
# TPS1100 Professional Series

## Application programs Field Manual 2

English

Version 2.1

Leica Geosystems

# *The quick way to start with the TPS1100 Programs.*



For additional details on single TPS1100 application program functions refer to the Applications Reference Manual on the CD.

To use the equipment in the permitted manner, please refer to the detailed safety instructions in the User Manual.

# Index

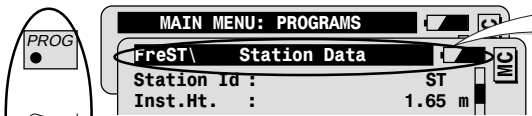
# How to use this manual

This manual gives step by step instructions for the basic uses of the TPS1100 field programs and explains some advanced program features. It shall be used together with a TPS1100 instrument or the TPS1100 PC simulation.

The proposed sequence of operations will guide you from the start to the end of a program.

***Example***

Start Free Station from the program menu.

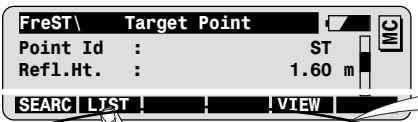



The title bar allows you to check if you are in the right dialog.




Sequence of operation to be done.

Enter the station Id and the instrument height.




To define a list of the target points and the measurement sequence.

Functions pointed to with a finger are optional.

## Symbols used in the sequence of operation


Press the fixed key PROG.

User input is necessary.


Press the function key F1 to activate the function ALL.

Repeat operation.

### Other Symbols

Important information and tips.

## Structure of the Field Manual

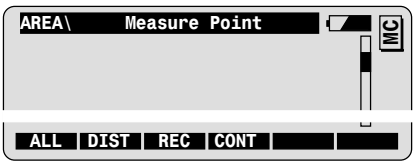
Each program is constructed with the same chapter structure. Each chapter answers questions:

| | |
|---|---|
| 1. Introduction | What does the program do? What are its typical uses? |
| 2. Basic Procedure | How do I start the program? How do I use it? |
| 3. Advanced Feature | Which special functions can I use to optimize my field work? |
| 4. Configuration | How can I configure the program to my needs? |
| 5. Program Flow | How can I navigate through the program? Where can I find a specific function? |

# General functions

This chapter explains common functions that are used in almost all programs (see also Quick Start).

## Measurement options




### ALL key

ALL F1

To measure a distance and record measurement data according to the active REC-mask.

### DIST and REC combination

DIST F2

To measure and display a distance.

REC F3

To record displayed distance and angles according to the active REC-mask.

### CONT

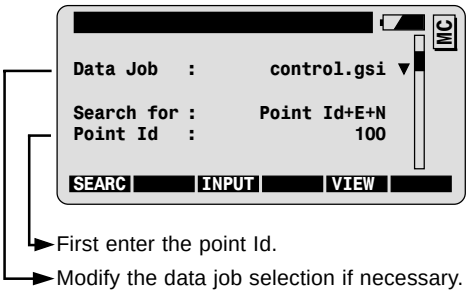
CONT F4

To accept displayed distance and angles, and continue to the next dialog without recording.

## *Search Point Dialog*

This dialog allows you to:

- Import the coordinates of a point from a data job or,
- Enter the coordinates of a point manually.




### *Coordinates available in Data Job*

**SEARC** F1 To import coordinates from data job and go to the next step **without** showing the point coordinates

**VIEW** F5 To import coordinates from data job and go to the next step **after** showing the point coordinates

### *Coordinates NOT available in Data Job*

**INPUT** F3 To enter coordinates manually.

**MEAS** F2 To measure and record point coordinates. Not available in every program.

# Area

## Introduction

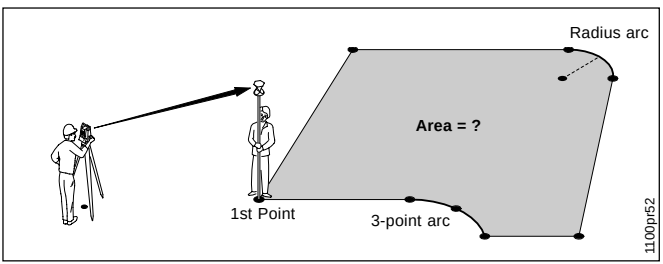
Calculates the area of a closed polygon which can be defined by straight lines and arcs.

The polygon points can be directly measured, imported from a coordinate data file, or entered manually.

On site, area calculation can be used for field check of values shown in plans, estimation of the needed quantity of building material for pavement areas, lot subdivision...

## Basic procedure

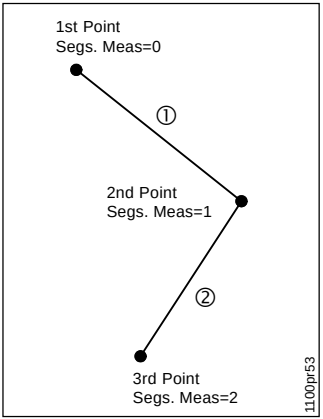
**Before starting Area:**
The station must be set up and oriented.




***Known or Measured:***
*Coordinates of the points defining the closed polygon.*

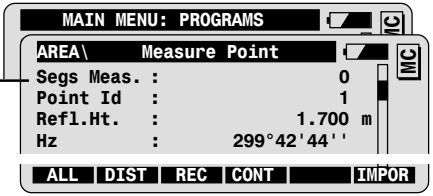
***Unknown:***
*Area of the closed polygon.*

### *Polygon with straigth segments*




Start Area from the program menu.

PROG




Segment counter. At the begining of an area the counter is set to zero.

Enter point Id and reflector height at the first polygon point.

**ALL** F1 To measure and record the first polygon point.
(See chapter *"Measurement options"*)
or
**IMPOR** F6 To import point coordinates from a data file.

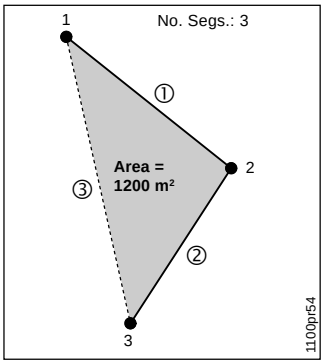
Repeat operation for second polygon point: this will complete your first straight segment.

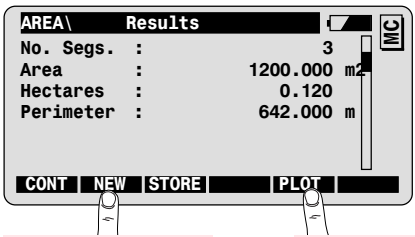
Repeat operation for third polygon point.

SHIFT **DEL** F3 To delete the last completed segment (Straight or Arc).

## *Area calculation*

SHIFT + CALC (F4) — To calculate the area of the polygon




To start a new area.

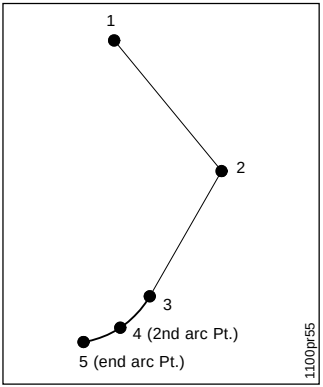
To display a plot of the closed polygon.

STORE (F3) — To store the displayed results if required.

CONT (F1) — To add new points to the polygon.
Returns to previous dialog "Measure Point".

SHIFT + QUIT (F6) — To quit the Area program.

### *Arc segment: 3 point ARC*





The first point of arc has already been measured or imported.

SHIFT ● **ARC** ● F5 To call the 3 point arc function.

Press the key combination again if it is necessary to change the arc method.

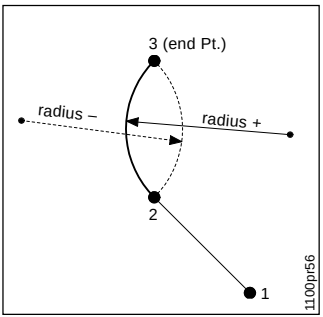

Enter point Id and reflector height at the second point of arc.

**ALL** ● F1 or **IMPOR** ● F6 To measure or import the second point of the arc.

Repeat operation for the third point of the arc.

Returns to the dialog "Measure Point", once the arc is completed.

### *Arc segment: Radius ARC: Arc defined by 2 points and radius*




*Radius +:* *radius Pt to the right of the arc*

*Radius -:* *radius Pt to the left of the arc*

```
AREA\      Measure Point      MC
Segs Meas. :              1
Point Id   :              3
```

The first point of the arc has already been measured or imported.

SHIFT ● **ARC** F5 To call the 3 point arc function.

Press the key combination again if it is necessary to change the arc method.

```
AREA\      Radius Arc         MC
Radius ARC, end point
Point Id   :              3
Refl.Ht.   :
```

Enter point Id and reflector height at the end point of the arc.

**ALL** F1 or **IMPOR** F6 To measure or import the second point of the arc.

```
AREA\      Radius Arc         MC
Start Pt.  :              2
End Pt.    :              3
Radius     :         10.500 m
```

Enter the radius of the arc.

CONT F1

Completes radius and returns to the dialog "Measure Point".

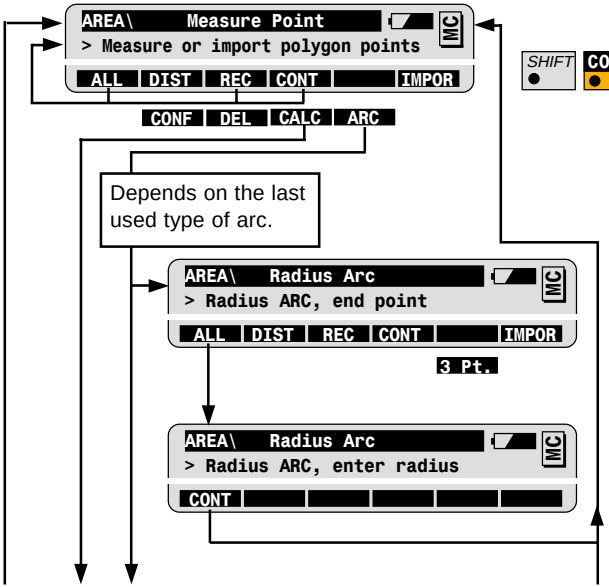
## *Configuration*

Call the configuration in the first application dialog.

SHIFT CONF F2


| | |
|---|---|
| **Two Faces** | Single or two face measurement. |
| **Code = 36** | Entry of identifying code (for instance: 36) for recording the area results in a GSI code block. |
| **Log File** | Creation of a logfile. |
| **Log Flname** | User definable name for the logfile. |
| **Meas. Job** | Selection of the job for recording measurements. |
| **Data Job** | Selection of the job containing the fix point coordinates. |

## *Program Flow*

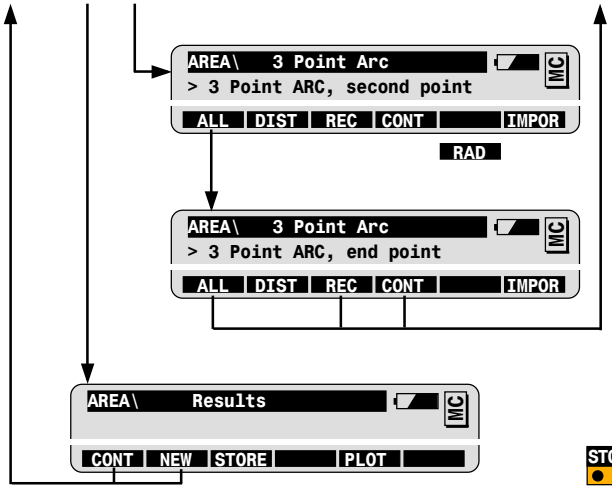



SHIFT ● CONF ● F2

Configuration can only be accessed in this first dialog.

SHIFT ● 3 Pt. ● F5

Change to 3 Point ARC




RAD
● F5

Change to Radius ARC

STORE
● F3

| | |
|---|---|
| Code number | WI41 |
| Number of Segments | WI42 |
| Area | WI43 |
| Perimeter | WI44 |

QUIT
● F6

To quit the Program at any time.

# Sets of Angles

## Introduction

Sets of Angles is used to measure directions to targets for which coordinates are not necessarily known. Distance measurements are optional.

The average direction of all sets, the standard deviation for the one observed direction and the standard deviation for the average of all directions is computed for each target.

This provides field checking and analysis of measurements while the instrument remains setup on the station.

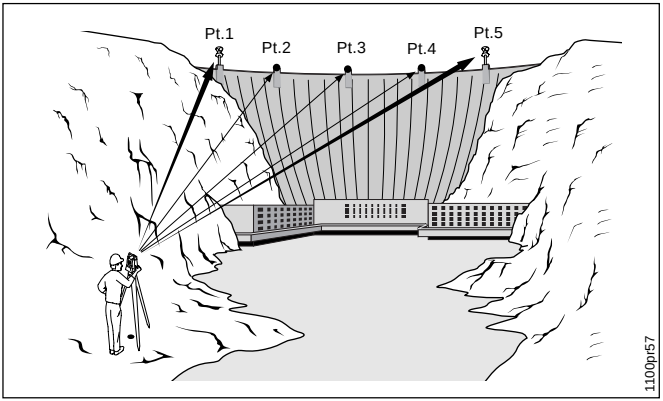
With motorized instruments rough pointing to each station is automatic, the operator needs only to refine the pointing before measuring. This eliminates observations to incorrect targets.

With Automatic Target Recognition, fine pointing and measurement can be automatic when the target is a reflector. The operator makes only the first observation to each station, then the rest of the measurements can be fully automated.

## *Basic procedure*

**Before starting Sets of Angles:**

Station set up and Orientation is optional (required if you want to record grid coordinates).



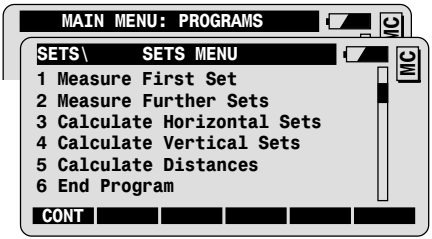

***Known:***
- *Target: Point Id*
  *Refl. Ht.: optional*

***Unknown:***
- *Directions*
- *Distances: optional*

***Measure at Least:***
- *Two Target Points*
- *Two Sets*

Start Sets of Angles from the program menu.

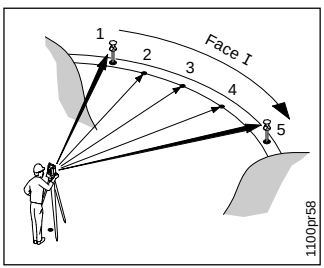
PROG

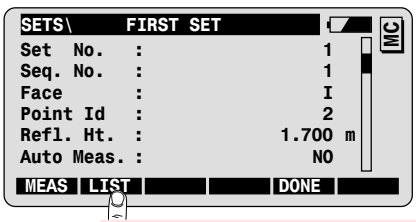



### *First half of First Set: Face I*

1

To measure first half of the first set. The instrument must be in Face I.



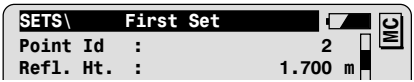

To define a list of Target points and the measurement sequence.

| | |
|---|---|
| **Auto Meas.**<br>**= YES** | Option of instruments with ATR.<br>Fine pointing and measurement to specified target are fully automatic. |

Enter Point Id at first target point.
If distances are measured: enter Refl. Ht. and check selection of the Prism Type at the bottom of the display.

**MEAS** F1

To call the measurement dialog.




**ALL** F1

To measure and record first target point
(See chapter *"Measurement options"*).

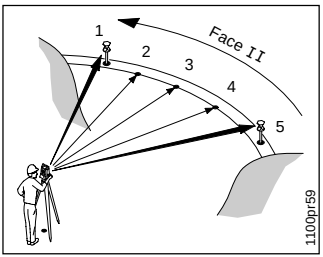
Repeat for each desired target.

You may define different reflector heights and prism types for each target. The values entered for each target will be recalled when measuring further sets.

**DONE** F5

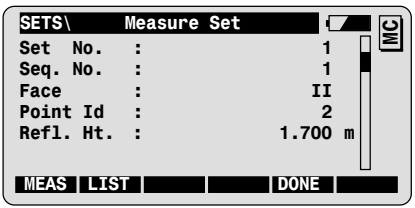
Ends first half of first set: all targets have been measured the first time.

### *Second half of First Set: Face II*





2 To complete first set, in Face II (required).

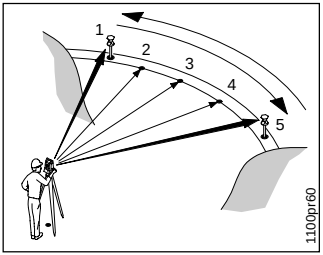



MEAS F1 To call the measurement dialog.
Proceed as with the first half of the first set to measure the second half of the set.

Motorized instrument will drive automatically to the target point.

If **Auto Meas** has been set to YES, instruments with ATR will automatically measure the second half of the first set to all targets.

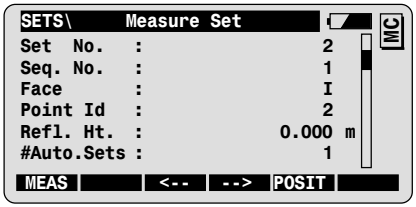
### *Measuring additional sets*




After the second half of the first set is completed, the Sets Menu is displayed again.


2

To measure additional sets.
You must measure at least two entire sets. You may measure up to a maximum of 64 targets, e.g. 8 sets to 8 targets.




MEAS F1

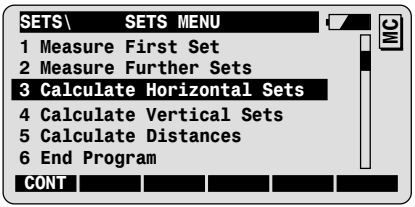
To call the measurement dialog.
Proceed as with the first set to measure the second set.

If you are working with **Auto Meas** = YES: you can set the number of sets to be automatically measured (**#Auto.Sets**).

## *Calculate Sets Results*

You can calculate the results only after you have measured two entire sets.

The results are calculated individually for Horizontal Directions, Vertical Directions and Slope Distances from the Sets Menu.




3 To calculate and display the results for horizontal sets.

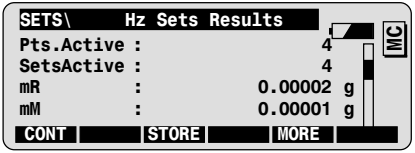
4 To calculate and display the results for vertical sets.

5 To calculate and display the results for distance sets.

### *Example for Horizontal Sets*

3 To display the results for horizontal directions:

| | |
|---|---|
| **mR** | Standard deviation of a single measurement. |
| **mM** | Standard deviation of the average of all measurements to the Point Id shown. |

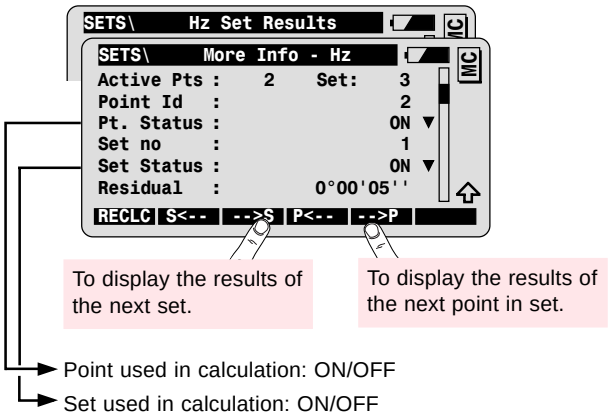



STORE F3 To store the Hz Set Results in the Meas Job and return to the Sets Menu.

## *Advanced Feature Results anlaysis: Example for Horizontal Sets*

Call the results analysis for individual points and sets from the results dialog.

MORE F5




RECLC F1 To recalculate with new settings.

ESC To return to the results dialog without changes.

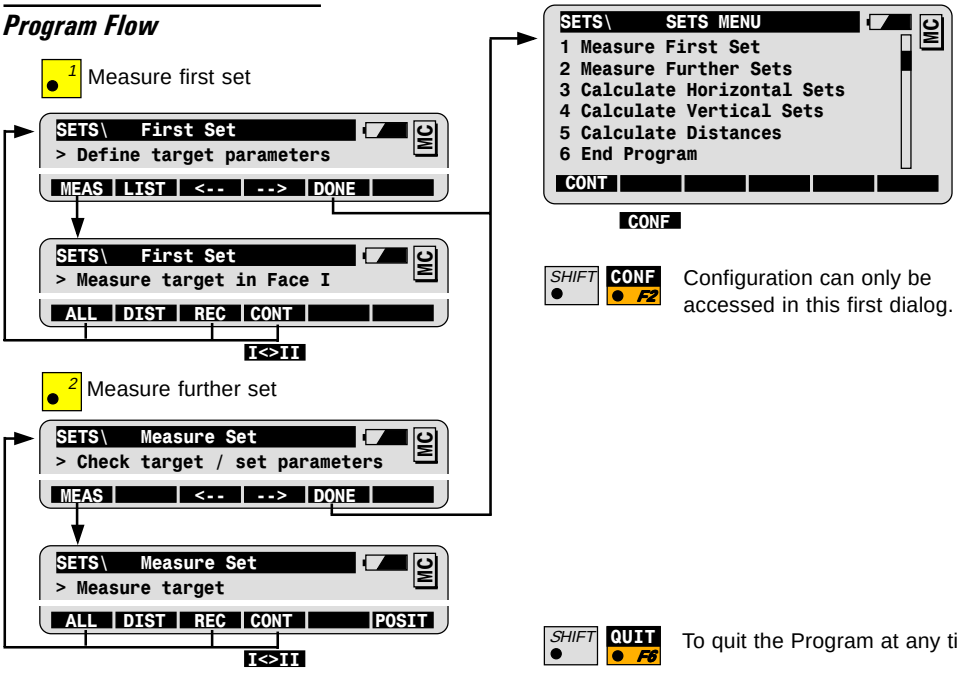
## Configuration

Call the configuration in the first application dialog.

SHIFT CONF F2

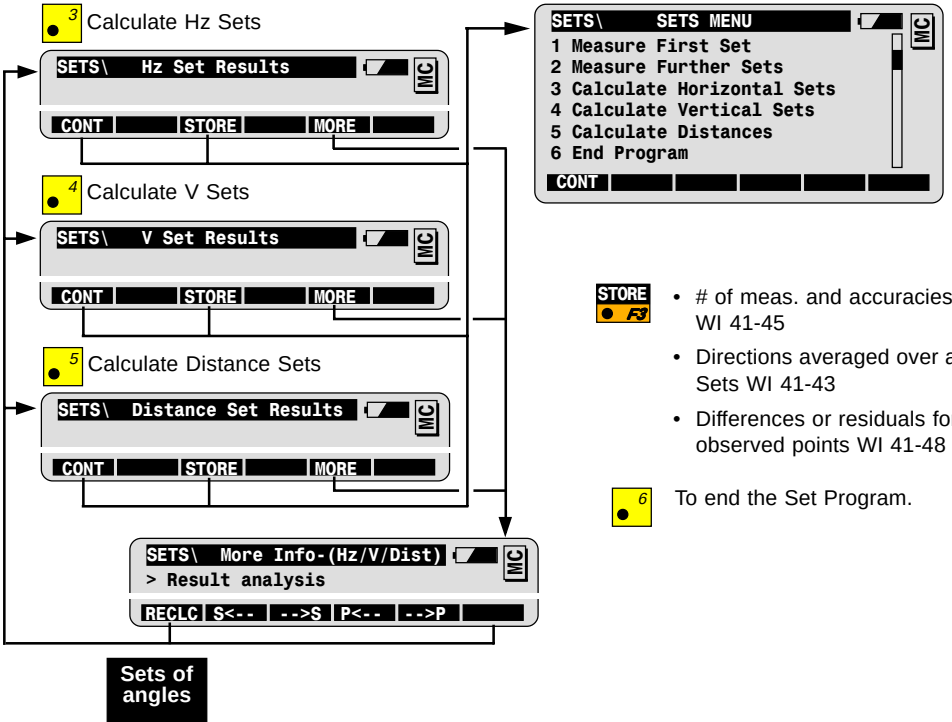

| | |
|---|---|
| **MeasMethod:** | |
| **=><** | Measure Face I, then measure Face II in the inverse sequence of Point Ids. |
| **=>>** | Measure Face I, then measure Face II in the same sequence of Point Ids. |
| **=◊** | Measure Face I followed immediately by Face II. |
| **User Disp.** | Use the display mask defined by the user. |
| **Hz Tol.** | Entry of the tolerance for Hz-directions. |
| **VAngle Tol.** | Entry of the tolerance for vertical directions. |
| **Dist. Tol.** | Entry of the tolerance for distances. |
| **Log File** | Creation of a logfile. |
| **Log Flname** | User definable name for the logfile. |
| **Meas. Job** | Selection of the job for recording measurements. |
| **Data Job** | Selection of the job containing the fix point coordinates. |

## *Program Flow*




SHIFT ● CONF ● F2 — Configuration can only be accessed in this first dialog.

SHIFT ● QUIT ● F6 — To quit the Program at any time.


3 Calculate Hz Sets
SETS\ Hz Set Results
MC
CONT
STORE
MORE
4 Calculate V Sets
SETS\ V Set Results
MC
CONT
STORE
MORE
5 Calculate Distance Sets
SETS\ Distance Set Results
MC
CONT
STORE
MORE
SETS\ More Info-(Hz/V/Dist)
> Result analysis
MC
RECLC
S<--
-->S
P<--
-->P
Sets of angles
SETS\ SETS MENU
MC
1 Measure First Set
2 Measure Further Sets
3 Calculate Horizontal Sets
4 Calculate Vertical Sets
5 Calculate Distances
6 End Program
CONT
STORE
F3
• # of meas. and accuracies WI 41-45
• Directions averaged over all Sets WI 41-43
• Differences or residuals for observed points WI 41-48
6
To end the Set Program.

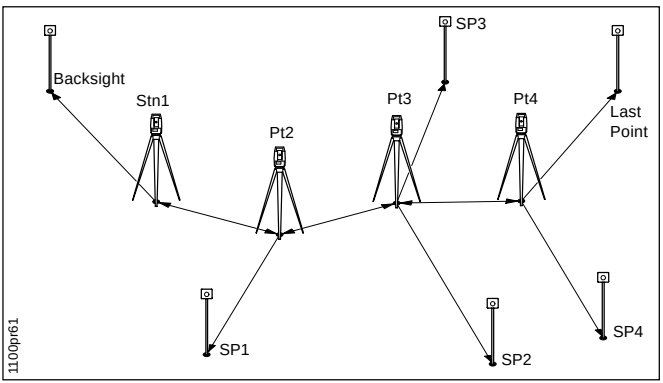
# Traverse

## Introduction

Traverse allows multiple measurements (optionally in both faces) to Traverse Points and to carry the coordinates in the field.

Traverse will compute and display the traverse closure error after the closing point has been measured providing a field check of the traverse measurements.

Traverse also allows multiple measurements to Sideshot Points.




***Known:***

- *Coordinates of first station*
- *Coordinates of backsight point or azimuth for orientation*
- *Coordinates of last Point*

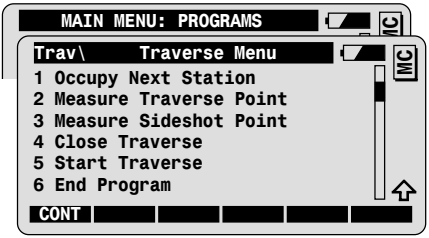
***Unknown:***

- *Coordinates of traverse points*
- *Closure Error*
- *Coordinates of sideshot points (SP1 - SP4)*

## Basic procedure

PROG

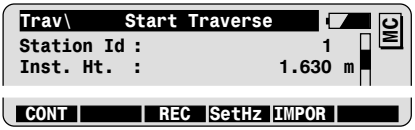
Start Traverse from the program menu.




### Start the Traverse: Set Station

5

To start a new traverse.




Enter Point Id and reflector height at the first point.

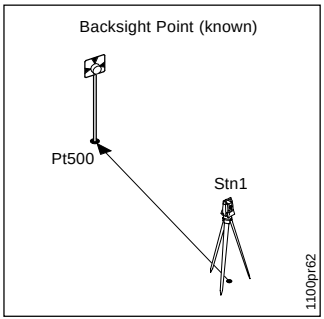
IMPOR F5

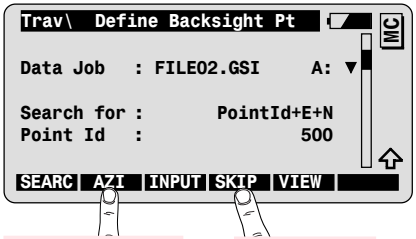
To search and import point coordinates from data job.

CONT F1

To set station and contiue to the dialog for orientation.

## *Set Orientation to Backsight Point*



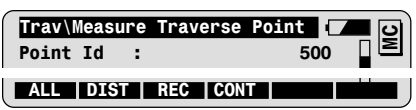




For backsight orientation given the azimuth

To keep the currently set orientation

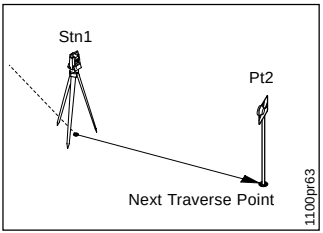
Enter backsight Point Id.

**SEARC** (F1) To search and import backsight point from data job.

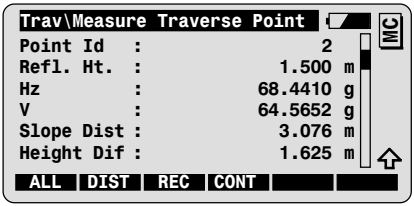



**ALL** (F1) To measure and record backsight point and set the orientation.
Continues to Traverse Menu.

## *Measure to next Traverse Point*



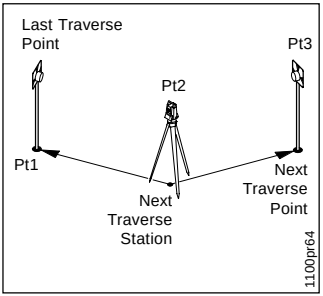

2 To measure to next Traverse Point.




Enter the point Id and Reflector Height at Traverse Point.

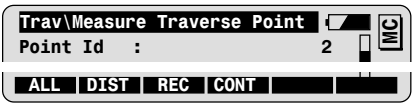
ALL F1 To measure and record Traverse Point.
Continues to Traverse Menu.

## *Occupy next Traverse Station*




The instrument has been set up on the next traverse station.

1 To Occupy next traverse station.




Enter Instrument Height.
Enter Reflector Height at Backsight Point (the Backsight is the last traverse point).

ALL F1 To measure and record Backsight.
Continues to Traverse Menu.

2 To measure to next traverse point.

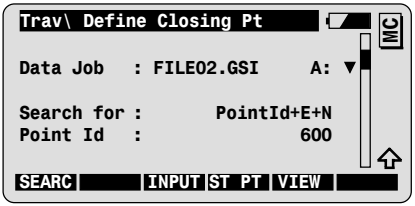
Enter Point Id and Reflector Height at traverse point.

ALL F1 To Measure and record traverse point.
Continues to Traverse Menu.

Repeat this sequence for each traverse point.

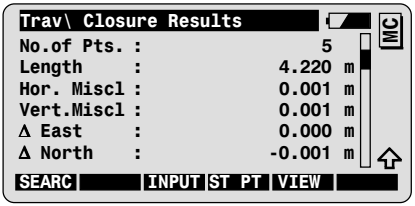
### *Close Traverse and Compute Closure Results*

4 To close traverse on known point.

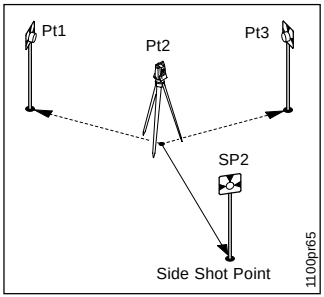



Enter the closing Point Id (the closing point is the last measured traverse point).

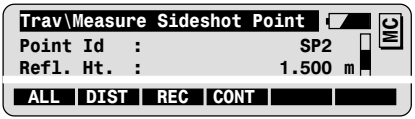
SEARC F1 To search and import coordinates of closing point from data job and view the Closure Results.



***Advanced Feature:***
***To Measure to a Sideshot Point***




3 To measure to a Sideshot Point.

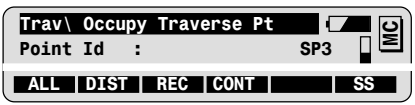



Enter the Point Id and Reflector Height at Sideshot Point.

ALL F1 To measure and record Sideshot Point.
Continues to Traverse Menu.

You may setup the instrument on a measured sideshot point if you want to measure further sideshots.

1 To occupy next Station



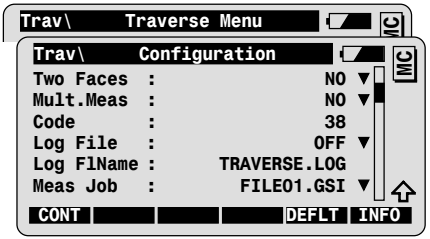

SS F6 To occupy a sideshot station.

ALL F1 To measure and record Backsight.
Continues to Traverse Menu.

## *Configuration*

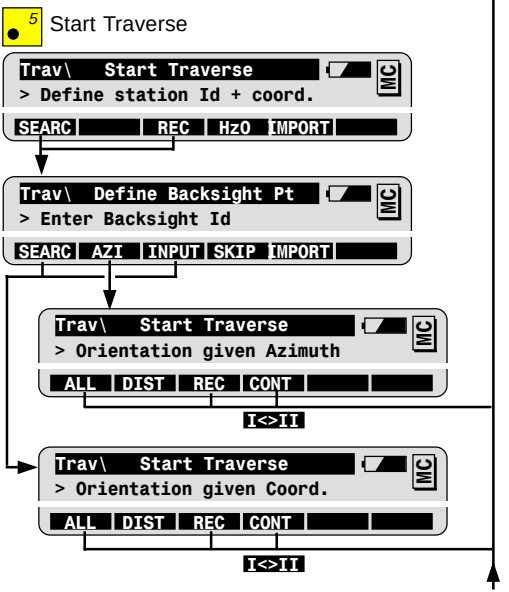
PROG CONF F2

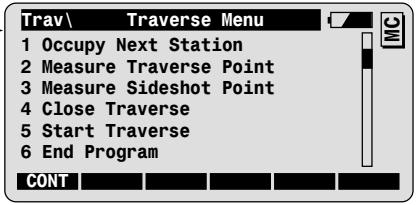
Call the configuration in the first application dialog.




| | |
|---|---|
| **Two Faces** | Single or two faces measurement. |
| **Mult.Meas** | Multiple measurement to a single target point. |
| **Code = 38** | Entry of identifiying code (for instance: 38) for recording the Traverse results in a GSI code block. |
| **Log File** | Creation of a logfile. |
| **Log Flname** | User definable name of the logfile. |
| **Meas. Job** | Selection of the job for recording measurements. |
| **Data Job** | Selection of the job containing the fix point coordinates. |

## *Program Flow*

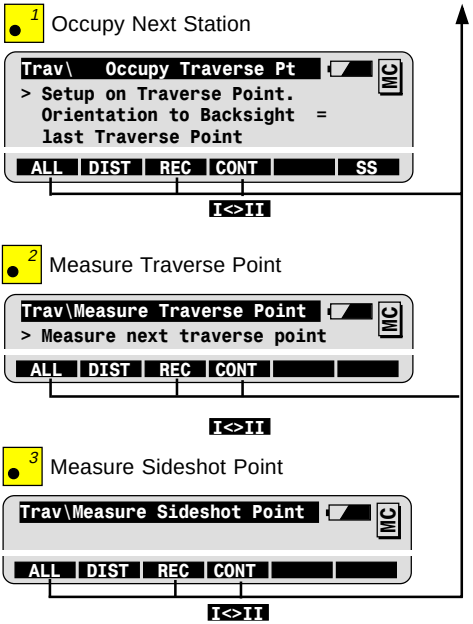




Configuration can only be accessed in this first dialog.

Common procedure:
(A) 5 Start Traverse
(B) 2 Measure Traverse Point
move
(C) 1 Occupy Next Station
(D) 2 Measure Traverse Point (optional)
(E) 3 Measure Sideshot Point
move ... and so on
(F) 4 Close Traverse




SHIFT ● QUIT ● F8 To quit the Program at any time.

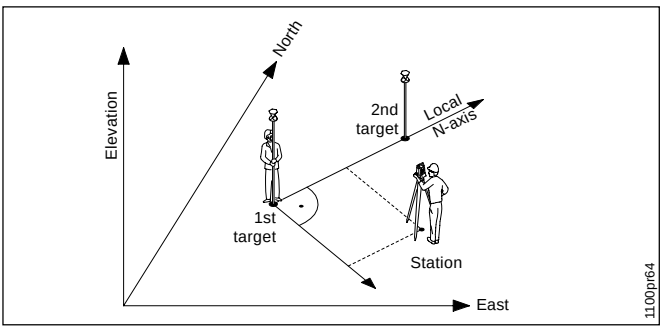
# Local Resection

## Basic Procedure

Local Resection is a resection in a local coordinate system.

The station coordinates and the Hz-circle orientation at the station are calculated in the local coordinate system from measurements to two points, where:

- the first point measured forms the centre of the local coordinate system.
- the second point measured determines the direction of the positive N-axis.




***Known:***

*Local Coordinates of 1st target:*

- $E_{Local} = 0$, $N_{Local} = 0$
- $Elevation_{Local} = 0$

*Direction of the local N-axis, given by the 2nd target point.*

***Unknown:***

*Station local coordinates:*

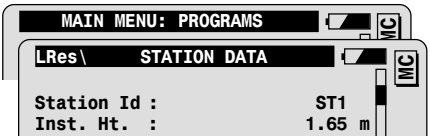
- *Stn.* $E_{Local}$ *, Stn.* $N_{Local}$
- *Stn.* $Elev._{Local}$ *(optional)*

*Orientation in local system*

## *Local Resection*

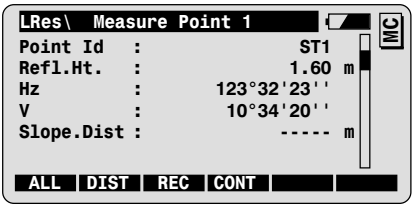
Start Local Resection from the program menu.

PROG




Enter the station Id and the instrument height.

CONT F1




Enter Point Id and reflector height at the first target point.

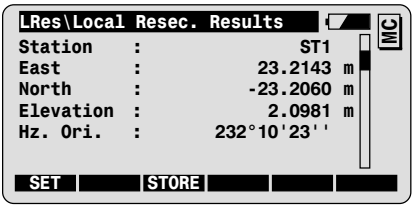
Note that the first target point defines the centre of the local system.

ALL F1

To measure and record first target point. (See chapter *"Measurement options"*)

Repeat sequence for the second target point. This will define the direction of the local N-axis.

Dialog for the Local Resection results.



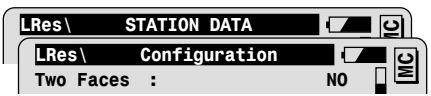

STORE F3 To record the Local Resection results.

SET F1 To set the station local coordinates and orientation, and close the program.

## *Configuration*

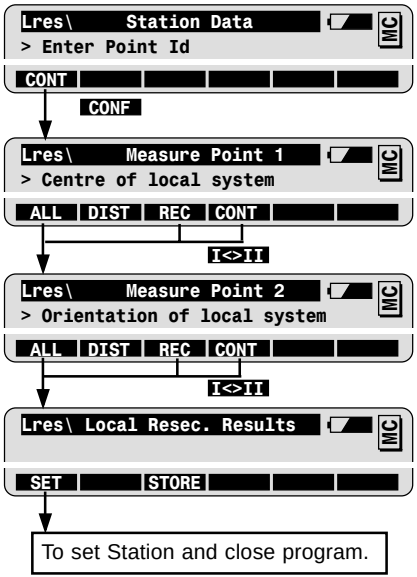
Call the configuration in the first application dialog:

SHIFT CONF F2




| | |
|---|---|
| **Two Faces** | Single or two faces measurement. |
| **Meas. Job** | Selection of the job for recording measurements. |
| **Data Job** | Selection of the job containing the fix point coordinates. |

## Program Flow




SHIFT ● CONF ● F2 — Configuration can only be accessed in this first dialog.

STORE ● F3

| | |
|---|---|
| Station Point Number | WI 11 |
| Orientation correction | WI 25 |
| Station coordinates | WI 84-86 |
| Last used reflector Ht | WI 87 |
| Instrument Height | WI 88 |

SHIFT ● QUIT ● F6 — To quit the Program at any time.

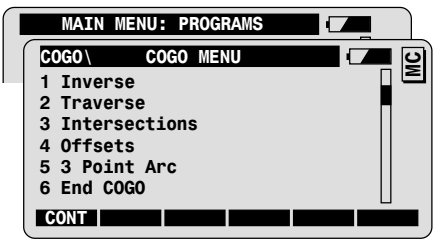
Program for **Co**ordinate **G**e**o**metry calculations.

**Before starting COGO:**
The station must be set up and oriented.

## COGO Menu

Call COGO from the program menu.

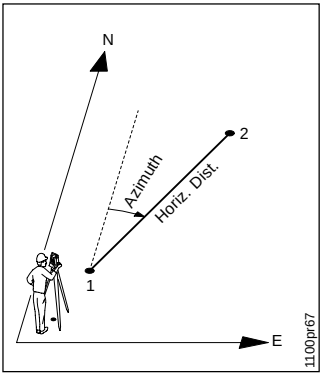
PROG




1 **Inverse** To calculate the azimuth and distance between two known points.

| | | |
|---|---|---|
| 2 | **Traverse** | To calculate coordinates, given the azimuth and the distance from a known point. |
| 3 | **Intersections** | To calculate intersections given<br>- Bearings from two known points.<br>- Distances from two known points.<br>- A bearing and a distance from two known points. |
| 4 | **Offsets** | - To calculate the cross and length offset of a known point in relation to a baseline.<br>- To calculate a point, given the cross and length offsets in relation to a baseline. |
| 5 | **3 Point Arc** | To calculate a radius point given 3 points. |

## Inverse




***Known:***

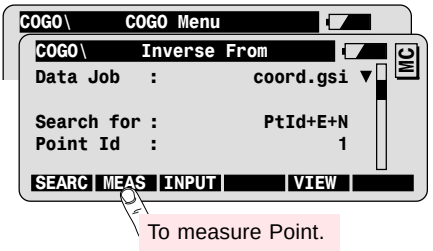
- *Point 1*
- *Point 2*

***Unknown:***

- *Azimuth*
- *Horizontal Distance*

Start the COGO function Inverse from the COGO Menu

1

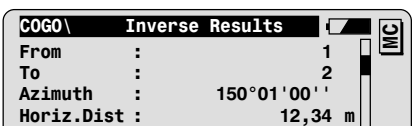



Enter the Point Id of the first point.

SEARC F1 To search and import point from data job.

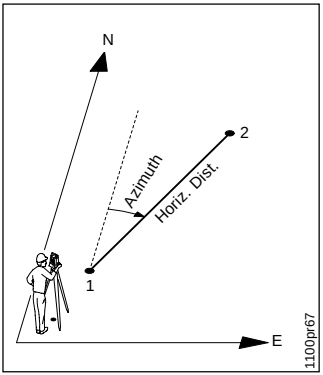
Enter the Point Id of the second point.

SEARC F1 To display the inverse results.




CONT F1 To return to the COGO Menu.

## Traverse



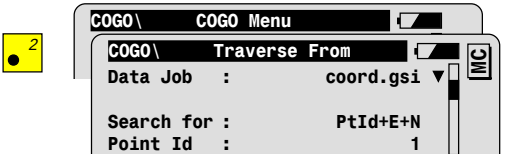

***Known:***

- *Point 1*
- *Azimuth and horizontal distance to point 2*

***Unknown:***

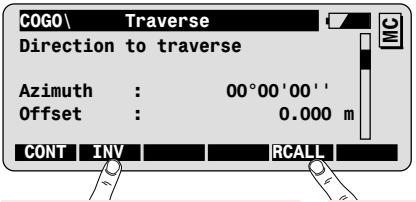
- *Coordinates of point 2*

Start the COGO function Traverse from the COGO Menu




Enter the Point Id of the first point of the traverse.

SEARC F1 To search and import point from data job.



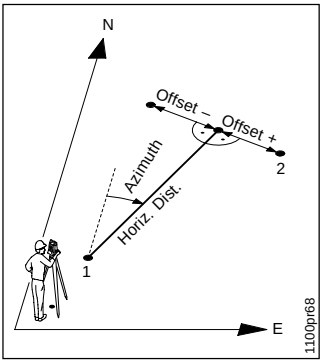

To start the inverse function to determine azimuth.

To recall previously stored azimuths.

Enter Azimuth via numeric keys.

COGO

### *Traverse with parallel offset*




***Offset +*** *to the right of the azimuth direction*

***Offset –*** *to the left of the azimuth direction*

**CONT** F1

```
COGO\      Traverse                MC
Distance to traverse

Horiz.Dist :          45.343 m
Offset     :          12.34 m
```

Enter horizontal distance to the second point of the traverse.

**CONT** F1 To display the traverse results:

```
COGO\      Traverse Results        MC
Point Id   :                 2
East       :           104.215 m
North      :           102.234 m
Elev.      :             -----
CONT | STORE | STAKE
```

**CONT** F1 To return to the COGO Menu.

Enter a Point Id to activate following functions:

**STORE** F3 To record the coordinates of the calculated point.

**STAKE** F5 To stake out the calculated point.

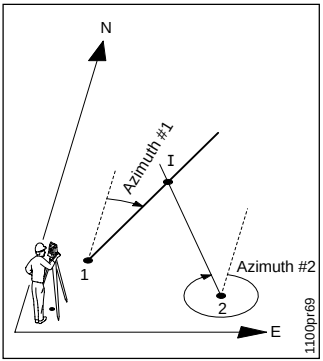
## Intersections

Start Intersections from the COGO menu and choose one of the following three methods to calculate intersections.

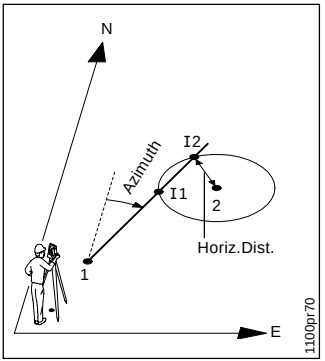
***Known:*** *coordinates of first and second points: #1, #2*

***Unknown:*** *coordinates of intersection point(s)*

*Given: Azimuth #1*
*Azimuth #2*



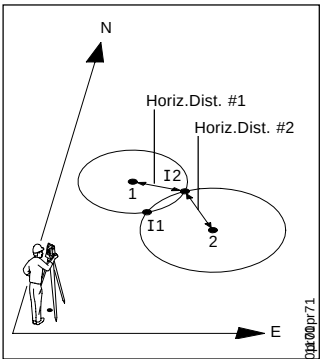

*Given: Azimuth*
*Horiz. Distance*




*1* Bearing-Bearing

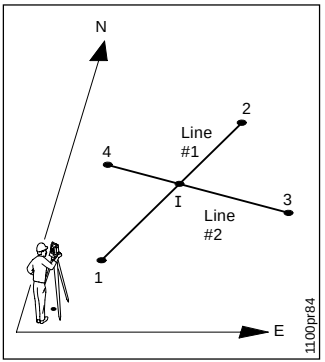
*2* Bearing-Distance

*Given: Horiz. Distance #1*
*Horiz. Distance #2*



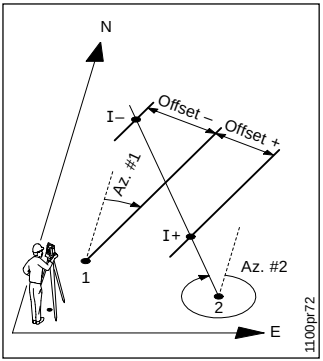

3 Distance-Distance

*Given: Coord. of Pt. #3*
*Coord. of Pt. #4*




4 Intersection by Points

### *Bearing-Bearing*




***Offset +*** *to the right of the azimuth direction*

***Offset –*** *to the left of the azimuth direction*

Start Bearing-Bearing from the intersection menu

1

```
COGO\   1st Bearing From                MC
```

Enter Point Id of first point.

SEARC F1

```
COGO\       Bearing #1                  MC
Direction from 1st point
```

Enter **Azimuth** from first point. A parallel **Offset** #1 to azimuth #1 can be defined.

CONT F1 To define the second point.

SEARC F1 To enter **Azimuth** from second point. A parallel **Offset** #2 to azimuth #2 can be defined.

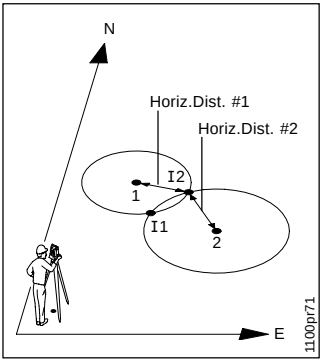
CONT F1 To display the intersection results.

```
COGO\   Brg-Brg Results                 MC
Point Id   :              -----
East       :            100.23 m
North      :            122.45 m
Elev.      :              -----
```

CONT F1 To return to the Intersections Menu.

COGO

### *Distance-Distance*




***Known:***

- *Point 1, Horiz. Dist #1*
- *Point 2, Horiz. Dist #2*

***Unknown:***

- *Coordinates of intersection points: I1, I2*

Start Distance-Distance from the intersection menu

3

```
COGO\   1st Distance From        MC
```

Enter Point Id of first point.

SEARC F1

```
COGO\   Distance-Distance        MC
Distance from 1st point
```

Enter horizontal distance from first point.

CONT F1 — To define the second point.

SEARC F1 — To enter horizontal distance from second point.

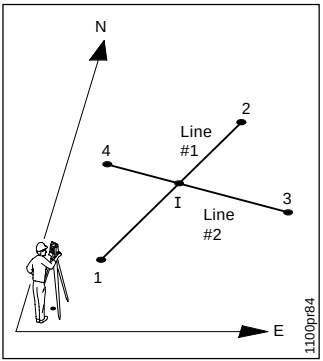
CONT F1 — To display the intersection results.

```
COGO\  Dist-Dist Results         MC
Point Id   :          -----
East       :       100.23 m
North      :       123.45 m
Elev.      :          -----
```

OTHER F2 — To toggle between intersection solution 1 or 2.

CONT F3 — To return to the COGO Menu.

### *Intersection by Points*




***Known:***

- *Point 1, Point 2*
- *Point 3, Point 4*

***Unknown:***

- *Coordinates of intersection pointI*

Start Intersection by Points from Intersections menu.

4

```
COGO\1st Point of 1st Line
```

Enter Point Id of first point of first line.

SEARC F1

To search and import point from data job.

Repeat operation for 2nd point of first line and for 1st and 2nd point of second line.

SEARC F1

To display the intersection results.

```
COGO\Inters by Pnts Results
Point Id   :          -----
East       :         100.23 m
North      :         123.45 m
Elev.      :          -----
```

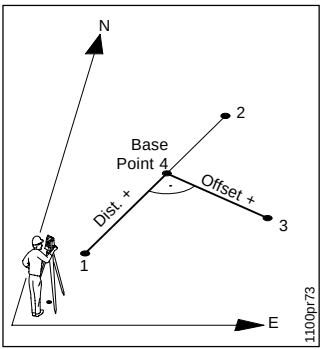
CONT F1

To return to the Intersections menu.

## Offsets

Start Offset from the COGO menu, then Distance--Offset from the Offset Menu.

### Distance-Offset




***Known:***

- *Start point 1*
- *End point 2*
- *Offset Point*

***Unknown:***

- *Line Distance, Offset*
- *Coordinates of Base Point*

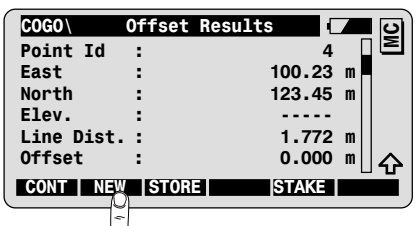
4

1


Enter the start point of the baseline.

SEARC F1 To search and import point from data job.

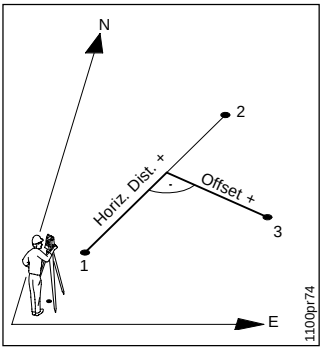
Repeat operation for the end point of the baseline and the offset point.




To enter a new offset point with reference to the previously defined baseline.

CONT F1 To return to the COGO menu.

### *Set point by Dist-Offset*




***Known:***

- *Start point 1*
- *End point 2*
- *Horiz. Dist and Offset to Offset Point*

***Unknown:***

- *Coordinates of Offset Point 3*

Start "Set point by Dist--Offset" from the Offset Menu.

2

```
COGO\      Offsets                    C
COGO\ Baseline Start Pt.              MC
```

Enter the start point #1 of the baseline.

SEARC F1 To search and import point from data job.

Enter the end point #2 of the baseline.

SEARC F1

```
COGO\  Distance from Start            MC
Distance along baseline

Horiz.Dist :              ----- m
```

Enter horizontal distance along the baseline.

CONT F1 To enter perpendicular offset from the baseline.

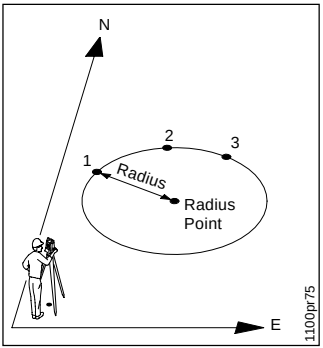
CONT F1 To display the calculated point coordinates.

```
COGO\  New Point coord.               MC
Point Id   :                      3
East       :              100.23 m
North      :              123.45 m
Elev.      :                ----- m
```

CONT F1 To return to the COGO menu

COGO

## 3 Point Arc




***Known:***

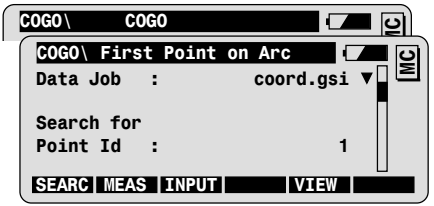
- *Arc Points 1, 2, 3*

***Unknown:***

- *Coordinates of Radius Point*
- *Radius of arc*

Start 3 Point Arc from the COGO Menu.

5

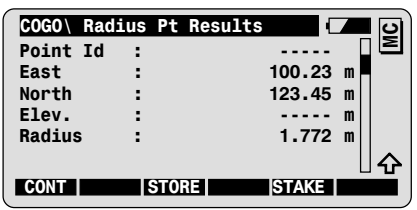



Enter the first point of the arc.

SEARC F1

To search and import point from data job.

Repeat operation for the second and third points of the arc.




CONT F1

To return to the COGO menu.

## Configuration

Call the configuration in the first application dialog.

SHIFT CONF F2


| | |
|---|---|
| **Direc.Type** | Define the type of direction to be displayed within COGO:<br>Choose between **BEARING** and **AZIMUTH**. |
| **Offset = Yes** | To allow the entry of parallel offsets. |
| **Meas job** | Selection of the job for recording measurements. |
| **Data job** | Selection of the job containing the fix point coordinates. |

CONT F1 To exit the configuration dialog.

# Auto Record

## Introduction

Auto Record is especially designed for instruments with ATR.

It is used to automatically record measurement data, based on following recording modes:

- Time mode,
- Distance mode
  and/or
- Stop mode.

You can combine the recording modes and manually record measurement data at any time in these modes.

Auto Record in **Stop** mode is recommended for ordinary detail surveys. As long as the prism is moving Auto Record will not record any measurement data. When the prism stops for a few seconds Auto Record will record measurement data, you may then start toward the next point.

Auto Record in **Time** or **Distance** mode is best for large survey, e.g. for topographic surveys which are not suitable for photogrammetry.

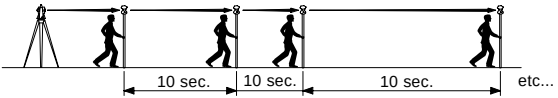
## Basic procedure

**Before starting Auto Record:**
The station must be set up and oriented.

You can select the recording mode in the configuration (see chapter *"Configuration"*).

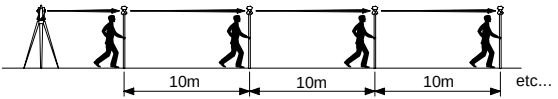
### Time Mode

You set the time between measurements



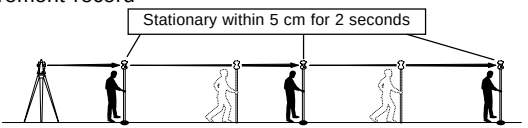

### Distance Mode

You set the distance between measurements



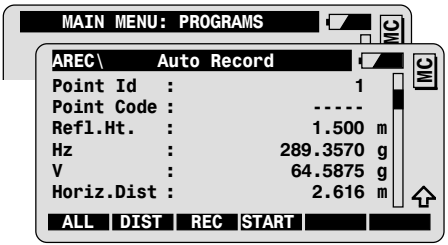

### Stop & Go Mode

You define “how close” for “how long” the prism is stable to trigger a measurement record



Start AutoRec from the program menu.

PROG




Enter Point Id of starting point and reflector height.
Aim at the reflector.

START F4

To start Auto Record: the instrument locks onto the prism and starts the rapid tracking mode. It follows the prism as your move about the survey site.
Measurement data are recorded automatically according to the settings in Configuration.
You may input and record codes as necessary as you capture data.

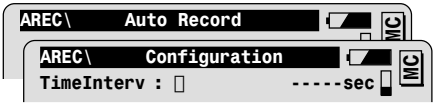
REC F3

To manually record measurement data at any time.

## *Configuration*

Call the configuration in the first application dialog.

SHIFT ● CONF ● F2




TIME ● F3 To switch the **time** mode ON or OFF.

DIST ● F4 To switch the **distance** mode ON or OFF.

ST&GO ● F5 To switch the **Stop & Go** mode ON or OFF.

| | |
|---|---|
| **Time Interv** | Time interval for automatic recording of the measurement data. |
| **Dist.Interv** | Distance interval for automatic recording of the measurement data. |
| **Stop Pos.** | In stability mode: range in which the prism must be held stable during **Stop Time**. |
| **Stop Time** | In stability mode: time interval during which the prism must be held stable within the range **Stop Pos**. |

CONT ● F1 To exit configuration dialog.

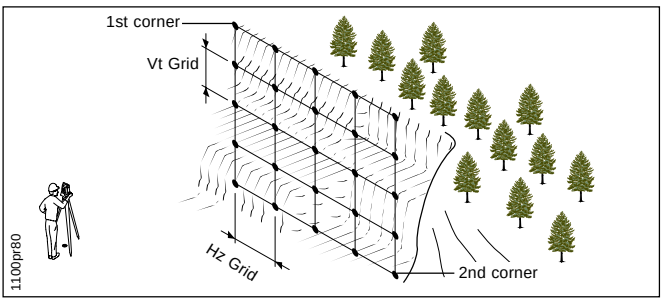
## Introduction

Face Scan automates the process of measuring a sequence of points along a vertical 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 motorized instruments with the option "reflectorless EDM" only.

## Basic Procedure

**Before starting Face Scanning:**
The station must be set up and oriented.

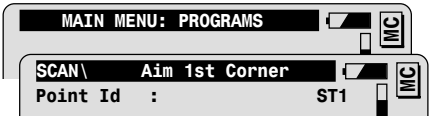



***Known:***
*Window to be scaned*
*Grid parameters:*
- *Hz Grid*
- *Vt Grid*

***Unknown:***
- *Grid Point Coordinates*

Start Face Scan from the program menu.

PROG




### *Window boundaries*

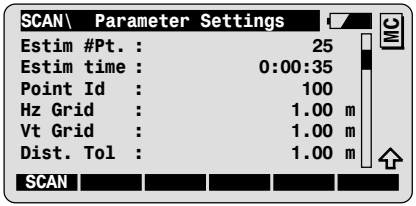
Enter point Id at the first corner of the window to be scaned.

ALL
F1

To measure and record first window corner. (See chapter *"Measurement options"*)

Repeat sequence for the second window corner.

### *Scanning Parameters*

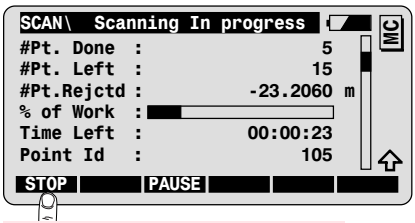



Enter Point Id of the first grid point.
Enter the grid parameters **Hz Grid** and **Vt Grid**.

Enter the distance tolerance (**Dist. Tol**): if the distance difference between measured and previous points exceeds the tolerance, the measured point will be rejected.

**SCAN** / **F1**

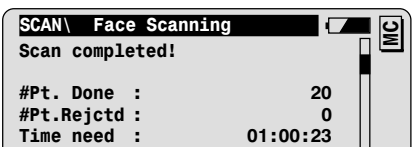
To start the face scanning and display information on the scanning process.




To interrupt the scanning process

***End of Scan***

Following dialog is displayed at the end of the scanning process.




*SHIFT* / **QUIT** / **F6**

To quit the program.

## *Configuration*

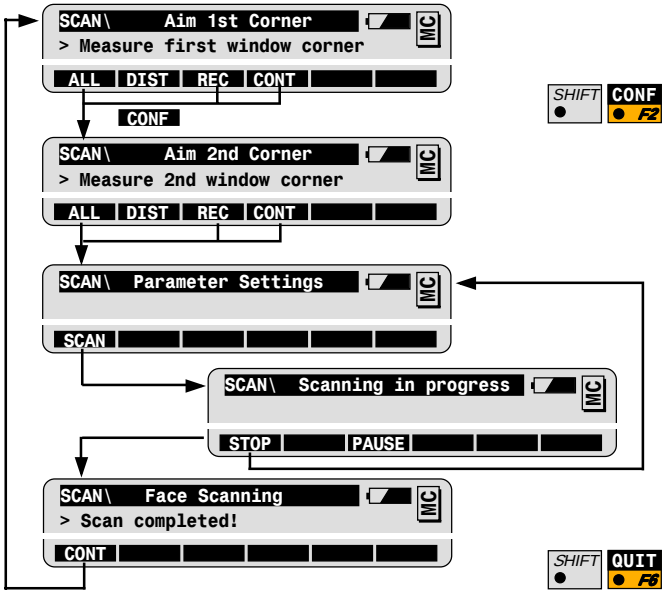
Configuration can only be accessed in this first dialog.

SHIFT CONF F2


| | |
|---|---|
| **Red Laser** | To activate the laser pointer. |
| **Log File** | Creation of a logfile. |
| **Log FlName** | User definable name for the logfile. |
| **Meas. Job** | Selection of the job for recording measurements. |
| **Data Job** | Selection of the job containing the fix point coordinates. |

CONT F1 To exit the configuration dialog.

## *Program Flow*




SHIFT + CONF (F2) — Configuration can only be accessed in this first dialog.

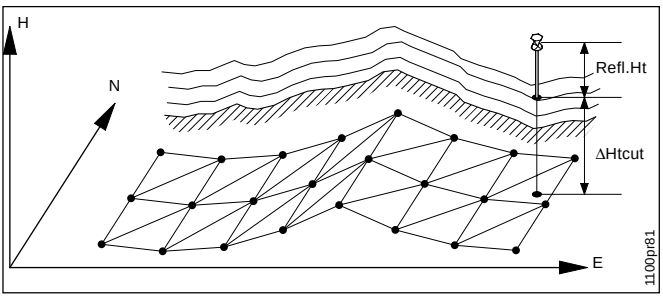
SHIFT + QUIT (F6) — To quit the Program at any time.

## Introduction

This program compares a field measurement against a stored Digital Terrain Model to calculate and display the Cut or Fill between the existing ground and the DTM.

DTM Stakeout may be used for staking out where the DTM represents the surface to be staked out. It may also be used for quality control purposes where the DTM represents the final project surface.

**Before starting DTM Stakeout:**
The station must be set up and oriented.

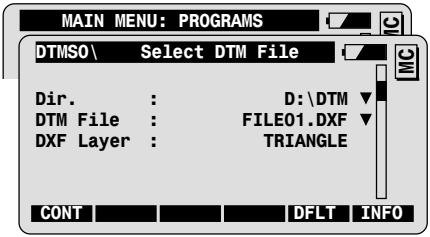



***Known:***
*DTM file*

***Unknown:***
*Cut of fill from any measurement to the surface of the DTM.*

Start DTM Stakeout from the program menu.

PROG



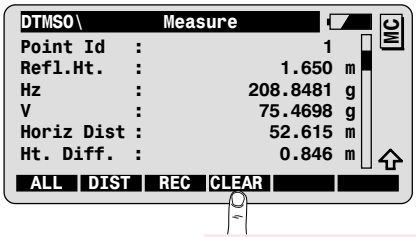

Select the filename for the DTM. The file must be in the "\DTM" directory on the PC Card.
If the file is a .DXF file, enter the DXF layer name for the DTM.

CONT F1

To continue to the Measure dialog.

DTM Stakeout will automatically check the validity of the file.

DIST F2 To measure a point and view results.




Enter the point Id and the reflector height of the target point.

DIST F2 To measure a distance and calculate the cut/fill values.

Scroll to the bottom of the dialog to view the cut/fill values.

ALL F1 To measure and record the cut/fill values and the coordinates of the target point. (See chapter *"Measurement options"*)

SHIFT QUIT F6 To quit the program.

# Reference Plane

## Introduction

Reference Plane is used to measure points in reference to a defined plane.

The plane is defined by 2-10 points. Two points define a vertical plane. If more than 3 points are used a least squares adjustment is calculated.

Points are calculated by intersection of the line of sight with the determined plane. The coordinates are updated with telescope movement. If a distance is measured to a point, the deviation of this point from the plane is also displayed.

The plane can be determined in the instrument coordinate system or a local coordinate system can be set by entering local coordinates for the first point. All measured points are calculated in the selected system.

## Basic Procedure

The first step is to define the plane using 2-10 points. The coordinate system is selected in the Main Menu.

**Before starting Reference Plane:**
If *Instrument Coordinates* are used, the station must be setup and oriented.

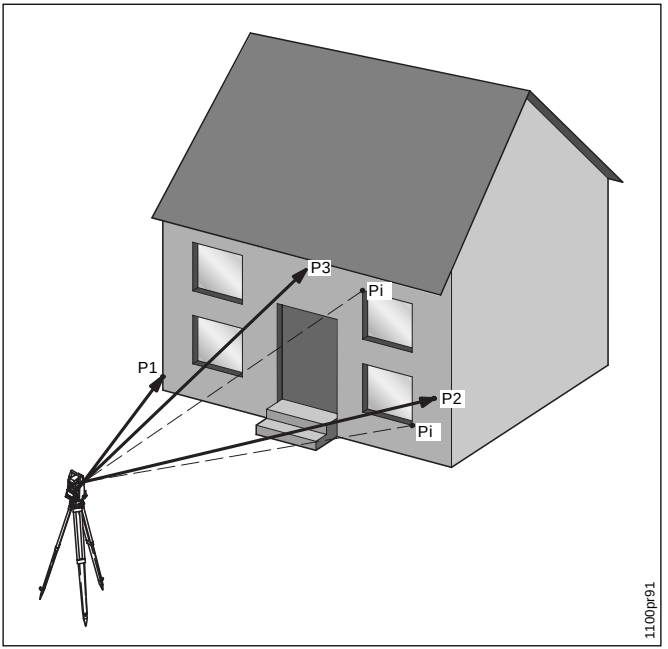
## *Coordinate System*

### 1 Local Coordinates

A "local" system is defined independent of the current instrument orientation by entering local coordinates for the first measured point.

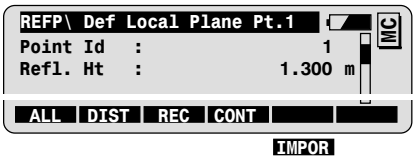
### 2 Instrument Coordinates

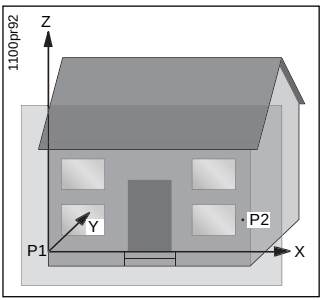
Points on the plane have instrument coordinates.



## Local System

1 Start Local Plane from the Reference Plane Menu




*A vertical plane is defined by 2 points. The X-axis goes through P1 and to the right (as seen from the station). It is horizontal.*

Enter Point Id and reflector height of the first plane definition point.

**ALL** F1 To measure and record the first point.

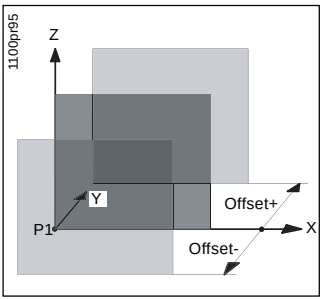
or

SHIFT **IMPOR** F5 To import point coordinates from a data file.

Repeat operation for up to 10 points to define plane.

**CALC** F6 To calculate the plane.
Calculation is possible after two points are input. Two points define a vertical plane, ≥ 4 points results in an adjustment.

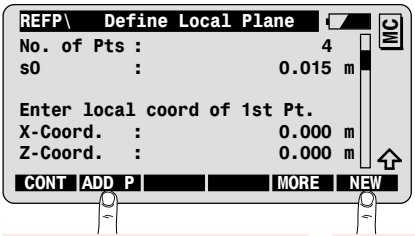
## *Define Plane*




***Offset +*** *in direction of the positive Y-axis (normal vector).*

***Offset –*** *in direction of the negative Y-axis (normal vector).*

Define and edit plane parameters. Display standard deviation.

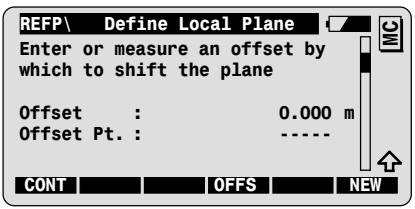



To measure additional points.

To define new plane.

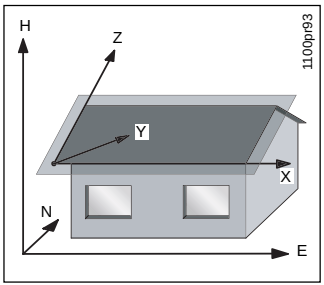
Coordinates of projection of first measured point onto plane. Determines the local coordinate system.

**CONT** F1




**OFFS** F4 To measure point to shift plane through.

### *Measure on plane*




*A tilted plane is defined by 3 or more points. The Z-axis is determined by the steepest grade, the Y-axis is the normal vector. X is perpendicular to both and horizontal.*

X and Z-coordinates change with telescope movement. If distances are measured, Y-coordinates and Δd (=distance from plane) change as well.

CONT F1

```
REFP\    Reference Plane                MC
Point Id   :                      5
Refl. Ht   :              0.000 m
X-Coord.   :              2.001 m
Y-Coord.   :              0.000 m
Z-Coord.   :              1.521 m
Δd         :              ----- m
 ALL | DIST | REC | CONT |      | DEF
```

**ALL** F1 To measure distance and record point. Deviation from plane is recorded.

**REC** F3 To record point on plane.

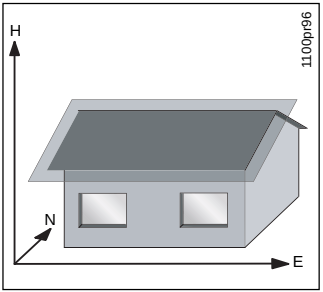
**The GSI file always stores system values. Turn Logfile ON to store local coordinates *(see Configuration).***

**DEF** F6 Return to Offset dialog.

SHIFT **QUIT** F6 To quit the Reference Plane program.

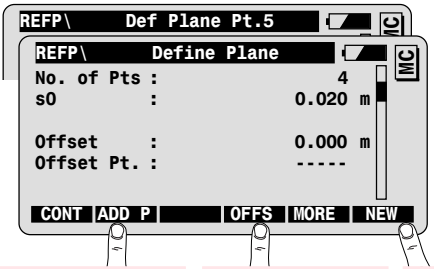
## *Instrument System*

In an Instrument system plane-coordinates are instrument coordinates. Point measurement is identical to Local System.




*In Instrument system the plane lies within the instruments coordinate system and orientation.*

**CALC** F6




To measure additional points.

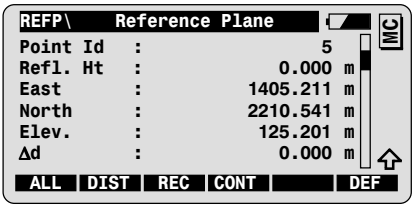
To measure offset point.

To define new plane.

**CONT** F1 To confirm settings and go measure points on plane.

### *Measure on plane*

All coordinates are updated with telescope movement. If a distance is measured, Δd is calculated.




**ALL** (F1) To measure distance and record point. Deviation from plane is recorded.

**REC** (F3) To record point on plane.

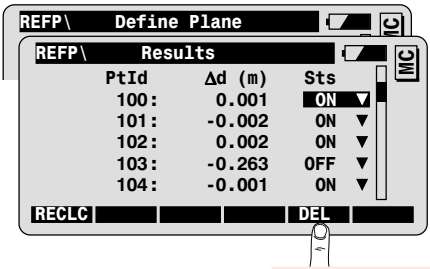
**DEF** (F6) Return to Define Plane dialog.

SHIFT **QUIT** (F6) To quit the Reference Plane program.

## *Advanced Feature: Result Analysis*

Call the result analysis dialog from the plane definition dialog to view the deviation of each point from the calculated plane.

MORE F5




Change the point status:

| | |
|---|---|
| **ON** | Point is included in the plane calculation. |
| **OFF** | Point is **not** included in plane calculation. |

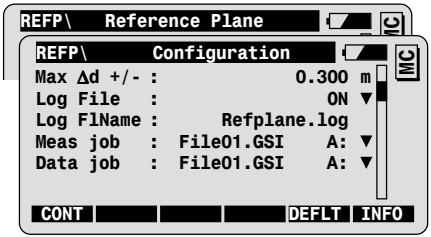
RECLC F1 To recalculate the plane with the new settings.

ESC To go back to Define Plane dialog without saving changes.

## Configuration

SHIFT CONF F2

Call the configuration from the first application dialog.



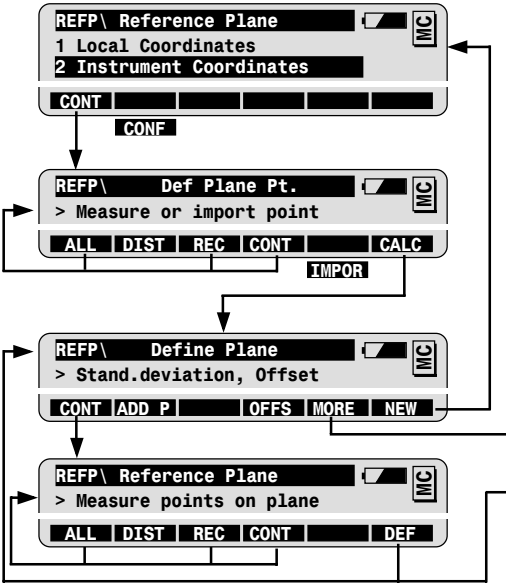

| | |
|---|---|
| **Max Δd** | Maximum allowed perpendicular deviation of plane definition point from calculated plane. |
| **Log File** | Create a Logfile. |

Should always be **ON** for Local systems since GSI file only stores system values.

| | |
|---|---|
| **Log FlName** | User definable Logfile name. |
| **Meas job** | Selected job to record data to. |
| **Data job** | Selected job containing fixpoint coordinates. |

CONT F1 Confirm settings and exit the Configuration dialog.

## *Program Flow*




SHIFT ● CONF ● F2 — Configuration can only be accessed in this dialog.

CALC ● F6 — Start calculations. Available after 2 points have been measured.

OFFS ● F4 — To measure an offset point.

SHIFT ● QUIT ● F6 — To quit program anytime.

***Leica Geosystems AG, Heerbrugg, Switzerland has been certified as being equipped with a quality system which meets the International Standards of Quality Management and Quality Systems (ISO standard 9001) and Environmental Management Systems (ISO standard 14001).***


***Total Quality Management - Our commitment to total customer satisfaction***

*Ask your local Leica Geosystems agent for more information about our TQM program.*

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Original text

Leica Geosystems

*Leica Geosystems AG*
*CH-9435 Heerbrugg*
*(Switzerland)*
*Phone +41 71 727 31 31*
*Fax +41 71 727 46 73*
*www.leica-geosystems.com*