundary points will be ignored.

Next step

CONT (F1) returns to the screen

CALC (F1) calculates the triangulation and continues to **VOLUMES Triangulation Results**.

VOLUMES Triangulation Results, Summary page



DONE (F1)
To close the triangulation of the surface and return to **Volumes Calculations Menu**.

DXF (F4)
To export the triangulation results to a DXF file on the data or root directory of the CF Card.

PAGE (F6)
To change to another page on this screen.

SHIFT CONF (F2)
To access **VOLUMES Configuration**.

Description of fields

Field	Option	Description
<Surface Name:>	Output	Name of the surface.
<Area:>	Output	Area of the base plane.
<No. Triangles:>	Output	Number of triangles used within the triangulation.
<No. Surf Pts:>	Output	Number of points inside the surface.

Field	Option	Description
<No. Bndy Pts:>	Output	Number of boundary points of the surface.

Next step

PAGE (F6) changes to the **Details** page.

Refer to "VOLUMES Triangulation Results, Details page".

VOLUMES Triangulation Results, Details page

Description of fields

Field	Option	Description
<No. Points:>	Output	Total number of points from the surface.
<Min Elevation:>	Output	Minimal elevation of the triangulated surface.
<Max Elevation:>	Output	Maximal elevation of the triangulated surface.
<Longest Side:>	Output	Value of the longest triangle side.
<Area (3D):>	Output	Surface area (3D).

Next step

PAGE (F6) changes to the **Map** page.

Refer to "VOLUMES Triangulation Results, Map page".

VOLUMES Triangulation Results, Map page

The **Map** page provides an interactive display of the data. Refer to "34 MapView Interactive Display Feature" for information on the functionality and softkeys available.

Next step

DONE (F1) returns to **Volume Calculation Menu** page.

Refer to "VOLUMES Volume Calculations Menu".

52.4.3 Step 3) Computing the Volume

Description

To calculate a surface by establishing a triangulation (triangulation method: delauny) of the measured surface points.

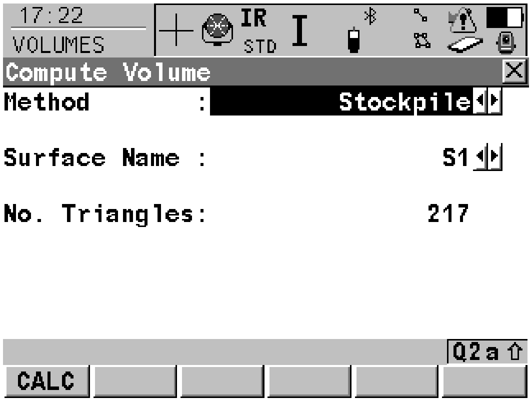
To compute the volume of the triangulated surface by using either:

- the stockpile method,
- an elevation plane as a reference,
- a single point as a reference.

Access

Refer to "52.2 Accessing Volume Calculations" to access **VOLUMES Compute Volume**.

VOLUMES Compute Volume



CALC (F1)
Computing the volume and access to the **VOLUMES Volume Calculation Results page**. **(F1)** changes to **CONT**.

SHIFT CONF (F2)
To access **VOLUMES Configuration**.

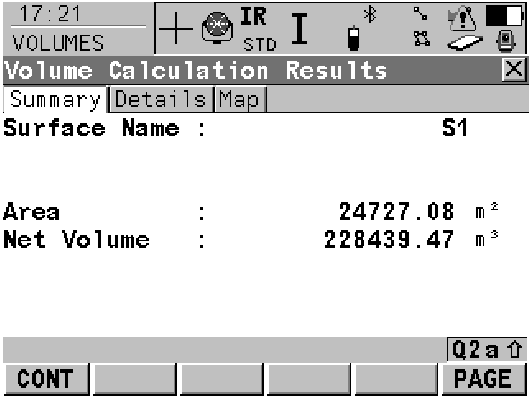
Description of fields

Field	Option	Description
<Method:>	Choicelist	To calculate the volume of the triangulated surface.
	Stockpile	To calculate a volume between the triangulated surface and the surface defined by the boundary points of the surface.
	Surface to Elev	To calculate a volume between the triangulated surface and the height entered by the user.
	Surface to Point	To calculate a volume between the triangulated surface and the height of a selected point.
<Surface Name:>	Choicelist	The surface chosen from the triangulated surfaces currently stored to the active job.
<No. Triangles:>	Output	The number of triangles from the triangulated surface
<To Elevation:>	User Input	To enter a height for the elevation plane. This height will be used as the reference when **<Method: Surface To Elev>** is selected.
<To Point:>	Choicelist	To select a point from the active job. This point height will be used as the reference when **<Method: Surface To Point>** is selected.
<Elevation:>	Output	The elevation of the selected point.

Next step

CALC (F1) calculates the volume and continues to **VOLUMES Volume Calculation Results**.

VOLUMES Volume Calculation Results, Summary page



CONT (F1)
Computing the volume and access to the **VOLUMES Volume Calculation Results page**. **(F1)** changes to **CONT**.

PAGE (F6)
To change to another page on this screen.

SHIFT CONF (F2)
To access **VOLUMES Configuration**.

Description of fields

Field	Option	Description
<Surface Name:>	Output	Surface.
<Area:>	Output	Area of the base plane.
<Net Volume:>	Output	Volume of the surface.

Next step

PAGE (F6) changes to the **Details** page.

Refer to "VOLUMES Volume Calculation Results, Details page".

VOLUMES Volume Calculation Results, Details page

Description of fields

Field	Option	Description
<Min Elevation:>	Output	Minimal elevation of the calculated volume.
<Max Elevation:>	Output	Maximal elevation of the calculated volume.
<Avg Thickness:>	Output	Average thickness of the calculated volume.
<Perimeter:>	Output	Perimeter of the measured surface area (intersection of the measured surface to the reference datum).

Next step
PAGE (F6) changes to the **Map** page.
Refer to "VOLUMES Triangulation Results, Map page".

VOLUMES Volume Calculation Results, Map page

The **Map** page provides an interactive display of the data. Refer to "34 MapView Interactive Display Feature" for information on the functionality and softkeys available.

Next step
CONT (F1) returns to **Volume Calculation Menu** page.
Refer to "VOLUMES Volume Calculations Menu".

Appendix A Menu Tree

Menu tree

MAIN MENU

- SURVEY
- PROGRAMS...
- MANAGE...
  - JOBS
  - DATA
  - CODELISTS
  - COORDINATE SYSTEMS
  - CONFIGURATION SETS
  - REFLECTORS
- CONVERT...
  - EXPORT DATA FROM JOB
    - EXPORT ASCII
    - EXPORT DXF
  - IMPORT DATA TO JOB

- IMPORT ASCII/GSI
- IMPORT DXF
- COPY POINTS BETWEEN JOBS
- CONFIG...
  - SURVEY SETTINGS...
    - ID TEMPLATES
    - DISPLAY SETTINGS
    - CODING AND LINEWORK SETTINGS
    - OFFSETS
    - TARGET CHECK
  - INSTRUMENT SETTINGS...
    - EDM & ATR SETTINGS
    - SEARCH WINDOWS
    - AUTOMATIC PRISM SEARCH
    - TPS CORRECTIONS
    - COMPENSATOR
    - INSTRUMENT ID

- GENERAL SETTINGS...
  - WIZARD MODE
  - HOT KEYS & USER MENU
  - UNITS & FORMATS
  - LANGUAGE
  - LIGHTS, DISPLAY, BEEPS, TEXT
  - START UP & POWER DOWN
- INTERFACES...
  - GSI OUTPUT
  - GEOCOM MODE
  - RCS MODE
  - EXPORT JOB
  - GPS RTK, for SmartStation
  - INTERNET, for SmartStation
- SMARTSTATION..., for SmartStation
  - REAL-TIME MODE, for SmartStation
  - POINT OCCUPATION SETTINGS, for SmartStation
  - SATELLITE SETTINGS, for SmartStation
  - LOCAL TIME ZONE, for SmartStation

- QUALITY CONTROL SETTINGS, for SmartStation
    - LOGGING OF RAW OBS, for SmartStation
- TOOLS...
  - FORMAT MEMORY DEVICE
  - TRANSFER OBJECTS...
    - CODELISTS
    - CONFIGURATION SETS
    - COORDINATE SYSTEMS
    - GEOID FIELD FILES
    - CSCS FIELD FILES
    - FORMAT FILES
    - JOBS, if internal memory is fitted
    - SYSTEM RAM CONTENTS
    - MODEM/GSM STATIONS, for SmartStation
    - IP HOSTS, for SmartStation
    - ANTENNA RECORDS, for SmartStation
    - PZ-90-TRANSFORMATION, for SmartStation
  - UPLOAD SYSTEM FILES...
    - APPLICATION PROGRAMS

- SYSTEM LANGUAGES
- INSTRUMENT FIRMWARE

- CALCULATOR
- FILE VIEWER
- LICENCE KEYS
- CHECK & ADJUST...
  - COMBINED (l, t, i, c, ATR)
  - TILTING AXIS (a)
  - COMPENSATOR (l, t)
  - CURRENT VALUES
  - END CHECK & ADJUST

Appendix B Memory Types

Types of memory available

CompactFlash card/Internal memory

- Jobs
  - Points
  - Codes
- Coordinate systems
- Raw observations
- ASCII output files
- Logfiles
- ASCII files to be imported (CompactFlash card)
- CSCS field files (usually on System RAM, can also be used from CompactFlash card)
- Geoid field files (usually on System RAM, can also be used from CompactFlash card)

The information is managed in the job database DB-X and in the measurement database.

Application programs memory, 8 MB	System RAM, 1 MB
• System language	• Codelists
• Font files	• Coordinate systems
• Application programs	• Configuration sets
• Language files	• Antenna files

• Font files	• Format files • CSCS models/CSCS field files • Geoid models/Geoid field files • Almanac • ID templates

Appendix C Directory Structure of the Memory Device

Description

On the memory device, files are stored in certain directories. The following diagram of the directory structure refers to both CompactFlash card and internal memory if fitted.

Backwards compatible with TPS1100 are GSI files.

Directory structure

|—— CODE	• Codelists various files
|—— CONFIG	• TPS configuration files (*.xfg)
|—— CONVERT	• Format files (*.frt)
|—— DATA	• ASCII files for import/export to/from job (*.*) • DXF files for import/export to/from job (*.*) • Logfiles created from application programs
| |—— GPS	• Almanac file (Almanac.sys)
| | |—— RINGBUF	• Ring buffer files
| | |—— GEOID	• Geoid field files (*.gem)
| | |—— CSCS	• CSCS field files (*.csc)

├── DBX	• Job files, various files • DTM jobs, various files • GNSS raw observation files • Coordinate system file from GPS1200 (Trfset.dat)
├── GPS	• Antenna file from GPS1200 (List.ant) • GSM/Modem station list from GPS1200 (Stations1200.fil)
├── GSI	• GSI files (*.gsi) • ASCII files for export from job (*.*)
├── SYSTEM	• Application program files (*.a*) • Firmware files (*.fw) • Language files (*.s*) • Licence file (*.key) • System files (System.ram)

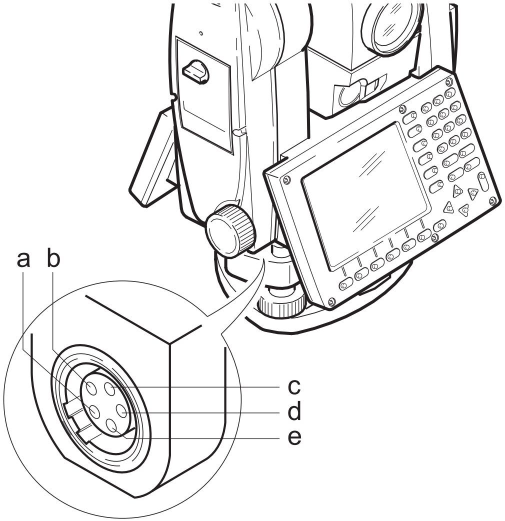
Appendix D Pin Assignments and Sockets

D.1 Instrument

Description

Some application programs require knowledge of the pin assignments for the instrument port.
In this chapter, the pin assignments and socket for the port 1 of the instrument are explained.

Port 1 at the instrument



TPS12_078

a) Pin 1
b) Pin 2
c) Pin 3
d) Pin 4
e) Pin 5

Pin assignments for port 1

Pin	Name	Description	Direction
1	PWR_IN	Power input, + 12 V nominal (11 - 16 V).	In
2	-	Not used.	-
3	GND	Single ground.	-
4	Rx	RS232, receive	In
5	Tx	RS232, transmit	Out

Sockets

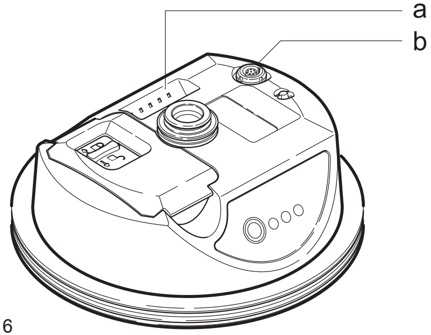
Port 1:	LEMO-0, 5 pin, LEMO ENA.OB.305.CLN

D.2 SmartAntenna

Description

Some applications require knowledge of the pin assignments for the SmartAntenna ports. In this chapter, the pin assignments and sockets for the ports of the SmartAntenna are explained.

Ports at the Smart-Antenna



TPS12_216

a) Clip-on-contacts for connecting SmartAntenna to SmartAntenna Adapter on TPS1200
b) 8 pin LEMO-1 to connect antenna cable

Pin assignments for 8 pin LEMO-1

Pin	Name	Description	Direction
1	USB_D+	USB data line	In or out
2	USB_D-	USB data line	In or out
3	GND	Signal ground	-
4	RxD	RS232, receive data	In
5	TxD	RS232, transmit data	Out
6	ID	Identification pin	In or out
7	PWR	Power input, 5 -28 V	In
8	ATX_ON	ATX on control signal, RS232 levels	In

Sockets

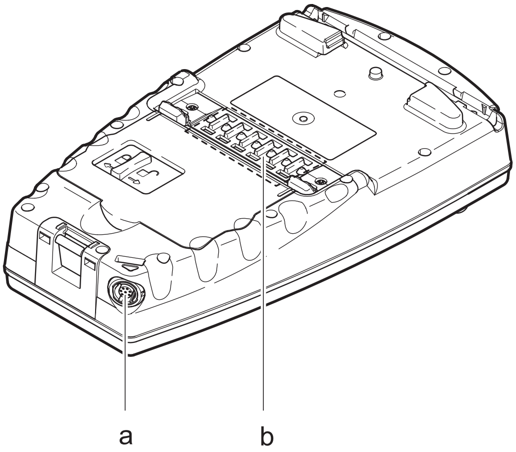
8 pin LEMO-1: LEMO-1, 8 pin, LEMO HMI.1B.308.CLNP

D.3 RX1250

Description

Some applications require knowledge of the pin assignments for the RX1250 ports.
In this chapter, the pin assignments and sockets for the ports of the RX1250 are explained.

Ports at the RX1250



RX12_040

a) 8 pin LEMO-1 to connect data cable
b) Clip-on-contacts for connecting RX1250 to GHT56 holder

Pin assignments for 8 pin LEMO-1

Pin	Name	Description	Direction
1	USB_D+	USB data line	In or out
2	USB_D-	USB data line	In or out
3	GND	Signal ground	-
4	RxD	RS232, receive data	In
5	TxD	RS232, transmit data	Out
6	ID	Identification pin	In or out
7	PWR	Power input, 5 -28 V	In
8	TRM_ON/USB_ID	RS232, general purpose signal	In

Sockets

8 pin LEMO-1:	LEMO-1, 8 pin, LEMO HMI.1B.308.CLNP

Appendix E Cables

Description

Some applications require the connection of instruments, devices or accessories to the TPS1200. In this chapter, the required cables and their use are listed.

Cables connecting instruments, devices or accessories

The table shows in alphabetical order which instruments, devices or accessories can be connected using cables. Refer to paragraph "Cables and product names" for a full description of these cables.

From	To	Cables
AX1200	GPS1200	• GEV108 • GEV119 • GEV120 • GEV134 • GEV141 • GEV142 • GEV194 • Cable 70 m, GNSS antenna
	GRX1200 Pro/ GRX1200 GG Pro	• GEV108 • GEV119 • GEV120 • GEV134

From	To	Cables
		• GEV141 • GEV142 • GEV194 • Cable 70 m, GNSS antenna
Car battery	GPS1200	• GEV97 + GEV71
	GRX1200 Pro/ GRX1200 GG Pro	• GEV97 + GEV71 • GEV172 + GEV171
	TPS1200	• GEV52 + GEV71
Device for Event Input	GPS1200	• GEV42
	GRX1200 Pro/ GRX1200 GG Pro	• GEV42
Device for PPS	GRX1200 Pro/ GRX1200 GG Pro	• GEV150
Ethernet communication device	GRX1200 Pro/ GRX1200 GG Pro	• GEV168
GEB171 or GEV208	GPS1200	• GEV97 • GEV97 + GEV172
	GRX1200 Pro/ GRX1200 GG Pro	• GEV97 • GEV97 + GEV172
	RX1250	• GEV215
	SmartAntenna	• GEV215

From	To	Cables
	TPS1200	• GEV52
Modem	GPS1200	• GEV113
	GRX1200 Pro/ GRX1200 GG Pro	• GEV113
Oscillator, external	GRX1200 Pro/ GRX1200 GG Pro	• GEV169
Power supply for GPS receiver, 12 V DC	GPS1200	• GEV172
	GRX1200 Pro/ GRX1200 GG Pro	• GEV172
Radio housing	Radio antenna on radio antenna arm	• GEV141
RS232 9 pin on PC	GFU14	• GEV171
	GPS1200	• GEV160 • GEV162
	GRX1200 Pro/ GRX1200 GG Pro	• GEV160 • GEV162
	RX1250	• GEV162
	SmartAntenna	• GEV162
	TPS1200	• GEV102 • GEV187

From	To	Cables
RX1210	GPS1200	• GEV163 • GEV164
	GRX1200 Pro/ GRX1200 GG Pro	• GEV163 • GEV164
RX1250	SmartAntenna	• GEV173 • GEV215
	TPS1200	• GEV217
Satelline radio	GPS1200	• GEV125
	GRX1200 Pro/ GRX1200 GG Pro	• GEV125
System 500 GFU	GPS1200	• GEV167
	GRX1200 Pro/ GRX1200 GG Pro	• GEV167
TCPS27	TPS1200	• GEV186
USB on PC	GPS1200	• GEV195
	GRX1200 Pro/ GRX1200 GG Pro	• GEV195
	RX1250	• GEV161
	TPS1200	• GEV189

Cables and product names

The product names of the cables in the above table are explained in detail below in ascending order.

Name	Description
-	Cable 70 m, GNSS antenna
GEV42	Cable, Event input for GPS
GEV52	Cable 1.8 m, TPS1200 to battery
GEV171	Cable 4.0 m, LEMO to 12 V DC power supply It allows a connection to a 12 V DC power supply for example a car battery. Cables used to connect to a GEB171 battery can be connected to adapter cable number 7.
GEV97	Cable 1.8 m, GX power cable
GEV102	Cable 2.0 m, TPS1200 to RS232
GEV108	Cable 30 m, GNSS antenna
GEV113	Cable, GX com to modem
GEV119	Cable 10 m, GNSS antenna
GEV120	Cable 2.8 m, GNSS antenna
GEV125	Cable, Satelline without housing to GX
GEV134	Cable 50 m, GNSS antenna
GEV141	Cable 1.2 m, GNSS antenna
GEV142	Cable 1.6 m, GNSS antenna, extension
GEV150	Cable, PPS output for GPS
GEV160	Cable 2.8 m, data transfer GX COM to RS232

Name	Description
GEV161	Cable 2.8 m, data transfer GX RX1250 to USB
GEV162	Cable 2.8 m, data transfer GX RX to RS232
GEV163	Cable 1.8 m, RX to GX
GEV164	Cable 1.0 m, RX to GX, all-on-pole setup
GEV167	Cable 0.5 m, GX to System 500 GFU housings
GEV168	Cable 5.0 m, GX to Ethernet communication device
GEV169	Cable 2.0 m, GX to external oscillator
GEV171	Y-cable 1.8 m, programming cable, GFU14 to RS232 with power
GEV172	Cable 2.8 m, dual external power input
GEV173	Cable 1.2 m, SmartAntenna to RX1250
GEV186	Y-cable 1.8 m, TCPS27 to TPS1200 with power
GEV187	Y-cable 2.0 m, TPS1200 to RS232 with power
GEV189	Cable 2.8 m, data transfer TPS to USB
GEV194	Cable 1.8 m, GNSS antenna, all-on-pole setup
GEV195	Cable 2.8 m, data transfer GX to USB
GEV208	Power supply unit, 12 V DC
GEV215	Y-cable, SmartAntenna and RX1250 to GEB171
GEV217	Cable 1.8 m, TPS1200 to RX1250

Appendix F NMEA Message Formats

F.1 Overview

Description

National **M**arine **E**lectronics **A**ssociation is a standard for interfacing marine electronic devices. This chapter describes all NMEA-0183 messages which can be output by the receiver.

Access

To set the output of NMEA messages on the receiver

Select **Main Menu: Config...\Interfaces...\NMEA Out**.

OR

Within the configuration set wizard. Refer to "11 Manage...\Configuration Sets".

Steer from a connected device

Use a query message. Refer to the interface control documents for GPS1200 for information on this query message. The firmware CD contains these documents in electronic format.

☞

A Talker ID appears at the beginning of the header of each NMEA message.
The Talker ID can be user defined or standard (based on the NMEA 3.0). This is normally GP for GPS but can be changed in **CONFIGURE NMEA Output 1** or **CONFIGURE NMEA Output 2**.

F.2 Used symbols for describing the NMEA formats

Description

NMEA messages consist of various fields. The fields are:

- Header
- Special format fields
- Numeric value fields
- Information fields
- Null fields

Certain symbols are used as identifier for the field types.
These symbols are described in this section.

Header

Symbol	Field	Description	Example
$	-	Start of sentence	$
--ccc	Address	• -- = alphanumeric characters identifying the talker Options: GP = GPS only GL = GLONASS only GN = **G**lobal **N**avigation **S**atellite **S**ystem like WAAS and EGNIOS	GPGGA

Symbol	Field	Description	Example
		• ccc = alphanumeric characters identifying the data type and string format of the successive fields. This is usually the name of the message.	

Special format fields

Symbol	Field	Description	Example
A	Status	• A = Yes, Data Valid, Warning Flag Clear • V = No, Data Invalid, Warning Flag Set	V
llll.ll	Latitude	• Degreesminutes.decimal • Two fixed digits of degrees, two fixed digits of minutes and a variable number of digits for decimal fraction of minutes. • Leading zeros are always included for degrees and minutes to maintain fixed length.	4724.538950
yyyyy.yy	Longitude	• Degreesminutes.decimal • Three fixed digits of degrees, two fixed digits of minutes and a variable number of digits for decimal fraction of minutes. • Leading zeros are always included for degrees and minutes to maintain fixed length.	00937.046785

Symbol	Field	Description	Example
eeeeee.eee	Grid Easting	At the most six fixed digits for metres and three fixed digits for decimal fractions of metres.	195233.507
nnnnnn.nnn	Grid Northing	At the most six fixed digits for metres and three fixed digits for decimal fractions of metres.	127223.793
hhmmss.ss	Time	• hoursminutesseconds.decimal • Two fixed digits of hours, two fixed digits of minutes, two fixed digits of seconds and a variable number of digits for decimal fraction of seconds. • Leading zeros are always included for hours, minutes and seconds to maintain fixed length.	115744.00
mmddyy	Date	• Monthdayyear - two fixed digits of month, two fixed digits of day, two fixed digits of year. • Leading zeros always included for month, day and year to maintain fixed length.	093003
No specific symbol	Defined field	• Some fields are specified to contain predefined constants, most often alpha characters.	M

Symbol	Field	Description	Example
		• Such a field is indicated by the presence of one or more valid characters. Excluded from the list of valid characters are the following that are used to indicate other field types: A, a, c, x, hh, hhmmss.ss, llll.ll, yyyyy.yy.	

Numeric value fields

Symbol	Field	Description	Example
x.x	Variable numbers	• Integer or floating numeric field • Optional leading and trailing zeros. Decimal point and associated decimal-fraction are optional if full resolution is not required.	73.10 = 73.1 = 073.1 = 73
hh_	Fixed HEX field	Fixed length HEX numbers	3F

Information fields

Symbol	Field	Description	Example
c--c	Variable text	Variable length valid character field	A
aa_	Fixed alpha field	Fixed length field of upper case or lower case alpha characters	N
xx_	Fixed number field	Fixed length field of numeric characters	1

Null fields

Symbol	Field	Description	Example
No symbol	Information unavailable for output	Null fields do not contain any information at all.	,,

☞ Fields are always separated by a comma. Before the Checksum field there is never a comma.

☞ When information for a field is not available, the position in the data string is empty.

F.3 GGA - Global Positioning System Fix Data

Syntax

$--GGA,hhmmss.ss,llll.ll,a,yyyyy.yy,a,x,xx,x.x,x.x,M,x.x,M,x.x,xxxx*hh<CR><LF>

Description of fields

Field	Description
$--GGA	Header including Talker ID
hhmmss.ss	UTC time of position
llll.ll	Latitude (WGS 1984)
a	Hemisphere, **N**orth or **S**outh
yyyyy.yy	Longitude (WGS 1984)
a	**E**ast or **W**est
x	Position quality indicator 0 = Fix not available or invalid 1 = No real-time position, navigation fix 2 = Real-time position, ambiguities not fixed 3 = Valid fix for GNSS **P**recise **P**ositioning **S**ervice mode, for example WAAS 4 = Real-time position, ambiguities fixed
xx	Number of satellites in use, 00 to 26.
x.x	HDOP

Field	Description
x.x	Altitude of position marker above/below mean sea level in metres. If no orthometric height is available the local ellipsoidal height will be exported. If the local ellipsoidal height is not available either, the WGS 1984 ellipsoidal height will be exported.
M	Units of altitude as fixed text M
x.x	Geoidal separation in metres. This is the difference between the WGS 1984 earth ellipsoid surface and mean sea level.
M	Units of geoidal separation as fixed text M
x.x	Age of differential GNSS data, empty when DGPS not used
xxxx	Differential reference station ID, 0000 to 1023
*hh	Checksum
<CR>	**C**arriage **R**eturn
<LF>	**L**ine **F**eed

Examples

User defined Talker ID = GN

$GNGGA,113805.50,4724.5248541,N,00937.1063044,E,4,13,0.7,1171.281,M,-703.398,M,0.26,0000*42

F.4 GGK - Real-Time Position with DOP

Syntax

$--GGK,hhmmss.ss,mmddyy,llll.ll,a,yyyyy.yy,a,x,xx,x.x,EHTx.x,M*hh<CR><LF>

Description of fields

Field	Description
$--GGK	Header including Talker ID
hhmmss.ss	UTC time of position
mmddyy	UTC date
llll.ll	Latitude (WGS 1984)
a	Hemisphere, **N**orth or **S**outh
yyyyy.yy	Longitude (WGS 1984)
a	**E**ast or **W**est
x	Position quality indicator 0 = Fix not available or invalid 1 = No real-time position, navigation fix 2 = Real-time position, ambiguities not fixed 3 = Real-time position, ambiguities fixed
xx	Number of satellites in use, 00 to 26.
x.x	GDOP
EHT	Ellipsoidal height
x.x	Altitude of position marker as local ellipsoidal height. If the local ellipsoidal height is not available, the WGS 1984 ellipsoidal height will be exported.

Field	Description
M	Units of altitude as fixed text M
*hh	Checksum
<CR>	**C**arriage **R**eturn
<LF>	**L**ine **F**eed

Examples

Standard Talker ID

$GNGGK,113616.00,041006,4724.5248557,N,00937.1063064,E,3,12,1.7,EHT1171.742,M*6D

User defined Talker ID = GN

$GNGGK,113806.00,041006,4724.5248557,N,00937.1063064,E,3,13,1.4,EHT1171.746,M*66

F.5 GGK(PT) - Real-Time Position with DOP, Trimble Proprietary

Syntax

$PTNL,GGK,hhmmss.ss,mmddyy,llll.ll,a,yyyyy.yy,a,x,xx,x.x,EHTx.x,M*hh<CR><LF>

Description of fields

Field	Description
$PTNL	$ = Start of sentence delimiter, talker ID fixed with PTNL
GGK	GGK sentence formatter
hhmmss.ss	UTC time of position
mmddyy	UTC date
llll.ll	Latitude (WGS 1984)
a	Hemisphere, **N**orth or **S**outh
yyyyy.yy	Longitude (WGS 1984)
a	**E**ast or **W**est
x	Position quality indicator 0 = Fix not available or invalid 1 = No real-time position, navigation fix 2 Not existing 3 = Real-time position, ambiguities fixed 4 = Real-time position, ambiguities not fixed
xx	Number of satellites in use, 00 to 26.
x.x	PDOP
EHT	Ellipsoidal height

Field	Description
x.x	Altitude of position marker as local ellipsoidal height. If the local ellipsoidal height is not available, the WGS 1984 ellipsoidal height will be exported.
M	Units of altitude as fixed text M
*hh	Checksum
<CR>	**C**arriage **R**eturn
<LF>	**L**ine **F**eed

Examples

Standard Talker ID

$PTNL,GGK,113616.00,041006,4724.5248557,N,00937.1063064,E,3,12,1.5,EHT1171.742,M*4C

User defined Talker ID = GN

$PTNL,GGK,113806.00,041006,4724.5248557,N,00937.1063064,E,3,13,1.2,EHT1171.746,M*43

F.6 GGQ - Real-Time Position with CQ

Syntax

$--GGQ,hhmmss.ss,mmddyy,llll.ll,a,yyyyy.yy,a,x,xx,x.x,x.x,M*hh<CR><LF>

Description of fields

Field	Description
$--GGQ	Header including talker ID
hhmmss.ss	UTC time of position
mmddyy	UTC date
llll.ll	Latitude (WGS 1984)
a	Hemisphere, **N**orth or **S**outh
yyyyy.yy	Longitude (WGS 1984)
a	**E**ast or **W**est
x	Position quality indicator 0 = Fix not available or invalid 1 = No real-time position, navigation fix 2 = Real-time position, ambiguities not fixed 3 = Real-time position, ambiguities fixed
xx	Number of satellites in use, 00 to 26.
x.x	Coordinate quality in metres

Field	Description
x.x	Altitude of position marker above/below mean sea level in metres. If no orthometric height is available the local ellipsoidal height will be exported. If the local ellipsoidal height is not available either, the WGS 1984 ellipsoidal height will be exported.
M	Units of altitude as fixed text M
*hh	Checksum
<CR>	**C**arriage **R**eturn
<LF>	**L**ine **F**eed

Examples

Standard Talker ID

$GNGGQ,113615.50,041006,4724.5248556,N,00937.1063059,E,3,12,0.009,1171.281,M*22

$GPGGQ,113615.50,041006,,,,08,,*67

$GLGGQ,113615.50,041006,,,,04,,*77

User defined Talker ID = GN

$GNGGQ,113805.50,041006,4724.5248541,N,00937.1063044,E,3,13,0.010,1171.281,M*2E

F.7 GLL - Geographic Position Latitude/Longitude

Syntax

$--GLL,llll.ll,a,yyyyy.yy,a,hhmmss.ss,A,a*hh<CR><LF>

Description of fields

Field	Description
$--GLL	Header including talker ID
llll.ll	Latitude (WGS 1984)
a	Hemisphere, **N**orth or **S**outh
yyyyy.yy	Longitude (WGS 1984)
a	**E**ast or **W**est
hhmmss.ss	UTC time of position
A	Status A = Data valid V = Data not valid
a	Mode indicator A = Autonomous mode D = Differential mode N = Data not valid
*hh	Checksum
<CR>	**C**arriage **R**eturn
<LF>	**L**ine **F**eed

☞ The Mode indicator field supplements the Status field. The Status field is set to A for the Mode indicators A and D. The Status field is set to V for the Mode indicator N.

Examples

Standard Talker ID

$GNGLL,4724.5248556,N,00937.1063059,E,113615.50,A,D*7B

User defined Talker ID = GN

$GNGLL,4724.5248541,N,00937.1063044,E,113805.50,A,D*7E

F.8 GNS - GNSS Fix Data

Syntax

$--GNS,hhmmss.ss,llll.ll,a,yyyyy.yy,a,c--c,xx,x.x,x.x,x.x,x.x,xxxx*hh<CR><LF>

Description of fields

Field	Description
$--GNS	Header including talker ID
hhmmss.ss	UTC time of position
llll.ll	Latitude (WGS 1984)
a	Hemisphere, **N**orth or **S**outh
yyyyy.yy	Longitude (WGS 1984)
a	**E**ast or **W**est
c--c	Mode indicator N = Satellite system not used in position fix or fix not valid A = Autonomous; navigation fix, no real-time fix D = Differential; real-time position, ambiguities not fixed R = Real-time kinematic; ambiguities fixed
xx	Number of satellites in use, 00 to 99
x.x	HDOP
x.x	Altitude of position marker above/below mean sea level in metres. If no orthometric height is available the local ellipsoidal height will be exported. If the local ellipsoidal height is not available either, the WGS 1984 ellipsoidal height will be exported.

Field	Description
x.x	Geoidal separation in metres
x.x	Age of differential data
xxxx	Differential reference station ID, 0000 to 1023
*hh	Checksum
<CR>	**C**arriage **R**eturn
<LF>	**L**ine **F**eed

Examples

Standard Talker ID

$GNGNS,113616.00,4724.5248557,N,00937.1063064,E,RR,12,0.9,1171.279,-703.398,0.76,0000*6C

$GPGNS,113616.00,,,,,,08,,,,,*69

$GLGNS,113616.00,,,,,,04,,,,,*79

User defined Talker ID = GN

$GNGNS,113806.00,4724.5248547,N,00937.1063032,E,R,13,0.7,1171.283,-703.398,0.76,0000*39

F.9 GSA - GNSS DOP and Active Satellites

Syntax

$--GSA,a,x,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,x.x,x.x,x.x*hh<CR><LF>

Description of fields

Field	Description
$--GSA	Header including talker ID
a	Mode M = Manual, forced to operate in 2D or 3D mode A = Automatic, allowed to automatically change between 2D and 3D
x	Mode 1 = Fix not available 2 = 2D 3 = 3D
xx	Numbers of the satellites used in the solution. This field is repeated 12 times. 1 to 32 = PRN numbers of GPS satellites 33 to 64 = Numbers of WAAS and WAAS like satellites 65 to 96 = Slot numbers of GLONASS satellites
x.x	PDOP
x.x	HDOP
x.x	VDOP
*hh	Checksum
<CR>	**C**arriage **R**eturn

Field	Description
<LF>	**L**ine **F**eed

Examples

Standard Talker ID

$GNGSA,A,3,01,11,14,17,19,20,24,28,,,,,1.5,0.9,1.2*26

$GNGSA,A,3,65,66,67,81,,,,,,,,,1.5,0.9,1.2*29

User defined Talker ID = GN

$GNGSA,A,3,01,11,14,17,19,20,23,24,28,,,,65,66,67,81,,,,,,,,,1.2,0.7,1.0*27

F.10 GSV - GNSS Satellites in View

Syntax

$--GSV,x,x,xx,xx,xx,xxx,xx,.....*hh<CR><LF>

Description of fields

Field	Description
$--GSV	Header including talker ID
x	Total number of messages, 1 to 4
x	Message number, 1 to 4
xx	Number of theoretically visible satellites according to the current almanac.
xx	PRN (GPS) / Slot (GLONASS) number of satellite
xx	Elevation in degrees, 90 maximum, empty when not tracking
xxx	Azimuth in degrees true North, 000 to 359, empty when not tracking
xx	**S**ignal to **N**oise **R**ation C/No in dB, 00 to 99 of L1 signal, null field when not tracking.
...	Repeat set PRN / Slot number, elevation, azimuth and SNR up to four times
*hh	Checksum
<CR>	**C**arriage **R**eturn
<LF>	**L**ine **F**eed

Satellite information may require the transmission of multiple messages, specified by the total number of messages and the message number.

The fields for the PRN / Slot number, Elevation, Azimuth and SNR form one set. A variable number of these sets are allowed up to a maximum of four sets per message.

Examples

Standard Talker ID

$GPGSV,3,1,11,01,55,102,51,11,85,270,50,14,31,049,47,17,21,316,46*7A
$GPGSV,3,2,11,19,31,172,48,20,51,249,50,22,00,061,,23,11,190,42*7E
$GPGSV,3,3,11,24,11,292,43,25,08,114,,28,14,275,44,,,,*45
$GLGSV,2,1,06,65,16,055,42,66,64,025,48,67,46,262,42,68,01,245,*64
$GLGSV,2,2,06,81,52,197,47,83,07,335,,,,,,,,,*68

User defined Talker ID = GN

$GNGSV,3,1,10,01,55,100,51,11,86,263,50,14,31,049,47,17,22,316,46*65
$GNGSV,3,2,10,19,30,172,48,20,52,249,51,23,12,190,42,24,12,292,42*6C
$GNGSV,3,3,10,25,09,114,,28,14,274,44,,,,,,,,*62

F.11 LLK - Leica Local Position and GDOP

Syntax

$--LLK,hhmmss.ss,mmddyy,eeeeee.eee,M,nnnnnn.nnn,M,x,xx,x.x,x.x,M*hh<CR><LF>

Description of fields

Field	Description
$--LLK	Header including talker ID
hhmmss.ss	UTC time of position
mmddyy	UTC date
eeeeee.eee	Grid Easting in metres
M	Units of grid Easting as fixed text M
nnnnnn.nnn	Grid Northing in metres
M	Units of grid Northing as fixed text M
x	Position quality 0 = Fix not available or invalid 1 = No real-time position, navigation fix 2 = Real-time position, ambiguities not fixed 3 = Real-time position, ambiguities fixed
xx	Number of satellites used in computation
x.x	GDOP
x.x	Altitude of position marker above/below mean sea level in metres. If no orthometric height is available the local ellipsoidal height will be exported.
M	Units of altitude as fixed text M

Field	Description
*hh	Checksum
<CR>	**C**arriage **R**eturn
<LF>	**L**ine **F**eed

Examples

Standard Talker ID

$GNLLK,113616.00,041006,764413.024,M,252946.774,M,3,12,1.7,1171.279,M*0F

$GPLLK,113616.00,041006,,,,,,08,,,*57

$GLLLK,113616.00,041006,,,,,,04,,,*47

User defined Talker ID = GN

$GNLLK,113806.00,041006,764413.021,M,252946.772,M,3,13,1.4,1171.283,M*04

F.12 LLQ - Leica Local Position and Quality

Syntax

$--LLQ,hhmmss.ss,mmddyy,eeeeee.eee,M,nnnnnn.nnn,M,x,xx,x.x,x.x,M*hh<CR><LF>

Description of fields

Field	Description
$--LLQ	Header including talker ID
hhmmss.ss	UTC time of position
mmddyy	UTC date
eeeeee.eee	Grid Easting in metres
M	Units of grid Easting as fixed text M
nnnnnn.nnn	Grid Northing in metres
M	Units of grid Northing as fixed text M
x	Position quality 0 = Fix not available or invalid 1 = No real-time position, navigation fix 2 = Real-time position, ambiguities not fixed 3 = Real-time position, ambiguities fixed
xx	Number of satellites used in computation
x.x	Coordinate quality in metres
x.x	Altitude of position marker above/below mean sea level in metres. If no ortho-metric height is available the local ellipsoidal height will be exported.
M	Units of altitude as fixed text M

Field	Description
*hh	Checksum
<CR>	**C**arriage **R**eturn
<LF>	**L**ine **F**eed

Examples

Standard Talker ID

$GNLLQ,113616.00,041006,764413.024,M,252946.774,M,3,12,0.010,1171.279,M*12

$GPLLQ,113616.00,041006,,,,,,08,,,*4D

$GLLLQ,113616.00,041006,,,,,,04,,,*5D

User defined Talker ID = GN

$GNLLQ,113806.00,041006,764413.021,M,252946.772,M,3,13,0.010,1171.283,M*1A

F.13 RMC - Recommended Minimum Specific GNSS Data

Syntax

$--RMC,hhmmss.ss,A,llll.ll,a,yyyyy.yy,a,x.x,x.x,xxxxxx,x.x,a,a*hh<CR><LF>

Description of fields

Field	Description
$--RMC	Header including talker ID
hhmmss.ss	UTC time of position fix
A	Status A = Data valid V = Navigation receiver warning
llll.ll	Latitude (WGS 1984)
a	Hemisphere, **N**orth or **S**outh
yyyyy.yy	Longitude (WGS 1984)
a	**E**ast or **W**est
x.x	Speed over ground in knots
x.x	Course over ground in degrees
xxxxxx	Date: ddmmyy
x.x	Magnetic variation in degrees
a	**E**ast or **W**est
a*hh	Mode Indicator A = Autonomous mode D = Differential mode

Field	Description
	N = Data not valid
<CR>	**C**arriage **R**eturn
<LF>	**L**ine **F**eed

Examples

Standard Talker ID

$GNRMC,113616.00,A,4724.5248557,N,00937.1063064,E,0.01,11.43,100406,11.43,E,D*1C

User defined Talker ID = GN

$GNRMC,113806.00,A,4724.5248547,N,00937.1063032,E,0.00,287.73,100406,287.73,E,D*10

F.14 VTG - Course Over Ground and Ground Speed

Syntax

$--VTG,x.x,T,x.x,M,x.x,N,x.x,K,a*hh<CR><LF>

Description of fields

Field	Description
$--VTG	Header including talker ID
x.x	Course over ground in degrees true North, 0.0 to 359.9
T	Fixed text T for true North
x.x	Course over ground in degrees magnetic North, 0.0 to 359.9
M	Fixed text M for magnetic North
x.x	Speed over ground in knots
N	Fixed text N for knots
x.x	Speed over ground in km/h
K	Fixed text K for km/h
a	Mode Indicator A = Autonomous mode D = Differential mode N = Data not valid
*hh	Checksum
<CR>	**C**arriage **R**eturn
<LF>	**L**ine **F**eed

☞ The Magnetic declination is set in the receiver in **CONFIGURE\Units & Formats**, **Angle** page.

Examples

Standard Talker ID

$GNVTG,11.4285,T,11.4285,M,0.007,N,0.013,K,D*3D

User defined Talker ID = GN

$GNVTG,287.7273,T,287.7273,M,0.002,N,0.004,K,D*3E

F.15 ZDA - Time and Date

Syntax

$--ZDA,hhmmss.ss,xx,xx,xxxx,xx,xx*hh<CR><LF>

Description of fields

Field	Description
$--ZDA	Header including talker ID
hhmmss.ss	UTC time
xx	UTC day, 01 to 31
xx	UTC month, 01 to 12
xxxx	UTC year
xx	Local zone description in hours, 00 to ±13
xx	Local zone description in minutes, 00 to +59
*hh	Checksum
<CR>	**C**arriage **R**eturn
<LF>	**L**ine **F**eed

This message is given high priority and is output as soon as it is created. Latency is therefore reduced to a minimum.

Examples

Standard Talker ID

$GPZDA,091039.00,01,10,2003,-02,00*4B

User defined Talker ID = GN

$GNZDA,113806.00,10,04,2006,02,00*76

Appendix G AT Commands

AT commands

Hayes Microcomputer Products is a leading manufacturer of modems that has developed a language called the AT command set for controlling digital cellular phones and modems that has become the de facto standard.

List of selected AT commands

The characters in the table below are the most commonly used AT commands when configuring a digital cellular phone or modem. Refer to the manual of the used digital cellular phone or modem for information on which AT commands to use.

General commands

AT command	Description
^M	Inserts a carriage return and send command.
^#	Inserts the phone number as defined in digital cellular phone connection.
~	Inserts a delay of 1/4 second.
^^	Insert character ^.

GSM commands

AT command	Description
^C	Bearer Service: Connection Element.
^S	Bearer Service: Speed including Protocol and NetDataRate.

Appendix H General Terminology

Glossary of terms

Term	Description
GPS Mode	• SmartStation always switches to GPS mode when measuring real-time.

GPS Point	• Points measured by SmartStation in GPS mode.
	• The coordinates of GPS points are always stored in the WGS84 coordinates system. This is a three dimensional system Cartesian coordinate system with the origin at the centre of the Earth. WGS84 coordinates are given as X,Y,Z Cartesian coordinates, or latitude, longitude and height (above the WGS84 ellipsoid).
	• GPS Points are stored as class MEAS or class NAV:
	  • Class MEAS: If there are 5 or more satellites and if the distance to the reference is not too great for the prevailing ionospheric conditions, SmartStation will compute a GPS real-time position. The CQ indicator for this type of point is about 0.01 m to 0.05 m.
	  • Class NAV: If the reference stops working, or if the communication link between the reference and SmartStation fails, SmartStation will only compute a navigation position. The CQ indicator for this type of point is about 3 m to 20 m.

TPS Mode	• SmartStation always switches to TPS mode when measuring angles and distances.

Term	Description
TPS Point	• Points measured by TPS1200. • Points measured by SmartStation in TPS mode. • The coordinates of TPS points are always stored as local grid coordinates. The coordinates are Eastings, Northings and Height (above a datum).

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