Trimble 3600 Zeiss Elta

Special & Professional Software User Guide

Part no.: 571 703 021

This manual is the second part of the Trimble 3600 Zeiss Elta user manual. It includes the description of the application programs of the software packages *Special* and *Professional*.

We would like to wish you every success in your work with your Trimble 3600. If you need any help, we will be glad to be of assistance.

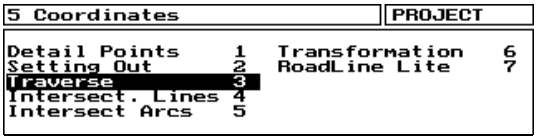
Yours

ZSP Geodetic Systems GmbH
Carl-Zeiss-Promenade 10
D-07745 Jena
Tel.: + +49 3641 64-3200
Fax: + +49 3641 64 3229
E-Mail: surveying@zspjena.de
http://www.trimble.com

User Manual	**Trimble 3600 Zeiss Eltas 2nd Part**
Software Packages ***Special*** and ***Professional***	
Edition 1:	**15.02.2001**
Act. Software Release:	**V1.40**
Cat. No.:	**571 703 021**

4 Coordinates

8 Configuration Programs



The programs *Traverse*, *Intersections of Lines and Arcs, Transformation* and *Roadline Lite* are implemented in the instrument software packages *Special* and *Professional*. These programs are useful tools for the daily surveyors practical work in the field.

Traverse

Intersections of Lines

Intersections of Arcs

Transformation

Roadline Lite

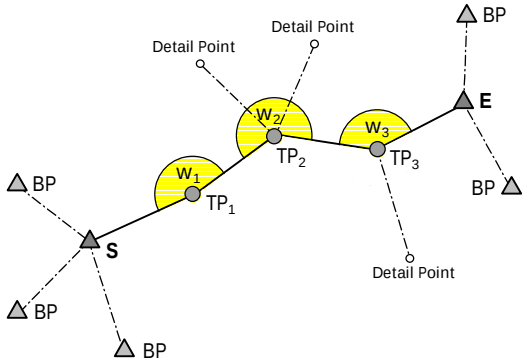
Detail Points

Coordinates 5

Traverse 3

Measurement of a Traverse through back and foresights, and computation with a choice of adjustments. During the Traverse measurement it is possible to measure detail points (side shots) which can also be corrected at the adjustment stage.

```
5 Coordinates                    TRAVERSE
Detail Points      1   Transformation    6
Setting Out        2   RoadLine Lite     7
Traverse           3
Intersect. Lines   4
Intersect Arcs     5
```



✍ $1 \leq TP_i \leq 20$

It is possible to measure from a start point S, up to a maximum of 20 Traverse Points TP and close on an end point E. The Stationing at S or E can incorporate up to 20 backsight points BP.

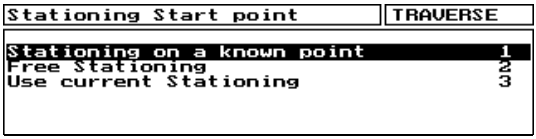
New Traverse

After program start, the computer searches for a current Traverse. If no traverse is found then a new traverse is initialised and the first step is to input the actual instrument height and the first backsight target height (other parameters can also be controlled at this point):

```
Input of Parameters
Inst.  :  1.555 m   Temp.  :   20 °C
Refl.  :  1.655 m   Press  : 1013 hPa
R.Typ  : Normal
Add.C  :  0.000 m   PrismC:   35 mm
Scale  : 1.000000   ppm    :    0
```

↵ to confirm and record the parameter input.

One can then choose the method of Stationing (coordinate and orientation) of the Start Point:



📖 **Stationing**

The methods for Stationing on a known point and Free Stationing are described in the *Stationing* chapter.

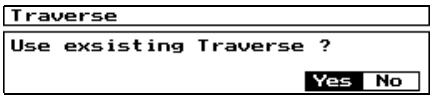
If there is no Height Stationing then the traverse will be computed without heights and the height softkey will show **Zoff** .

📖 Measure Traverse

After Stationing, the traverse will begin with the measurement of the foresight to the first Traverse Point TP_1.

Continue Traverse

If after the program start an unfinished Traverse is found, then the program will ask if you wish to continue the existing traverse:

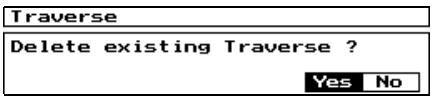


📖 Measure Traverse

📖 Finish Traverse

Yes To go further with continuing the exisiting unfinished traverse ,

No Then the unfinished traverse will be deleted after confirmation:



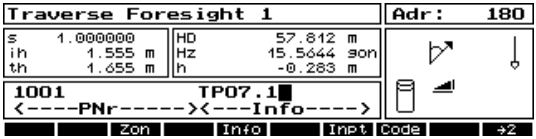
🕮 New Traverse

Yes the Traverse will be deleted, and cannot be continued at a later date. However, The measure data will remain in the Project file. A new traverse will be initialised.

No The unfinished traverse will not be deleted. Return to *Coordinates* Menu.

Measure Traverse

After Stationing on the Start Point S the traverse will continue via the foresight measurement to the first Traverse point TP :

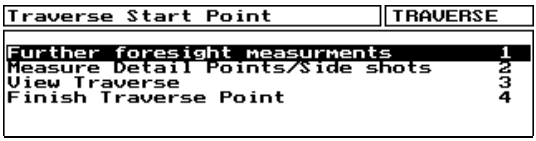


to input the reflector height (also possible via the **Inpt** softkey.

or ⊙ to measure the foresighto TP_1.

After the measurement comes the Traverse Menu:

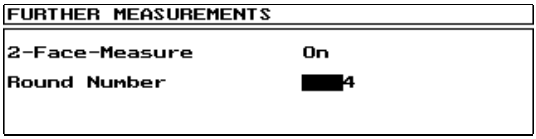
Station Menu Start Point



Further foresight measurem. 1

Measuring further points to the traverse point TP.

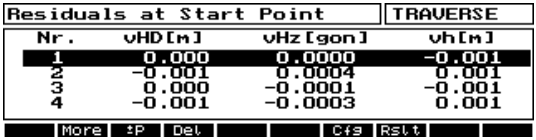
Further measurements can be chosen. 2 face measurement is also possible.



select On / Off.

↵ or ◉ to start further measurements.

After measurement, the residuals to the mean measurement will be displayed:



More Futher Measurement

± P Point on/off

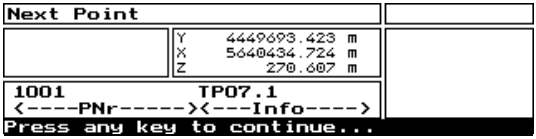
Del Delete Measurement

Cfg Configuration

By select more measurement with the softkey **More** then the round count will be reset to 1.

By more measurements of the fore and backsights of Traverse points it is possible to achieve an improved accuracy of the Traverse points.

Rslt Result of the coordinate of the foresight-TP (Interim Result).



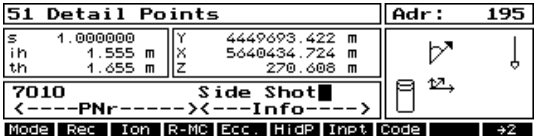
This is the interim coordinate result as calculated from the FS measurement. The end result is only possible after a BS measurement to this point (and any required adjustment at closing).

↵ or Esc to go back to the TP menu.

Measure Detail Points 2

To measure detail points (side shots) for the station point.

📖 **Coordinates**
Detail Points



Handling/functionality as by *Detail points*.

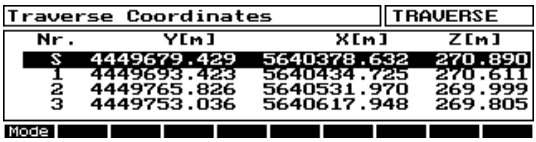
↵ or ◉ to measure a detail point.

Detail points can be later adjusted like the traverse points TP_i. Detail Points measured on start point S or on traverse end point E will not be adjusted.

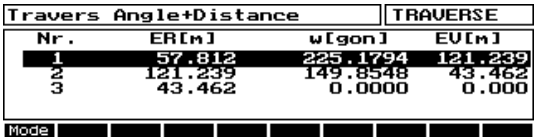
View Traverse 3

Display of the traverse up to this point.

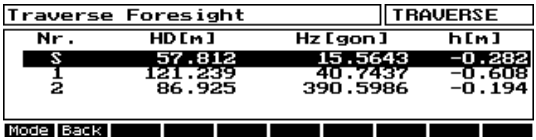
Mode Toggle the results



Display of the TP coordinates.



ER Horizontal distance of backsight in [m]
EV Horizontal distance of foresight in [m]
w internal angle in [gon]

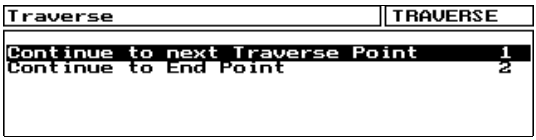


Fore / **Back** Toggles between foresight and backsight

HD Horizontal distance - mean value in [m]
Hz Hz - mean value in [gon]
h Height difference - mean value in [m]

Finish Traverse Point 4

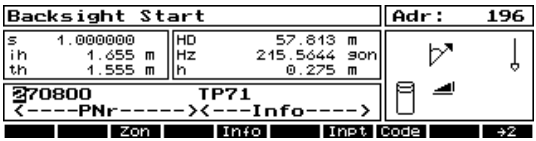
Change the traverse point, with selection of next TP or the End Point EP.



Choose 1: The next Station Point is a TP.

Choose 2: The next Station Point is the End Point E.

After moving the instrument the program goes further with the backsight to the Start Point:



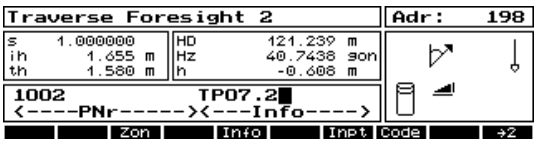
It is normal practice to swap the instrument and target by unclamping the tribrachs. The instrument height and target height of the backsight measurement will be automatically set.

or **Inpt** to change any of these values if necessary.

or ⊙ to measure the backsight to the previous station (in this example it is the Start Point).

After the backsight measurement it is necessary to measure the foresight to the next TP:

> **Attention !**
>
> Do not forget to input the reflector height of the foresight measurement!

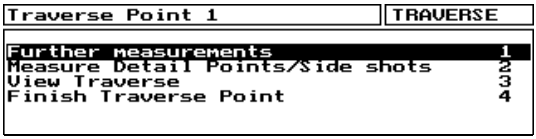


to input the reflectorheight of the foresight.

or ⊙ to measure the foresight.

Afterwards he Traverse Point menu will be displayed for TP_1:

Traverse Point menu



It is possible to finish the Traverse Point here. Although further (additional) measurements are possible for foresight and bachsight measurement as well as detail point (side shots).

To finish the traverse point and continue to the next, the station point needs to be changed. At this stage it is possible to exit the traverse program - this will allow the instrument to be turned off.

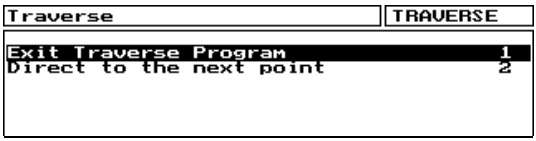
Esc to leave the program or

4 next station point

You must then confirm that the current Traverse Point and foresight coordinates are to be stored and used for the next Station Point.

No The TP will not be stored as a station and the program will return to the Traverse Point Menu for further measurement.

Yes The TP will be stored. Further with:



At this point it is possible to exit the Traverse

Esc is possible in every menu.

To this menu you will come from every menu in the program by pressing **Esc**.

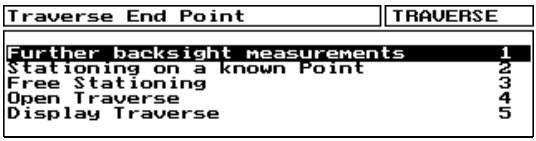
The continuation of the traverse is possible immediately or at a later time. It is possible to turn off the instrument, and restart at a later time. After a new start the instrument program will return to this point.

End Traverse

Continue to End Point 2

To choose the next station point as the End Point of the traverse. After the backsight measurement to the previous TP comes the End Point Menu:

Station Menu End Point



Esc to exit this menu and to save the selected „End Point“ as a normal Traverse Point. Then the program goes on with „Exit Traverse“ or „Direct to the next point“ to continue traverse measurement.

Further backsight measure. 1

At the End Point E of the traverse it is possible to make further backsight measurement (no foresight measurements are possible).

Open Traverse 4

It is possible to finish the traverse without closing on a point of known coordinates and directions.

Stat. on a known Point 2

By stationing on a known point it is possible to accidentally select the interim result of the end point as the known point from the project data, thus providing a false adjustment.

In order to correctly control and adjust the traverse, it is necessary to close on a known coordinate and direction either by stationing on a known point or by free stationing. You need to confirm the continuation of the end point by:

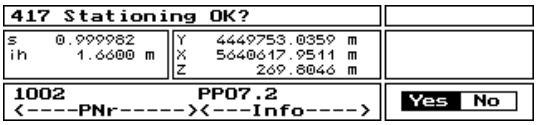
Free Stationing 3

No E will not be stored as the end point, and the program will not go back to the End point Station Menu.

Yes E will be saved as a station, ready to control the traverse on the final Stationing action as selected above.

📖 **Stationing**

Result of the Stationing



After the Stationing, the program will go to the *End Traverse* menu:

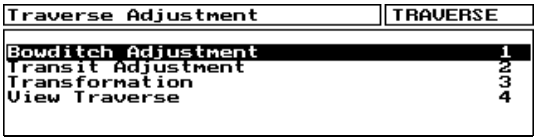
📖 Measure Traverse

Polar Detail Points can be measured here, as at other traverse points.

Traverse Adjustment

Adjustment of Traverse 3

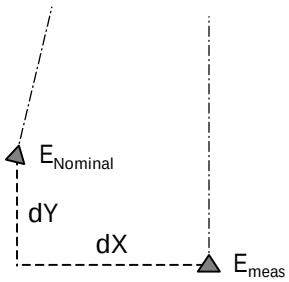
The adjustment can be done with either the classic Bowditch (distance) adjustment, the Transit (proportional coordinate) adjustment or via a Transformation.



 to select.

Attention !

It is only possible to *Adjust Traverse* when a proper Stationing has been carried out on the end point E.



By Stationing on the End Point E a nominal coordinate and direction $E_{Nominal}$ will be computed. Comparison with the measured End point E_{meas} will show angle direction and coordinate closing errors, which can be distributed over the traverse.

Before calculating a Bowditch or Transit adjustment it is possible to distribute the angle misclosure:

No No distribution of angle misclosure

Yes The angle misclosure will be evenly distributed.

The adjustment is carried out in the following order:

1. Distribution of angle misclosure (or not).
2. Computation of new coordinate closing error.
3. Adjustment of the new coordinate closing error.

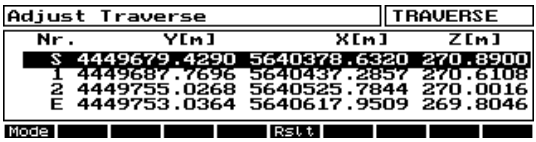
Bowdich Adjustment 1

With the Bowditch adjustment, the adjustment of the coordinate closing error will be made in proportion to the measured distances with:

$$vX_i = \frac{dX_{clos.error}}{\sum s} * s_i$$

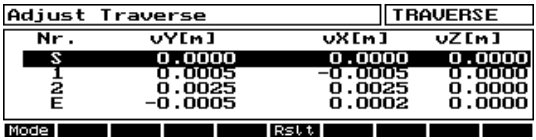
$$vY_i = \frac{dY_{clos.error}}{\sum s} * s_i$$

$$vZ_i = \frac{dZ_{clos.error}}{\sum s} * s_i$$



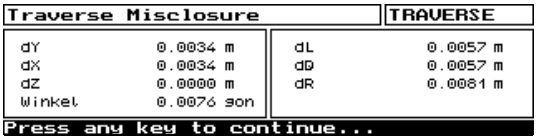
Display of the adjusted coordinates.

Mode Toggle between the results



Display of the coordinate adjustments vX_i, vY_i, vZ_i.

Rslt To display the misclosure errors



Esc in the adjustment menu to finish and store the results:

No the adjustments will not be saved. Back to the End Point menu,

Yes Save the adjusted traverse coordinates, followed by the question:

The adjusted coordinates will be stored in the next available address lines in the project data.

Yes The adjustment will also be applied to the measured polar detail points (side shots).

No Detail points will remain with the measured coordinates.

Transit Adjustment 2

The Transit adjustment computes the adjustment of the coordinate closing error poportionally to the sum of the absolute coordinate differences:

$$vX_i = \frac{dX_{clos.error}}{\sum|\Delta X|} * |\Delta X_i|$$

$$vY_i = \frac{dY_{clos.error}}{\sum|\Delta Y|} * |\Delta Y_i|$$

The height coordinates will be computed in proportion to the measured distances.

Transformation 3

🕮 Transformation

Another possible alternative adjustment is the transformation of the polygon traverse. The transformation will be computed via the Start and End points (S and E):

System A: S and E_{meas}

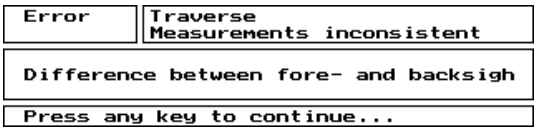
System B: S and $E_{Nominal}$

☝ Attention !

Correction of the angle misclosure is not possible with the transformation method. No transformation is possible if the start and End point are the same (S ≡ E)

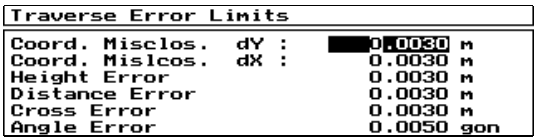
Error Messages

If there is an inconsistency in fore and backsights between following station points then:



Cfg Softkey Link Configuration Traverse

📖 **Configuration**
Programs
Coordinates
Traverse



If configured error limits are exceede, then suitable error information is given.

Important Notes

The current traverse is handled on the internal drive. This means that it is not possible to work on two traverses at the same time in two projects.

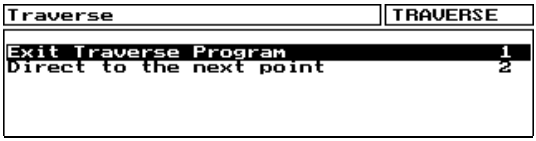
☞ Tip

If the project file is not available anymore, the results from the last measured traverse can restored.

Battery Change

If the message comes from the instrument „Battery low – please change“, the traverse measurement must be interrupted for this time.

Esc in every program level



Choose „Exit Traverse“ for changing the battery. Starting the traverse program again it is possible to continue on this point.

Achtung !

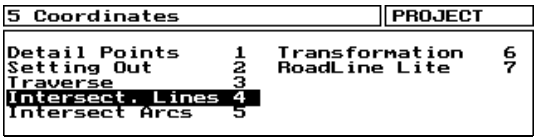
If the program was not executed correctly for changing the battery, there is no way to continue on this point.

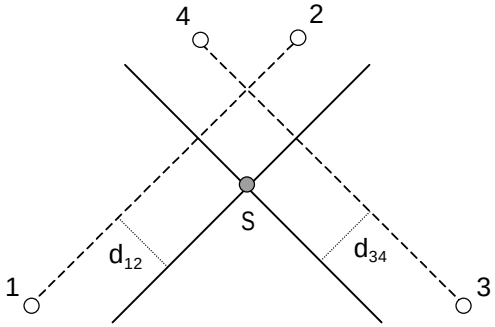
For instruments with a battery buffer there´s no need to exit the program. Nevertheless the Battery should be changed quickly.

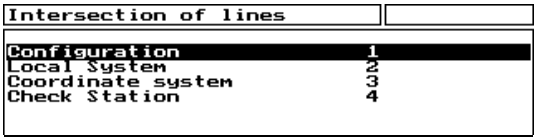
Coordinates 5

Intersect. Lines 4

Calculation of the intersection of two lines in diverse combinations. The defining points can be measured, recalled points or manual input. The Intersection point S can also be set out.





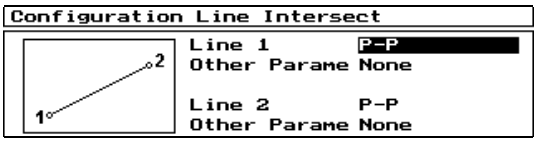


The first step is to configure the method to define the two intersecting lines. The intersections can then be calculated in a local or a coordinate system.

Line Configuration

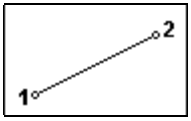
Configuration 1

Here, different methods can be used to define the two lines.



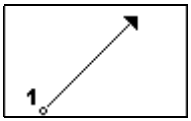
 to toggle the choices.

 confirm the selected options.



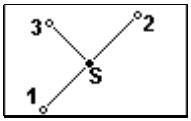
PP

Point-Point



PD

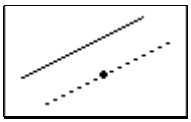
Point-Direction



PL

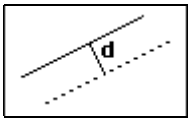
Perpendicular Point

Line Element	**defined through**
Line L1	**Point – Point** **Point – Directon**
Other parameters	**None** **Parallel through point** **Parallel with offset** **Perpendicular through point**
Line L2	**Point – Point** **Point – Direction** **Perpendicular Point**
Other parameters	**None** **Parallel through Point** **Parallel through Offset**



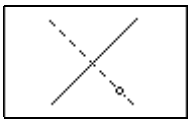
PaP

Parallel through Point



PaA

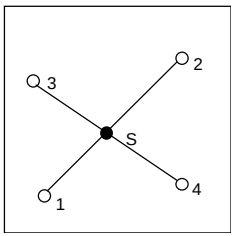
Parallel with offset



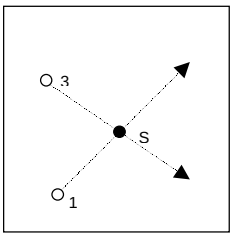
SeP

Perpendicular through Point

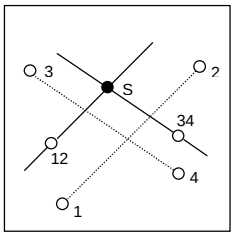
Here are 4 common examples of the various configuration possiblilities:



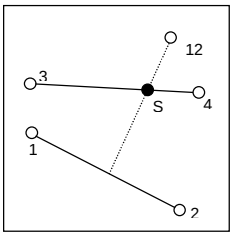
PP (-) x PP (-)



PD (-) x PD (-)



PP (PaP) x PP (PaP)

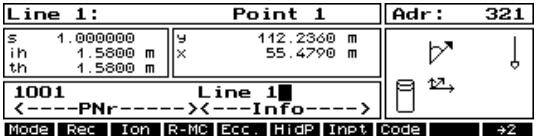


PP (SeP) x PP (-)

Measuring in a Local System

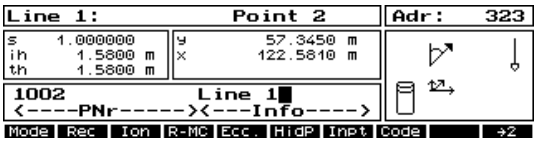
Local System **2**

All line points will be defined by measuring in a local system



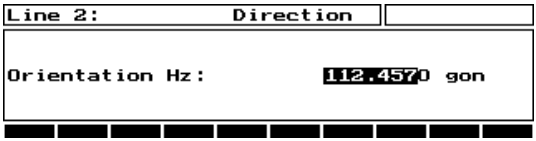
or to measure point P_1.

Mode Toggle the measure mode DHzV / y x z



or to measure point P_2.

If the method of definition is point and direction then after the measurement the direction can be input:



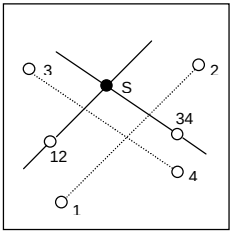
to confirm the input.

📖 **Measure in a local System**

☞ Tip

It is possible to set the horizontal angle direction of the instrument before measurement of the first point.

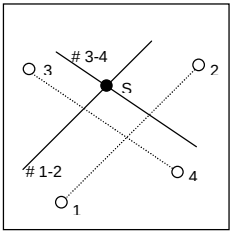
After definition of the line, other parameters (that have been selected) must be defined.



Parallel 1		Point 12		Adr: 333
s 1.000000 ih 1.5800 m th 1.5800 m		y 4.3243 m x 55.2345 m		
1007 Parallel Pnt <----PNr-----><---Info---->				
Mode	Rec	Ion	R-MC	Ecc.	HidP	Inpt	Code		>2

e.g. Parallel through Point (PaP).

to measure point 12 (or 34).

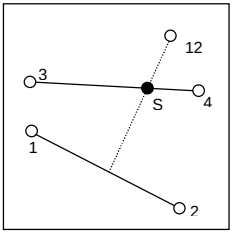


Parallel 1: Offset	
Offset: 2.5000 m Posit.: left	

e.g. Parallel through Offset (PaA). The position of the offset is defined by looking from point P1 at point p2.

to toggle a position left or right.

to confirm the input.



Perpendic. 1		Point 12		Adr: 341
s 1.000000 ih 1.5800 m th 1.5800 m		y 112.0000 m x 49.0000 m		
1011 Senkrechte 12 <----PNr-----><---Info---->				
Mode	Rec	Ion	R-MC	Ecc.	HidP	Inpt	Code		>2

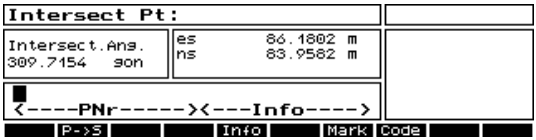
e.g. perpendicular through point (SeP).

to measure the point P12 (or 34).

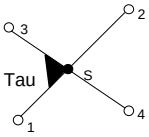
The definition of Line 2 is with the same method as Line 1.

In the case of a Perpendicular Point then the measurement of point 3 will follow.

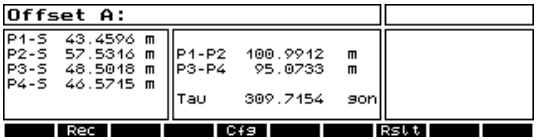
After definition of the lines, the intersection point will be calculated and displayed:



If the intersection angle is too acute or there is no intersection, then an error message will be displayed.



P→S Display of the offset distances between intersection point and the line points



Rec Recording of the offset distances,

Cfg Configuration of the intersection angles,

Rslt Back to the display of the Intersection point.

Tau Intersection angle of the lines.

 to record the intersection point.

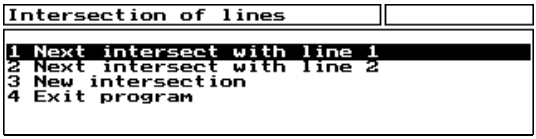
📖 **Configuration**
Programmes
Coordinates

☞ Tip

If the intersection falls outside of the lines, then the length of the line will be displayed.

If the value of the intersection angle Tau is under the selected value, then the value will be displayed with * values.

After finishing the intersection calculation, the following menu will appear:



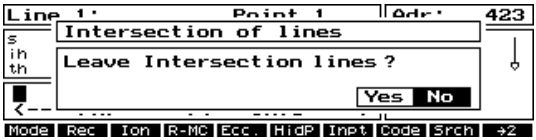
Choose 1 New intersection by redifining line 2.

Choose 2 New intersection by redefining line 1.

Choose 3 New intersection by redefining line 1 and 2.

Choose 4 Leave the program

Esc in exit the program in any measurement menu:



No remain at the same point in the program,

Yes leave the program

Measuring in a Coordinate System

Coordinate system 3

Before working in a coordinate system it is necessary to have a current stationing.

```
Intersection in Coordinate System

Use current stationing        1
New Stationing                2
```

The majority of the program is identical to that of the local system. The following sections outline the differences.

Choosing option 1 will leave the program in the current stationing definition and coordinate system.

Definition of Lines

Points of definition can be given in various ways:

- Measurement of the Line point (as in Local)
- Recall of the point using **Edit**
- Combination of measure and recall
- Manual input with **Inpt**

Edit Recall the point from the editor

Inpt Input the point

```
Line 1:          Point 1          PROJECT

    14 3000          Standpunkt
    19 3000          Standpunkt
    23 4001          Geradenpunkt1
    25 4002          Geradenpunkt2
    27 2002          System B

Proj Inpt      Edit Srch Adr. PNr      Filt
```

   to recall the point P_1 from the Editor.

```
Line 1:          Point 2          Adr:  352

s    1.000000    SD      124.5723 m
ih     1.5800 m  Hz      242.5200 gon
th     1.5800 m  V1      101.2340 gon

4002                Line Point 2
<----PNr----->|<---Info---->

Mode Rec      Edit      1Fce Mark SwtC SwtP →1
```

 or  to measure P_2.

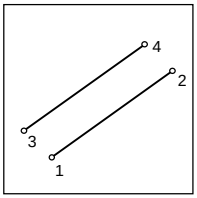
Calculation of the intersection point is the same as in the local system.

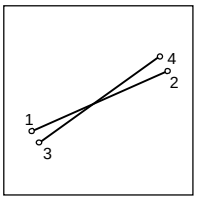
However, after confirming and recording the intersection point, it is possible to set out (stake out) the point:

Yes The point will be set out in the setting out program as normal

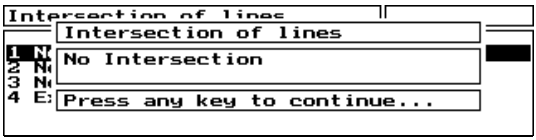
No No setting out, further with the program.

Error Messages

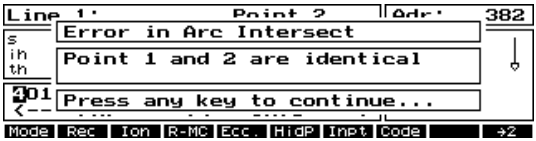




If there is no intersection, or the intersection angle is smaller than that defined in the configuration then the following error warning is given:



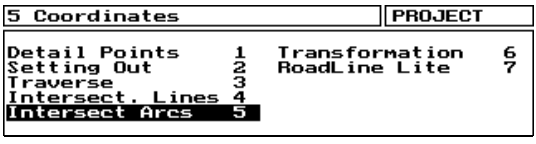
If two points defining the line are identical then:

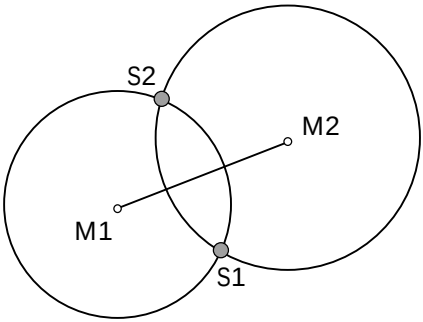


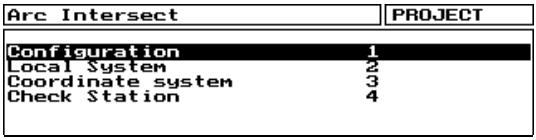
Coordinates 5

Intersect Arcs 5

Calculation of the intersection points of 2 circles or a circle and a line. The defining points can be measured, recalled or input. The intersection point can then be set out.





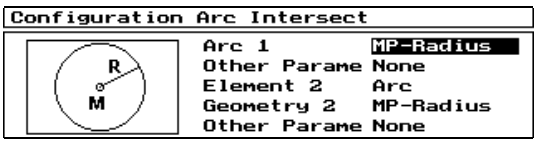


The first step is to configure the definition of the intersection, and then to choose the definition in a local or a coordinate system.

Arc Configuration

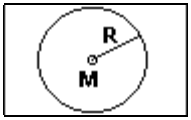
Configuration 1

Under this menu, there are meny available definitions



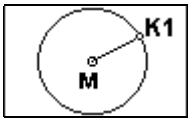
 to toggle the choices.

 to confirm the selections.



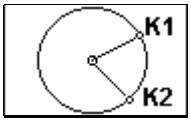
MP-R

Middle Point - Radius



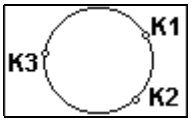
MP-K1

Middle Point - Arc point



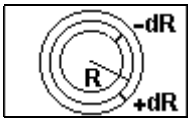
2KP-R

2 Arc points – Radius



3KP

3 Arc points



PaR

Parallel offset of the radius

Intersect Element	**defined through**
Circle 1	Middle Point – Radius Middle Point – Arc point 2 Arc points - Radius 3 Arc Points
Other elements	None Parallel offset of radius
Element 2	Arc 2 Line

Geometry Element 2

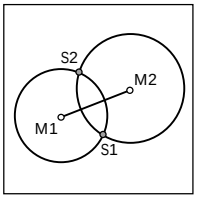
Arc 2	Middle Point – Radius Middle Point – Arc Point 2 Arc Points - Radius 3 Arc Points
Other elements	None Parallel offset of radius
Line	Point – Point Point – Direction
Other Elements	None Parallel through Point Parallel through offset Perpendicular to Point

Attention !

When defining an Arc with 2 arc points, select the two points K1 and K2 in the order so that the Middle Point lies to the right of the line K1-K2 (seen from K1 to K2).

Intersections

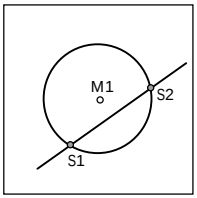
Here are examples of 4 possibilites for intersections:



Intersection Arc – Arc

First the Intersection point S1 will be computed as it falls on the right of the line M1 – M2.

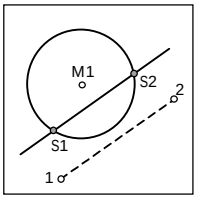
The second intersection point will be displayed with the softkey S-2 .



Intersection of Arc – Line

First the intersection point S1 will be calculated.

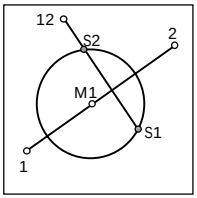
The second intersection point will be displayed with the softkey S-2.



Intersection Arc – Parallel

First the intersection point S1 will be calculated.

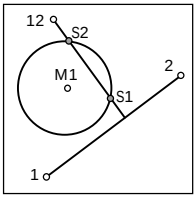
The second intersection point will be displayed with the softkey S-2



Intersection Arc – Perpendicular

In this case S1 is right of the line and will be computed first.

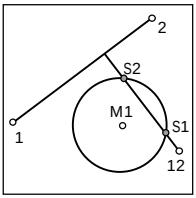
The second intersection point will be displayed with the softkey S-2



Intersection Arc left – Perpendicular

If the arc lies left of the line P1 – P2 the th intersection point S1 will be computed first as it lies nearest to the line P1 – P2 .

The second intersection point will be displayed with the softkey S-2



Intersection Arc Right – Perpendicular

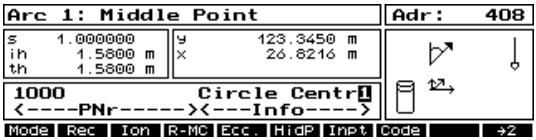
If the Arc lies left of the line P1 – P2, then the intersection point S1 will be calculated first as it lies near to the point 12 .

The second intersection point will be displayed with the softkey S-2

Measuring in a Local System

Local System 2

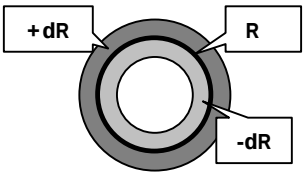
After configuration, the defining points can be measured.



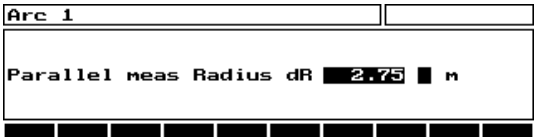
or ⊙ to measure M_1.

Then input the radius of Arc 1:

to confirm the input.



Depending on the configuration, further elements may here be defined:



to confirm the parallel offset.

Definition of Element 2

📖 **Intersection of Lines**

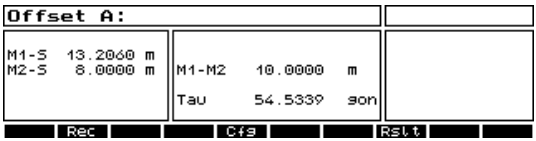
The second element will then be defined. If the element is a line, please refer to the *Intersection of lines* section.

After defining the elements the first intersection point will be calculated and displayed:

to record the intersection point.

S - 2 to see the second intersection point

P→S to display the other offset distances

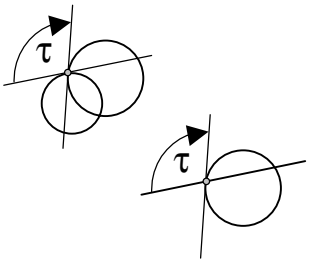


Rec Record the offsets

Cfg Configuration of the intersection angle

Rslt Back to the intersection point

Tau Intersection angles



The intersection angle **Tau** is defined as follows:

Intersection Circle-Circle

Tau the intersection angle of both tangents

Intersection Circle-Line

Tau the intersection angle of the tangent with the line.

📖 **Configuration**
Programs
Coordinates

The limits of the angle **Tau** is defined in the configuration of Intersections.

Rslt Back to the intersecion display

↵ to confirm and record.

After completing the computation of the intersection points, the following menu will allow further computation possibilities:

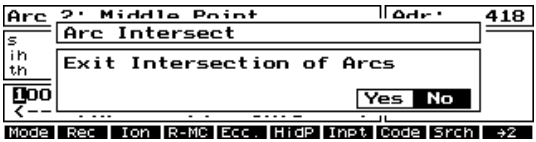
Choose 1 Intersection by redefining Arc or line 2.

Choose 2 Intersection by redefining Arc 1.

Choose 3 Intersection will be redefined with Arcs 1 and 2.

Choose 4 Leave intersection of arcs.

Esc in every measurement menu to leave the program:



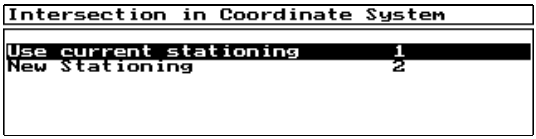
No back and further with the program,

Yes Escape without saving.

Measuring in a Coordinate System

Coordinate System 3

Before working in a coordinate system it is necessary to have a current stationing.



The majority of the program is identical to that of the local system. The following sections outline the differences.

Choosing option 1 will leave the program in the current stationing definition and coordinate system.

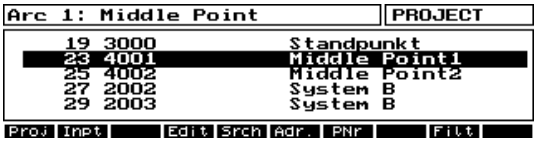
Definition of Lines

Points of definition can be given in various ways:

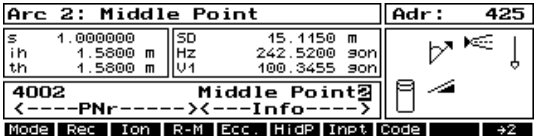
- Measurement of the Line point (as in Local)
- Recall of the point using **Edit**
- Combination of measure and recall
- Manual input with **Inpt**

Edit Recall points from the project data

Inpt Input a point



Recall of arc middle point M_1 in Editor.



or to measure point M_2.

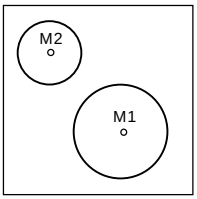
Calculation of the intersection point is the same as in the local system.

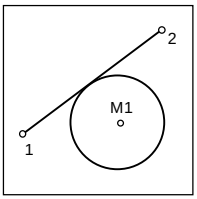
However, after confirming and recording the intersection point you will be asked if you want to set out (stake out) the point:

Yes The point will be set out in the normal way.

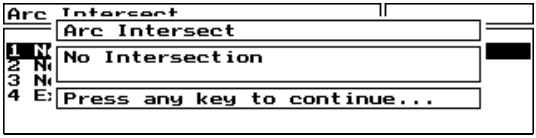
No No setting out, further in the Program.

Error Messages





If no intersection can be calculated then:

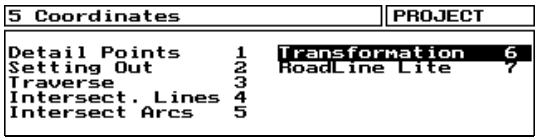


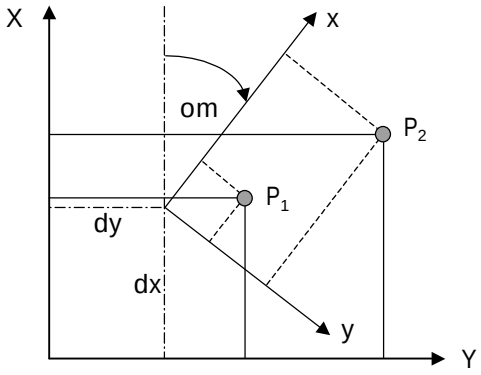
If the line lies exactly on the tangent or does not intersect then:

Coordinates 5

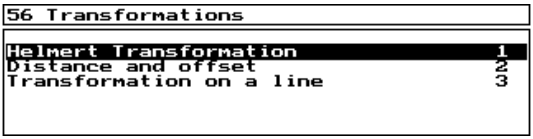
Transformations 6

By selection of between 2 and 20 common points, it is possible to transform one set of coordinates in system A into coordinates in system B, or vice versa.





Selection of Transformation type

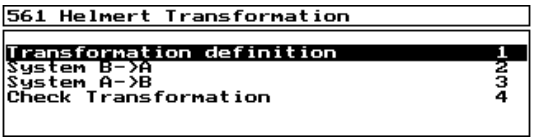


Helmert Transformation

Helmert Transformation 1

Computation of transformation parameters by max. of 20 identical points.

✍ $2 \leq P_T \leq 20$



The Helmert Transformation Menu.

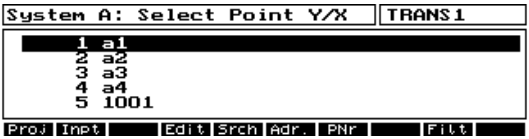
The Helmert-Transformation starts with the definition of the transformation parameters.

Define Transformation Parameters

Transformation definition 1

Definition of transformation parameters by selection of identical points in both systems.

Select 1 to define the new transformation parameters by selecting common points in system A and system B.



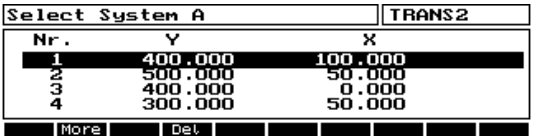
YX and yx points will be filtered. Select points to define system A.

Filt Select Filter

Mode Toggle to the local System

Search for points in the same way as the normal editor.

to select and confirm.

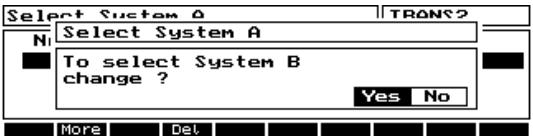


More to add more points from the editor

Del to delete a point from the list

Up to 20 points can be selected

to continue to select system B points



No to return to the system A list

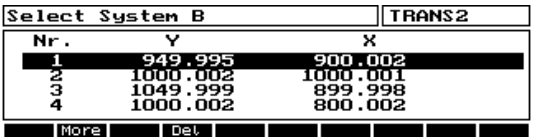
Yes to go further and select common points in system B

Esc to return to Helmert Transformation menu

↵ to add points to the system B list

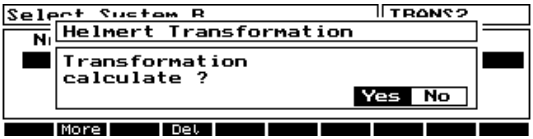
More to add more points from the editor

Del to delete a point from the list



Points must be selected in the same sequence. It is possible to have an uneven number of points in the two systems. The software will ignore any additional point that has no partner.

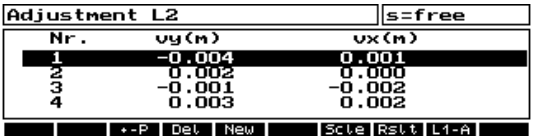
↵ to compute the transformation



No to escape to the Transform menu

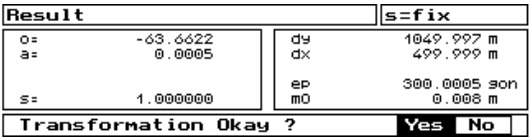
Yes To compute the Helmert Transformation

📖 Stationing



Operation of Softkeys and their functions are the same as in the Stationing Programs.

Esc to see the result of the Transformation, and the Transformation Parameters



dy, dx Coordinate shift

Om Orientations angle

s Scale factor

o, a Transformation parameters

If only 2 points are transormed then the only the coordinate shifts (dy, dx) and the orientations angle will be computed.

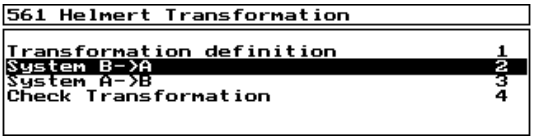
No Back to the results menu.

Yes Saving of the results parameters and back to the Helmert transformation menu.

Transform from System B -> A

System B - > A 2

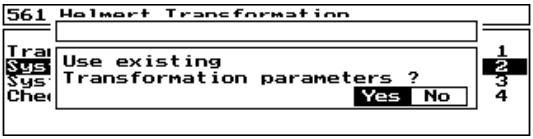
This allows the transformation of points in system B to the coordinates system A



Attention !

If a Transformation is not currently defined, the program will automatically spring to Transformation definition

Select from menu in the usual way. If a transformation is currently defined then:



No to redefine the Tranformation Parameters

Yes To use the existing Transformation Parameters to define the coordinate change.

Esc to return to Helmert Transformation menu

Filt Select Filter

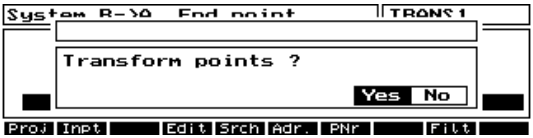
Mode Toggle to the local System

Proj Change the project

↵ to select the Start Point of a block of points to be transformed

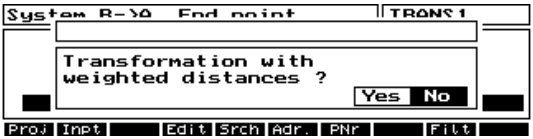
↵ to select the End Point of a block of points to be transformed

> ☞ **Tip**
>
> If you only wish to transform 1 point, then select this as the Start and End Point



No to return to the Helmert Transformation menu

Yes to go further with the Transformation calculation



Select if the points should be computed with a weighted distance (neighbourhood points).

The transformed coordinates will be recorded in the current project file

Attention !

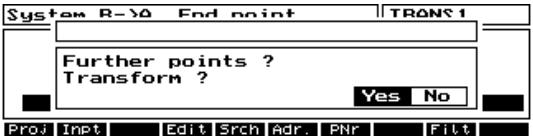
For a weighted distances computation of neighbourhood points a minimum of 3 identical points are needed.

Doing a weighted distances computation of neighbourhood points the residuals of the identical points will be reduced to Zero. The transformed non identical points will be re-adjusted by new residuals depending on their position to the identical points.

The transformed points will be stored with the point identification PI and their new coordinates in the project file.

Attention !

Only a 2D Transformation is computed. The height values will remain as they were originally

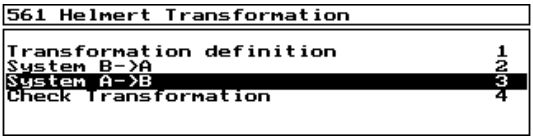


No to return to the Helmert Transformation menu

Yes to select and transform further points

Transform from System A -> B

System A -> B 3



Use this method to transform points in system A to the coordinate system B

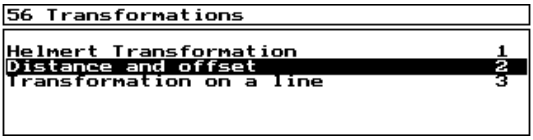
📖 Transformation System B → A

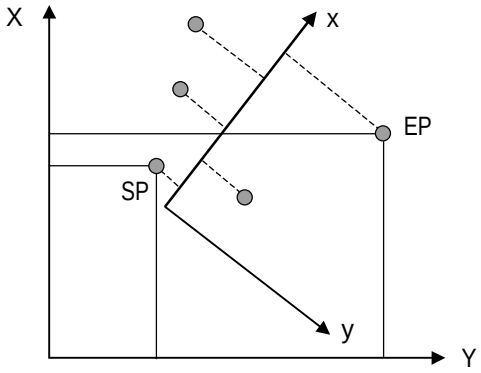
Follow the method described above to carry out the Transformation.

Distance and offset

Distance and Offset 2

The coordinates of a local orthogonal line measurement will be transformed into the global coordinate system.





✍ $P_T = 2$

The coordinates of two identical points (Start- and Endpoint) must be known in both systems.

Select the Start Point in the global coordinate system:

Esc to return to Transformation menu.

PNr To search via Point Number.

Srch To search using PI

Proj To select another project

↵ to select.

Select End Point EP in the same way:

↵ to select the End Point

The two points now have to be defined in terms of the measuring line. The distance and offset from the measuring line has to be entered:

Esc to exit to the Tranformation menu

Input the Distance and Offset for the Start Point SP.

↓ or ↑ to switch between inputs

↵ to confirm.

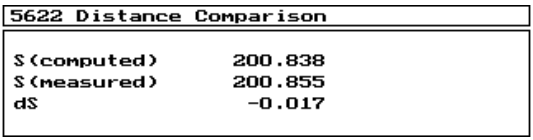
Enter the Distance and Offset for the End Point EP

↓ or ↑ to switch between inputs

↵ to confirm

The measured distance point SP and EP will be compared to the computed distance from the Global coordinates.

The following screen will display the comparison:



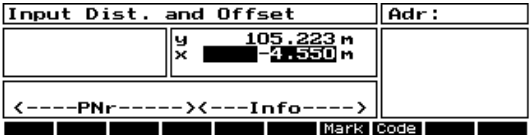
Esc to return to the Transformation menu

A scale factor for the measuring line will be computed using the distance error.

↵ to continue

The Transformation will be computed.

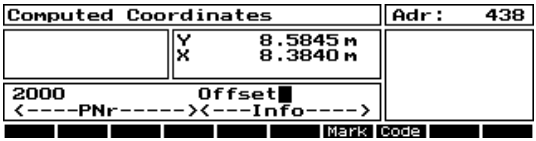
By input of the Distance and Offset of a point in relation to the measuring line, the Global Coordinates can be computed and recorded.



Esc to return to the Transformation menu

Input the Distance and Offset to the Point

↵ to continue



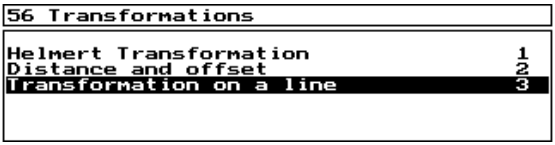
Esc to return to the Input Distance and Offset screen without recording

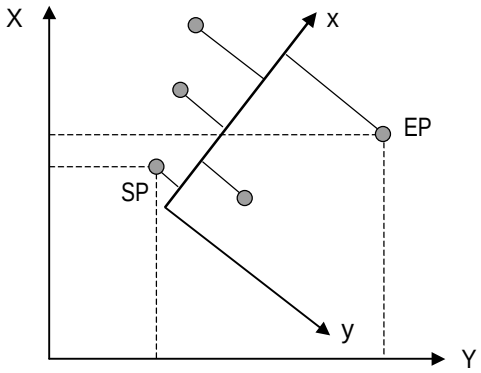
Enter the required Point Identification PI.

↵ to record the coordinate and PI in the current project

Transformation on a line

Transformation on a line 3





Definition of the Global System in relation to the measuring line is carried out in the same way as described above for Distance and Offset.

After the Transformation is computed, it is possible to recall points in the Global system from the editor, in order to compute the Distance and Offset of the point from the local measuring line:

Esc to return to Transformation menu.

PNr To search via Point Number.

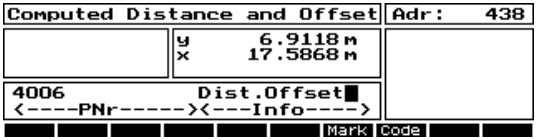
Identify the required coordinate in the usual way.

Srch To search using PI

Proj To select another project.

Esc to return to the global coordinate selection without recording

↵ to select the coordinate point



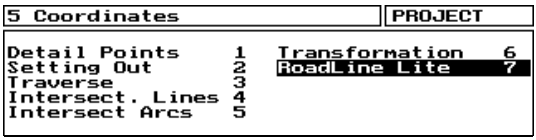
The Distance and Offset will be computed and displayed

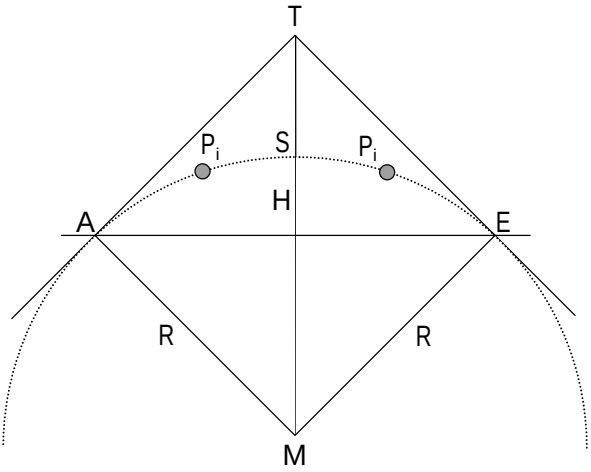
↵ to record the local coordinate in the current project, and return to the Global coordinate selection screen

Coordinates 5

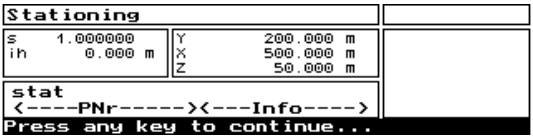
Roadline Lite 7

Setting out of elements in relation to a Line, Arc or Spiral.



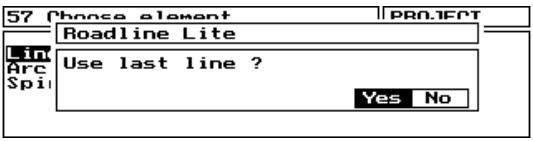


After choosing the RoadLine program, the current stationing will be displayed:



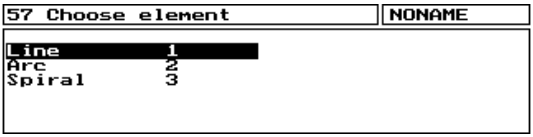
Check the current stationing.

After confirming the stationing, you will be asked if you wish to use the last used RoadLine element:



Yes the program will go straight to the Station and Offset input of the last element..

No The following Element menu will be displayed:

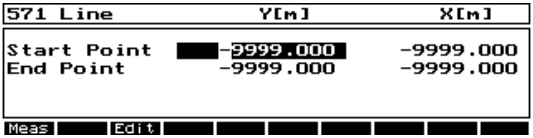


↑ ↓ ↵ Choose and confirm.

Esc Exit program.

Definition of a Line

Line 1



Editor menu of the Line element.

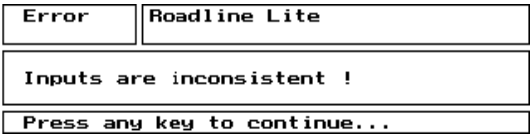
Meas Measure the defined point.

Edit To recall a point from a project using the editor.

The start and end point of the Line needs to be defined, by input, measure, or recall from project..

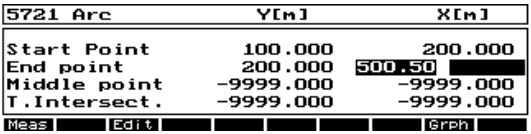
↵ to confirm

An incomplete or inconsistent input will result in the following error message:



Definition of an Arc

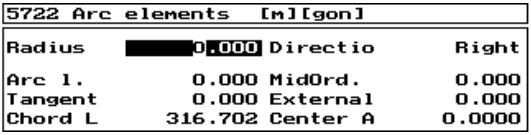
Arc **2**



Input menu of the Arc elements. The definition of an Arc needs a minimum of two points.

✍ Position Values
0 ... 9999 m

✍ Angle Values
0 ... 400 gon



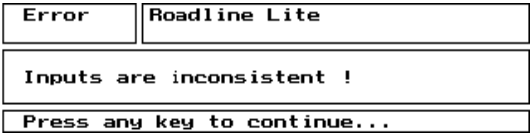
Input of the known Arc elements. The Direction is as seen from the start point.

 to toggle the direction.

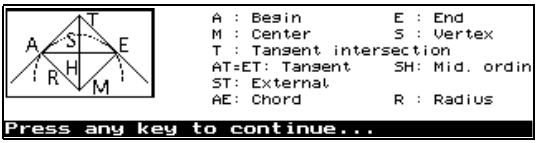
 to confirm.

Meas To measure the defined point.

To few elements, or an inconsistency will result in the following error message:



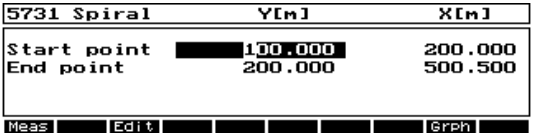
Grph to show a graphic display of the required elements.



Display of the allowed elements

Definition of a Spiral

Spiral **3**

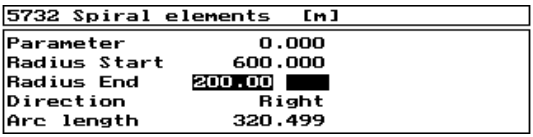


Meas Measure the defined point

Definition of the start and end point by input, measure or project recall.

✍ Position value
0 ... 9999 m

0,00 = ∞

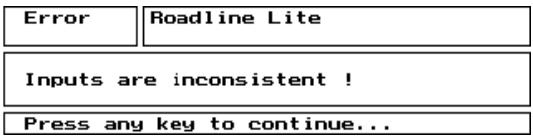


Input of the known Spiral elements. The direction is as seen from the start point.

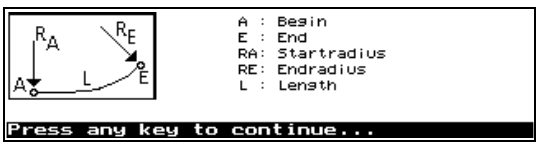
 to toggle the direction.

 to confirm and continue.

To few elements, or an inconsistency will result in the following error message:

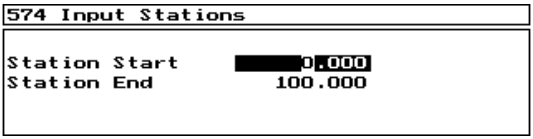


Grph for a graphic display of the allowed elements



Graphic display of the allowed elements.

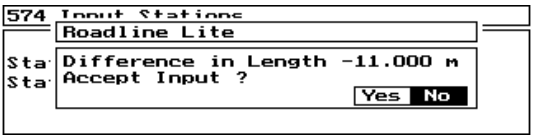
Definition of the Start and End Stations



Input of the Start and End Stations (also known as chainages). This input is optional.

↵ to confirm.

Esc back to the RoadLine Elements

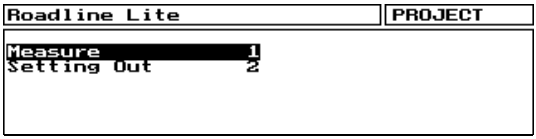


This warning comes when there is an inconsistency comes from the coordinate positions and the station input.

Yes Continue with the known inconsistency.

No Back to the definition input.

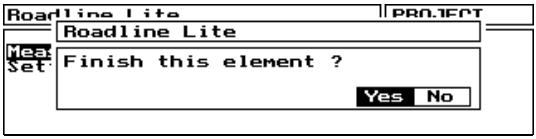
Measurement of Points



After definition of roadline elements points can be measured or set out refering to the defined roadline element.

↓ + ↵ to select and start, or

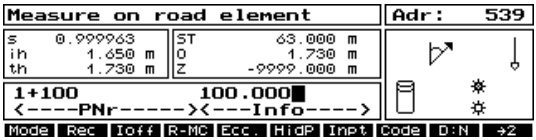
Esc to finish the roadline element.



Yes Back to selection menu roadline element

No Further with measurement on the roadline element.

Measure **1**



or to measure.

Mode Switches the display of SDHzV, HDHzh, YXZ

Rec Additional registration of the displayed values by **Mod**e

The measured point will be computed refering to the roadline element and his Station and Offset will be displayed.

ST Station

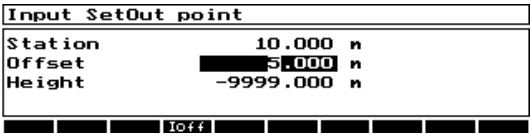
O Offset

Esc leave measure menu, further with selection of another roadline element.

Setting Out of RoadLine Points

Ioff to increment the station and offset

Ion elements after each point is set out.



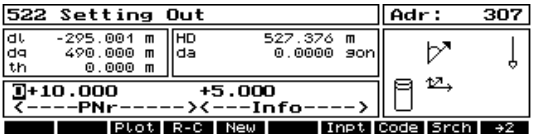
↑ ↓ to choose

Using ± will define left (-) or right (+) of the line.

↵ to confirm.

The instrument will turn to the required direction and the Setting Out display will be shown:

New New input of the setting out elements without recording.



📖 **Coordinates** Setting Out

Setting out of the elements in the normal way.

Esc to save and return to the station and off set input.

Esc again to exit this element.

Yes back to the RoadLine element menu.

No To continue setting out the element.

Verification Points

implemented in software package *Professional Plus*

Verification of points in the detail measurement program by

- identical point numbers, or
- defineable search radius (catch circle).

Only points with coordinates in the actual project file will be checked. These points will be saved in a temporary indexlist for the actual project.

Configuration
Programs
Coordinates
Detail Points
(Menu 92211)

If the Point Verification is activated in the program configuration the detail point measurement starts with the following question:

No No switch on.

Yes Switch on Verification Points.

> **Tip**
>
> If the point verfication is not needed, it´s better to turn it off. For large project files it could be a time consuming search function.

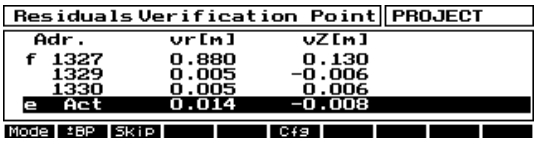
Verify identical Point Numbers

Automatic search for

max. 10 identical Points (incl. P_{Act})

After measurement of a point P_{Act} the project file will be checked for multiple point numbers in the corresponding point number block of the marking. If identical numbers P_i are found, then it goes on as follows:

1. Computing of an average coordinate value of the found identical points P_i .
2. The residuals to this average value of all found identical points incl. P_{Act} will be displayed for a control after measurement:



 to scroll in list.

Adr. Recording address of the identical point in the project file

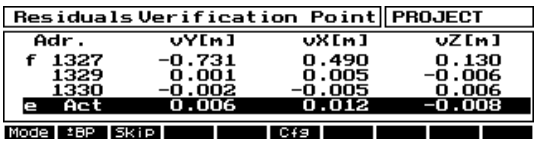
vr radiale difference
vZ height difference

📖 **Configuration**
Menu 922111

An „**e**“ in the first column means that the residual for this point is outside the error limits set in the Configuration.

An „**f**“ in the first column means that this point was edited (not measured). Then the point status is „fixed“ that means, this coordinates cannot be changed and the point is not used for averaging. This point will be displayed only for controlling the other coordinate differences.

Mode Toggles display to vl, va, vq vY, vX, vZ



vl Residuals in length
va Residual in angle bearing
vq Residual in normal to direction

vY Residuals in Y-Coordinate
vX Residuals in X-Coordinate
vZ Residuals in Z-Coordinate

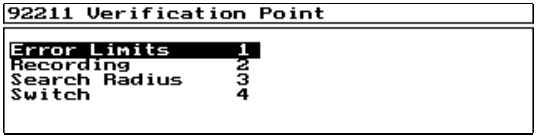
± BP Takes points off from computation

Possibility to take off points from averaging. They not will be used for saving the mean values.

Skip P_{Act} will not used

The softkey **Skip** leaves the menu without saving P_{Act} or using this point for a further average computaion.

Cfg Link to Configuration Verification Points



📖 **Configuration** Menu 92211

In the configuration error limits, recording mode, search radius and the verfication point switch (point number or search radius) can be set.

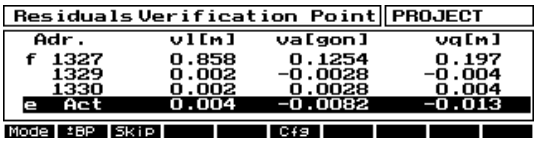
Verification by search radius

Automatic search for

✍ max. 10 identical Points (incl. P_{Act})

If the method search radius (instead of Point number) is selected in configuration, the project file will be searched for points having plane coordinates in the set search radius. This is independend from point identification. If multiple points are found, they will be listed in similar way as described for verification by point numbers.

Recording Verification Points



↵ in the residual menu accepts the measured point P_{Act} and saves the point in the project file.

Configuration
Menu 922112

If in configuration verification points the recording of average values and differences is activated, the new average coordinates (incl. the P_{Act} values) will be stored together with the residuals **vr** and **vZ** in the project file. The saved average point becomes the same point identification as P_{Act}.

The following theoretic recording example of a verification point 777888 gives more information how the points will be stored:

```
 1|TI  COORDINATES/DETAILPT/|              |                  |                |
 2|PI1 777888  1.Measure    |SD  100.0000 m |Hz 100.00000 gon |V1 100.00000 gon |M
 3|PI1 777888  1.Measure    |Y  1100.0000 m |X  1000.0000 m   |Z   122.6010 m   |M
 4|TI  VERIFICATION POINTS  |              |                  |                |
 5|PI1 777888  1.Measure    |vr    0.1000 m |                  |vz    0.0000 m   |
 6|PI1 777888  2.Measure    |vr    0.1000 m |                  |vz    0.0000 m   |
 7|PI1 777888  2.Measure    |Y  1100.1000 m |X  1000.0000 m   |Z   122.6010 m   |A
 8|PI1 777888  2.Measure    |SD  100.2000 m |Hz 100.00000 gon |V1 100.00000 gon |M
 9|PI1 777888  2.Measure    |Y  1100.2000 m |X  1000.0000 m   |Z   122.6010 m   |M
10|TI  VERIFICATION POINTS  |              |                  |                |
11|PI1 777888  1.Measure    |vr    0.2000 m |                  |vz    0.0000 m   |
12|PI1 777888  2.Measure    |vr    0.0000 m |                  |vz    0.0000 m   |
13|PI1 777888  3.Measure    |vr    0.2000 m |                  |vz    0.0000 m   |
14|PI1 777888  3.Measure    |Y  1100.2000 m |X  1000.0000 m   |Z   122.6010 m   |A
15|PI1 777888  3.Measure    |SD  100.4000 m |Hz 100.00000 gon |V1 100.00000 gon |M
16|PI1 777888  3.Measure    |Y  1100.4000 m |X  1000.0000 m   |Z   122.6010 m   |M
```

Registration example with registration switch on R-MC

The 1st measure of point 777888 is registrated on address 3 (Y = 1100.000m). A 2nd measurement with Y = 1100.200m leads to an average value of Y = 1100.100m. This average is stored at address 7 and gets the signature „**A**“ (Average) in column 119 in the project file. The 2nd point measured is registrated at address 9. All Measurement points will be signed with a „**M**“ in column 119.

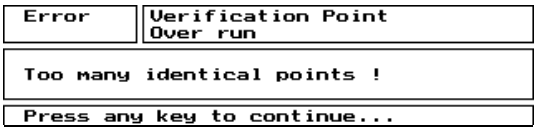
The 3rd measurement of point 777888 (Y = 1100.400m) leads to an average value of Y = 1100.200m (together with the 1st and 2nd measurement), recorded at address 14, signed as well with an „**A**“. The measurement value is registrated at address 16.

The residuals **vr** and **vz** will be stored with the PI of the measured point before the average value.

The signatures „**A**“ and „**M**“ will be shown in the editor as well::

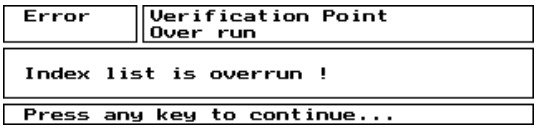
Error Messages Verification Points

If a point number or the number of points in the search radius was found more than 10 times, the following error message appears:



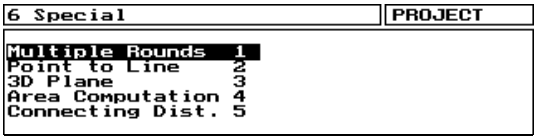
The number of identical points has to be reduced.

The following message will be displayed if the indexlist of coordinates is larger than 1000 points.



Each point after will result in one point from the beginning being removed from the list. Therefore the latest points will be in the list.

> ☞ **Importand Note !**
>
> Points, registrated with the **Rec** Softkey, will not be used for verification control.



This chapter descripes advanced applications in the daily surveyors practical work. This applications are implemented in the menu *Special* of the instrument software.

Multiple Rounds

3D Plane

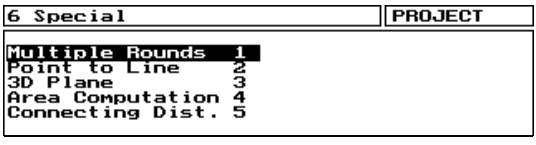
Area Calculation

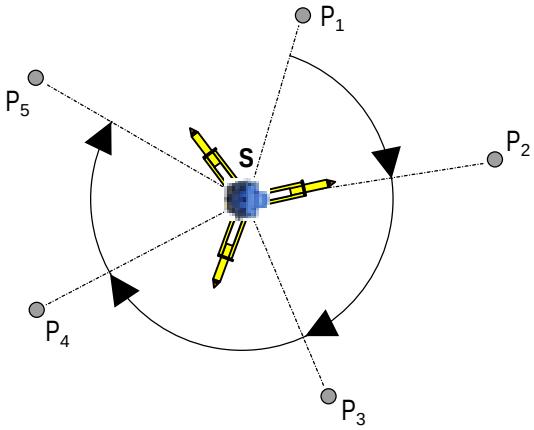
Connecting Distances

Special 6

Multiple Rounds 1

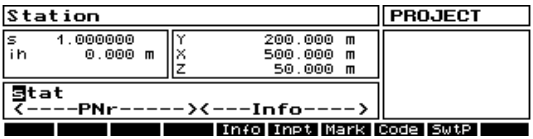
To measure accurate rounds of directions (and distances) from a station point.





✍ $2 \leq P_i \leq 50$

It is possible to measure a maximum of 20 points in a maximum of 20 rounds in one or two faces. It is possible to measure angles only, angles and distances and average as measured or reduced data (including coordinates using the current stationing).



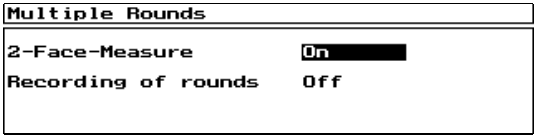
Esc back to Special - Menu

After the program start, the current stationing will be displayed. This is only of use if you are interested in measuring in coordinated. If the stationing is not correct then a new stationing should be performed in the usual way.

↵ to confirm and continue

Preparation

Choose the measure method and recording requirement



It is possible to turn off 2 Face measuring. The required recording protocol can selected:

HDHzV, **YXZ** or **Off**.

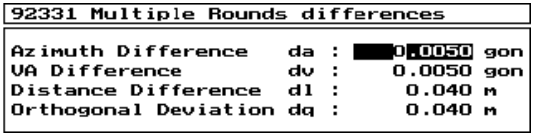
to select

to confirm and continue

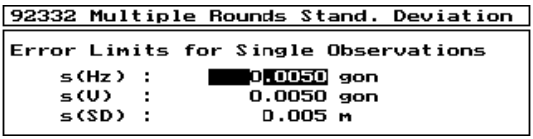
📖 **Configuration**
Programs
Special

In the Configuration of the Special Programs it is possible to set the differences and standard deviations of the measurements.

Configuration of the round differences



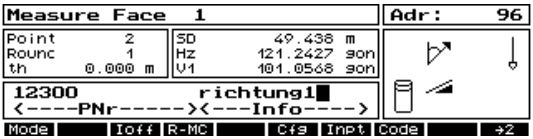
Configuration of the standard deviations



Standard deviation for a single measurement.

Measuring the first half round

The first half round determines which points will be measured.



The first half round is performed manually to define the number of points to be measured and their position.

Mode Choose between **SD Hz V** and **Hz V**

R-MR Registration mode

Cfg Configuration

Inpt Parameter input

↵ or ⊙ to measure

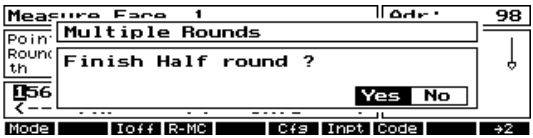
The Registration mode will be automatically set to the recording method previously chosen

↑ to input a reflector height

> **☞ Tip**
>
> The correct reflector height must be given for each point (where required)

Esc to finish the first half round.

If only one point was measured in the first half round, the program ask to abort. If more then one points were measured, comes:

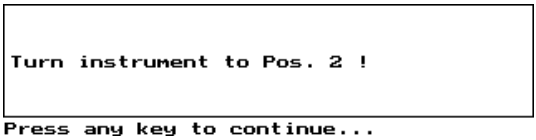


Yes to complete the half round,

No to measure further points in the half round.

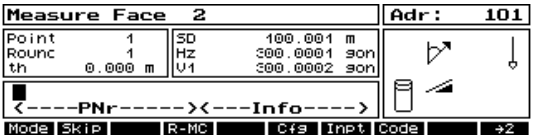
When the maximum number of 20 points is reached then after a warning the half round will be automatically ended..

Measuring in two faces



Turn the instrument in Hz and V through 180° in the second face.

If 2 Face measurement is defined then the second half round will then be measured.



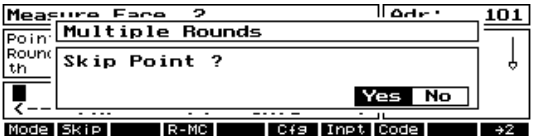
Measure in face 2 beginning from the last point of the first half round. The instrument display shows the PI of the points to be measured.

to measure in manual mode.

Mode Select either **SD Hz V** or **Hz V**

Skip to skip this point

Using the **Skip** function it is possible to miss a measurement if the point is temporarily blocked. The final computations will take care of the missing measurement in any adjustment that takes place.



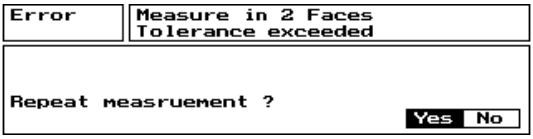
Yes The point will be skipped.

No To measure the point.

Attention !

The PI and the Reflector height cannot be edited in the second half round.

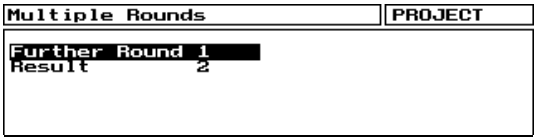
If a measurement is outside the given tolerance, then the following error message appears:



Yes to try a second measurement.

No To accept the current measurement

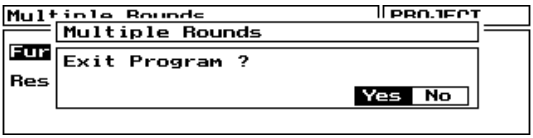
After measuring the last point, the round average for each point will be saved and the total average computed. The instrument must turn back to face 1 and the following End of Measurement menu will be offered:



Further Rounds 1 further rounds will be measured, starting the next round in Face 1.

Result 2 To show the current averaged result. Further measurements are possible.

Esc to finish the measuring and compute the averages.

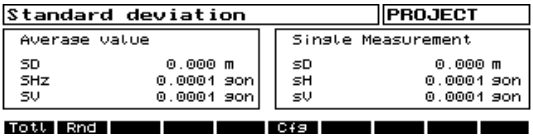


Yes Program will be finished, and the averaged measurements and standard deviations will be stored in the selected measure mode.

No Back to the last menu.

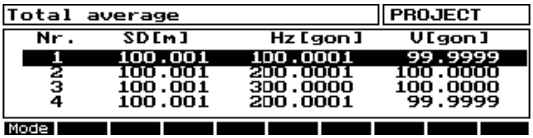
Result Display

Result 3



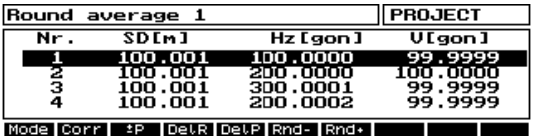
The standard deviation of the average measurement and the single point will be displayed.

Totl To show the total average



Press **Mode** to display HD Hz h.

Rnd to show the round average.



± P remove the point from the calculation.

DelP Point will be completely removed.

DelR the round will be completely removed.

Rnd± Scrolling between the rounds.

Corr Displaying corrections.

PgUp PgDn ↑ ↓ to scroll the display.

☞ Tip

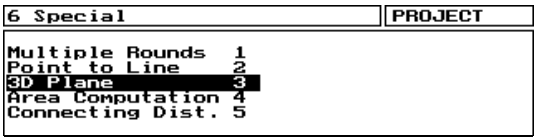
When an average value is not possible, then the row will be empty.

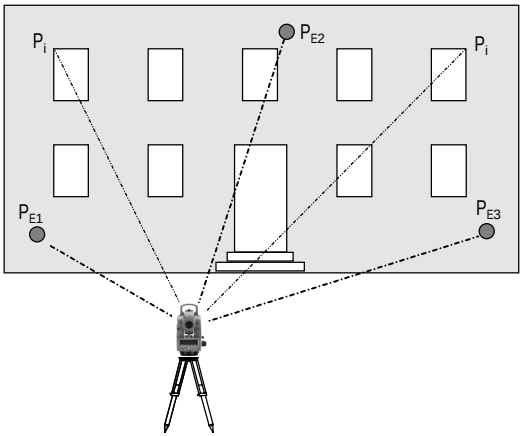
For a classic direction average, the standard deviation of the average is the important value. For monitoring projects, the standard deviation of the single point is the critical information.

Special 6

3D Plane 3

Establish a remote 2D or3D plane, and then measure detail points in the plane without using a prism

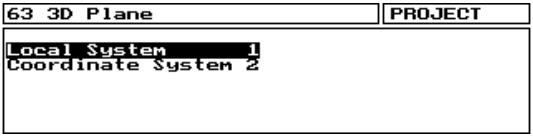




✍ $2 \leq P_E \leq 30$

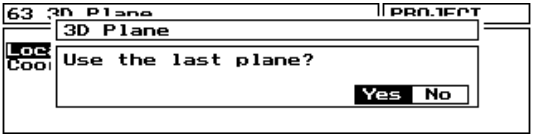
Measuring 3 - 30 points P_E will define a three dimensional plane. 2 Points P_E are used to define a vertical plane. Once the plane is established, points in the plane P_i can be measured only by the use of angles . There is no need to measure a distance. The coordinates of P_i are measured in the defined Coordinate System.

If measuring in a coordinate system, the 3D Plane defining points P_E can be called up from the project file.



Choose the system required to define the plane.

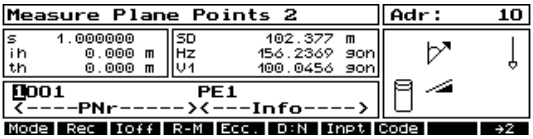
Working in a local system



Yes the last defined plane will be used,

No to continue defining a new plane.

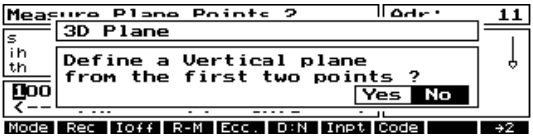
Definition of the 3D Plane



or to measure the plane points.

Measure in a vertical building facade is possible with only 2 points.

After measuring the second plane point you will be asked if you want to define a two face facade.



Yes the plane will be defined with 2 points,

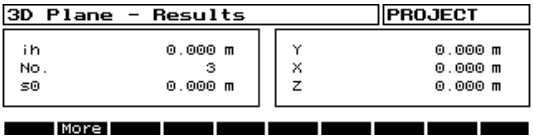
No to take further measurements.

☞ Tip

If using 2 point plane, setup the Total Station in a good position perpendicular to the plane.

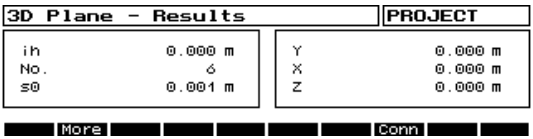
After measuring a 3rd point, the following result display will be shown:

More to measure further plane points



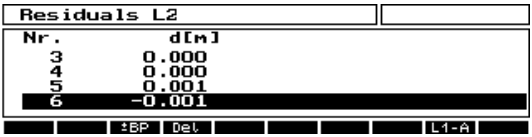
Y X Z Station Coordinates
s0 Standard Deviation of the Adjustment

A 3D Plane can be defined with 3 points, but there is no check on the measurements.



Measuring further points will allow an adjustment of the plane.

Corr To display the residual corrections



L1-A L1-Norm Adjustment to find gross errors

d[m] Orthogonal offset of the adjusted points.

±AP Point out- / in- from calculation

Del Delete point

Attention !

The geometry of the plane is very important to the overall accuracy. Always ensure that you place yourself in a good poistion to sight the plane.

If their are not enough points with good geometry to define the plane, then the following error message will be displayed:

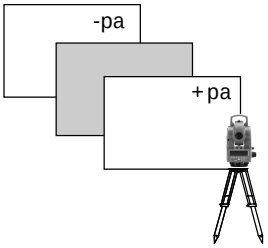
Error	3D Plane
Further points necessary !	
Press any key to continue...	

If after 30 points there are still not enough points to define the plane, then an error message will be displayed

Esc to confirm the definition of the plane

Measuring in the Plane

Measure in plane			Adr: 42
ih 0.000 m pa 0.000 m	5D 107.736 m Hz 191.2233 gon V1 105.4376 gon		
20005 Facade <----PNr-----><---Info---->			
Mode Rec Ioff R-MR Inpt Code CtrP →2			



With HzV angle measurement points in the plane can be measured and their 3D position computed.

pa Parallel offset of the defined plane

to input ±pa.

or to take a measurement.

The measure method to measure in a 3D plane is the same as that for normal detail point measurement, but without the need to measure a distance, which is computed from the angle geometry.

Esc to finish measuring.

Mode Choose measure Mode

Inpt Input parameters

Ioff Incrementation

Mark Marking

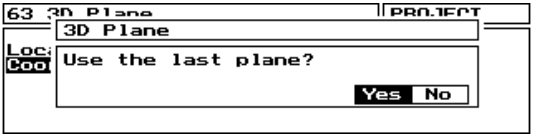
Rec Repeat save

R-MR Registration mode

Measure in a coordinate system

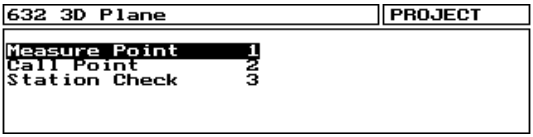
Coordinate System 2

After a position and height stationing, the 3D plane can be defined, and will allow measuring within the same coordinate system



Yes to use the existing definition,

No futher to redefine the plane.



Measure Point 1

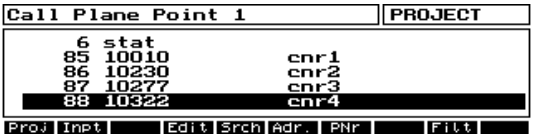
To measure the points in the given coordinate system.

📖 Measure in a local system

Call Point 2

To recall the points from the coordinate editor.

📖 Data management Editor

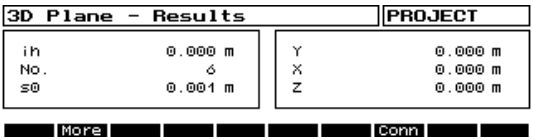


↵ Confirm the chosen point.

Esc Exit to the result screen.

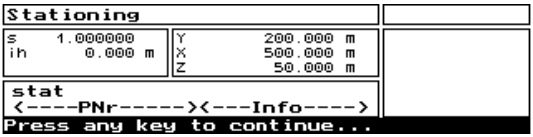
📖 Measure in a local system

The results screen is the same as that used for local system definition:



Check Station **3**

Before measurement the current stationing can be checked



Attention !

A height stationing is always required in order to measure in a 3D plane

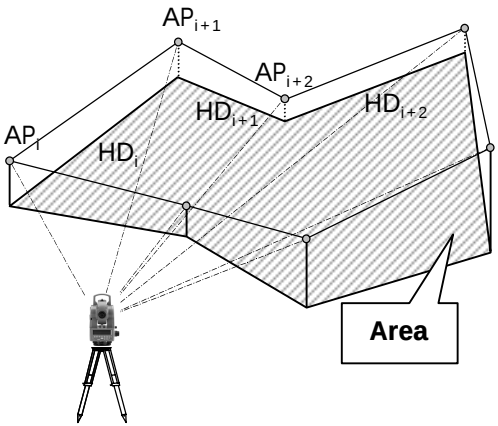
Special **6**

Area Computation **4**

Allows an horizontel area calculation by measuring or recalling between 3 and 99 coordinate points AP in sequence.

✍ $3 \leq AP_i \leq 99$

```
6 Special                                PROJECT
Multiple Rounds   1
Point to Line     2
3D Plane          3
Area Computation  4
Connecting Dist.  5
```




```
64 Measure Point 1                       Adr:    321
s     1.000000      SD        123.347 m
ih        1.620 m   Hz      115.9663 gon
th        1.750 m   V1      101.2756 gon
10013                    Area Point 1
<----PNr-----><---Info---->
Mode Rec Ion R-M Ecc. Edit Inpt Code Srch ->2
```

or to measure each point in sequence.

It is possible either to measure points directly or recall points from the editor (or a mix):

Edit to recall a coordinate from the editor.

```
64 Recall Point 2                        AREA
    1 1001          Corner Point
    2 1002          Radius begin
    3 1003          Radius End
    4 1004          Radius begin
    5 1005          Corner Point
Proj Inpt      Edit Srch Adr. PNr      Fitt
```

to select and return to the measure screen.

The selected or measured point defines to the previous point a connecting distance.

The points must be entered in sequence!

For an area calculation a minimum of 3 points in sequence is needed.

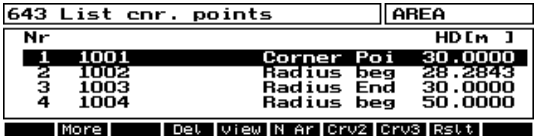
Calculation

More to add a area point after the high-lighted area point

Del to remove points from the sequence

View to see the PI and coordinate of the highlighted point

Esc to finish inputting, and go to the Area Point List:

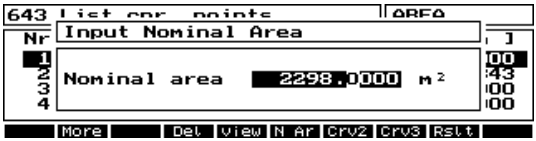


This shows the actual list of coordinates and the Horizontal Distance between them.

E horizontal distance to the next point.

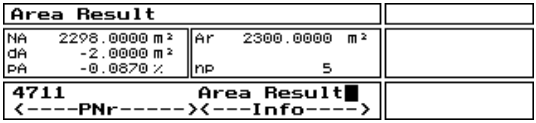
PgUp PgDn ↑ ↓ to scroll in the list.

N Ar to input a nominal area (m² / ft²)



↵ to enter the nominal area.

Rslt to see an interim result

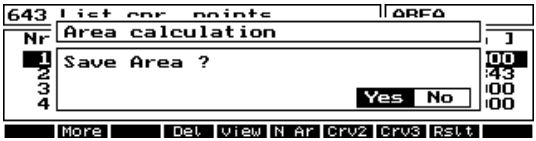


Ar computed area in [ft² / m²]
np number of points defining the area
NA entered nominal area in [ft² / m²]
dF difference dF = NA – Ar in [ft² / m²]
pF percentage difference
pF = (dF / NA)*100% in [%]

It is possible to enter a PI for the calculated area.

Esc or ↵ for return to the liste of area points and to enter or measure further points.

Esc in the point list to finish the program:



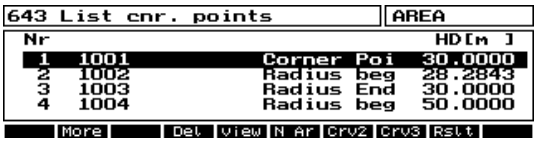
Yes the computed area will be stored.

No No storing.

The program returns to the *Special* menu.

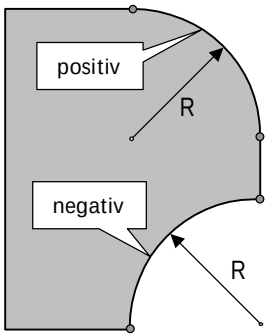
Curves

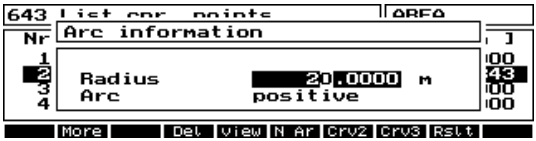
A 2 point curve area can be defined by selecting the softkey on the start point. The next point on the list is the end point.



List of Area Points.

Crv2 defines a 2 point curve by entering of a radius.





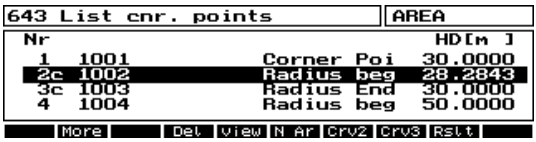
The cursor has to be set on the curve starting point in the list. The next point in list will be automatically the end point of the curve .

Press **Crv2** to define the 2 point curve.

toggle between arc positiv / negativ.

to confirm and continue.

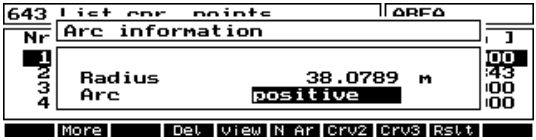
The two points defining the curve will be displayed with a „**c**“ tag:



Crv2 again on start point to cancel a 2 point curve

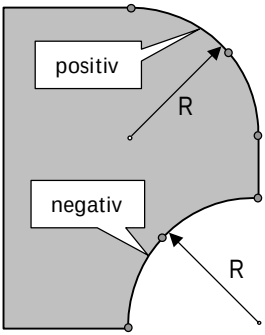
The points 2 and 3 in the list define an arc. To eliminate the arc, set the cursor on the start point and press **Crv2** again.

Crv3 defines a 3 point curve



The cursor has to be set on the curve starting point in the list. The next 2 points on the list are the middle and end points. Pressing softkey **Crv3** to define the 3 point curve.

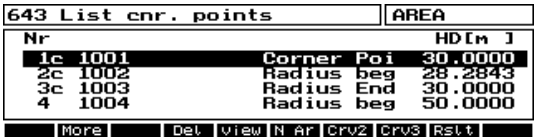
The radius of the arc will be calculated. It is not possible to edit the radius.



toggle between arc positiv / negativ.

to confirm and continue.

The three points defining the curve will be displayed with a „**c**“ tag:



Crv3 again on start point to cancel a 3 point curve

The points 1, 2 and 3 in the list define an arc. To eliminate the arc, set the cursor on the start point and press **Crv3** again.

📖 Calculation

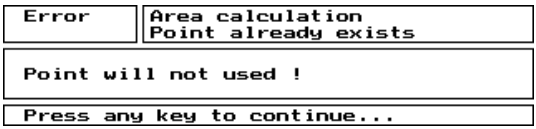
Area calculation and results are similar to the Area without curves, see *Calculation.*

Attention !

It is not possible to have one point as both the end point of one curve and the start of another.

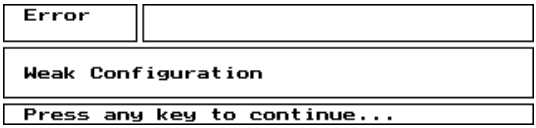
Error Messages

If an already existing point in the list will be measured or selected again, the following message occurs:



The point will be ignored.

If the radius is not appropriate to the coordinates, then the failure message



will be displayed and the curve will be ignored.

Special 6

Connecting Distances 5

Calculation of Connecting Distances (Slope-, Horizontal Distance, Heightdifference)

- between the first measured point P_1 and further points (P_1 -> P_i)

or

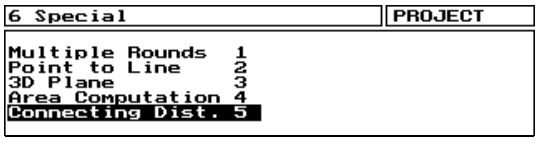
- between successive points (P_i -> P_{i+1})

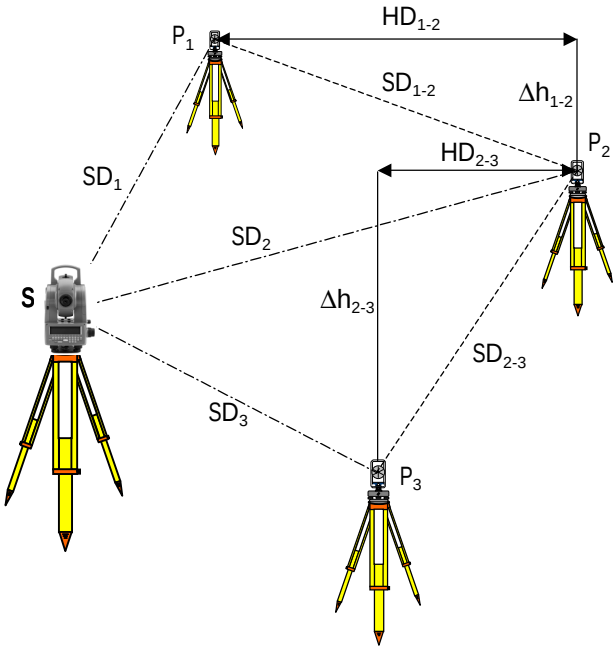
by

- Measure in a local system.

or

- Measure or call up points from project file in the stationed coordinaten system.



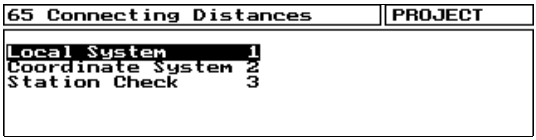


: $SDHzV_{S-Pi}$

: SD_{1-i} , HD_{1-i} , Δh_{1-i} or

: SD_{i-i+1} , HD_{i-i+1} , Δh_{i-i+1}

The number of points P_i is only limited by the storing capacity of the data carrier.

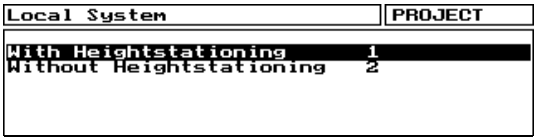


to select the coordinate system.

Local System

Local System 1

The connecting distances will be calculated only by measured points.

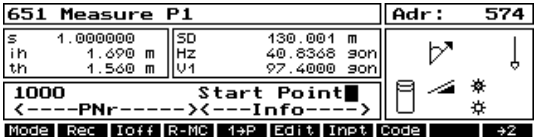


In a Local System it is possible to work with or without a Heightstationing.

Without Heightstationing the station height of z = 0.000 is the reference height. Using the actual Heightstationing, all z-values in the Local System refering to the Z-height of the stationing. Selecting with Heightstationing, the last stationing will be displayed for control:

No Back to the last menu.

Yes The Heightstationing will be accepted. Further with measurement of the connecting distances:



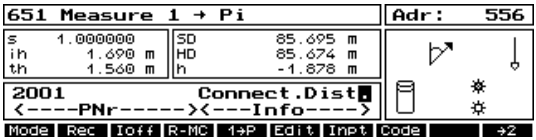
The first point (start point) P_1 has to be measured.

 or  to measure.

Further measurements and calculations now depending the switch of softkey **F5** :

1→P Conn. Dist. $P_1 \rightarrow P_i$

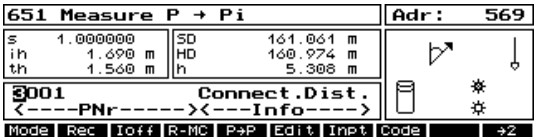
The connecting distances to further measuring points P_i will be calculated to P_1 .



or to measure.

P→P Conn. Dist. $P_i \rightarrow P_{i+1}$

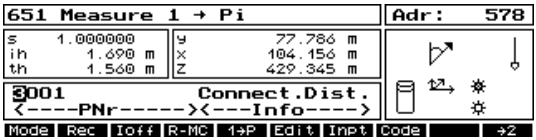
The connecting distances of successive points P_i - P_{i+1} will be calculated.



or to measure.

> **Tip**
>
> It is possible to switch between 1-P or P-P during measurement.

Swich for display of further measurement results



Mode

Mode 1 Conn. Dist. Slope Distance SD
Conn. Dist. Horizontal Dist. HD
Conn. Dist. Height Difference h

Rec Additional registration of results displayed by pressing **Mode** depending on the registration switch R-C, R-MC.

Mode 2 Conn. Dist. Slope Distance SD
Conn. Dist. Horizontal Dist. HD
Height Z (Heightstationing)
Height z (local system)

Mode 3 Local Coordinates x, y, z

Mode 4 Original Measurement SD, Hz, V

☞ **Tip**

The registration softkey **R-M, R-C** or **R-MC** defines, which kind of data will be stored by pressing  for measurement or **Rec** for additional result registration. For saving calculated results (e.g. HD, h, x, y, z, Z) the registration switch should be **R-C** or **R-MC** .

R-MC Switch registration mode

(1) **R-M** only original measurement values
(2) **R-C** only calculated values
(3) **R-MC** both of them

🕮 **Measure in Local System**

All the other softkeys in the measurement menu have similar functionality as described in applications like *Measure in a Local System* or *Detail Point* Measurement.

Coordinate System

Coordinate System 2

The Connecting Distance will be calculated by call up points from project file or by measurement. A combination is possible

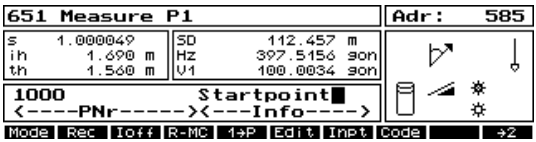
Softkeys

📖 **Data Management** Editor

The program goes automatically into the Editor to call up the start point P_1 from project file.

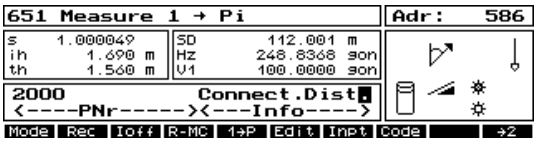
↑ ↓ ↵ to select, or

Esc to leave the Editor. The start point has to be measured then:



↵ or ◎ to measure.

The program stays on in the measurement menu for further measurements.



↵ or ◎ to measure.

Edit Call up points from project file

Use **Edit** to switch back to the Editor for calling up points from project file. The program remains then on in the Editor. Press Esc for going back to the measurement menu.

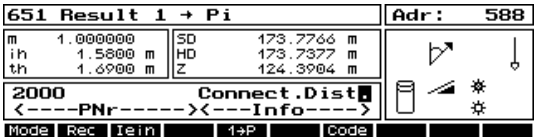
📖 **Connecting Distances** Local System

The operation and softkey handling is similar to the Connecting Distances measurement in Local System.

If a point was called from project file, the program stays in the Editor for calling up further points P_i :

↑ ↓ ↵ to select or Esc to leave the Editor to measure further points.

After selection a point from project file the Connecting Distance is calculated and a result screen will be displayed:



↵ to save the result in the project file.

Esc no saving, back to the Editor.

1→P Connect. Distance $P_1 \rightarrow P_i$

The connecting distances to further measuring points P_i will be calculated to P_1.

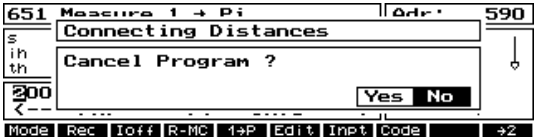
P→P Connect. Distance $P_i \rightarrow P_{i+1}$

The connecting distances of successive points P_i - P_{i+1} will be calculated.

Exit Program

Exit all menus by pressing Esc.

In the measurement menu comes

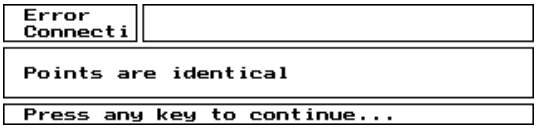


No Back to the measurement menu.

Yes Cancel the program, back to the *Special* menu.

Error Messages

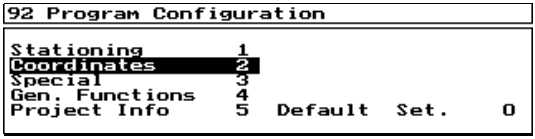
In case of measurement or call up of identical points for a calculation of the Connecting Distance comes:



Measure or call up another (different) point.

If there are no coordinate points in the project file found, comes:

Input the Point coordinates or measurement of points is possible then..



This chapter describes the Configuration of application programs in the software packages *Special* and *Professional* .

Configuration Coordinates

Configuration Special

Programs 2

Coordinates 2

```
922 Coordinate Programs
Detail Points      1   Helmert Transf.   6
Setting Out        2
Traverse           3
Intersections      4
Transformation     5
```

Configuration menu of Coordinate Programs.

Detail Points 1

Configuration Verification Point.

```
92211 Verification Point
Error Limits       1
Recording          2
Search Radius      3
Switch             4
```

Menu Configuration Verification Point.

Detail Points 1

Error Limits 1

Input of admissible differences for points verified several times.

✍ $0.000 \leq da < 1$ gon

$0 \leq dr/dq/dl/dh < 1$ m

```
Verification Point Error Limits
Radial Dev.    dr :    0.030 m
Angle Dev.     da :  0.0050 gon
Orthog. Dev.   dq :    0.020 m
Longit. Dev.   dl :    0.020 m
Height Dev.    dh :    0.020 m
```

Input of the values in predefined measuring units.

	Default-values:
Linear deviation **dr**:	**0.030 m**
Bearing deviation **da**:	**0.0050 gon**
Transverse deviation **dq**:	**0.020 m**
Logitudinal deviation **dl**:	**0.020 m**
Height deviation **dh**:	**0.020 m**

Detail Points 1

Recording 2

Switch On / Off recording of average and difference values.

```
Verification Point Recording
Averaged Value          On
Differences             Off
```

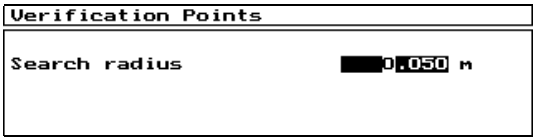
 to toggle,  to accept.

Detail Points 1

Search Radius 3

Input of a search radius.

✍ 0.000 ≤ SR ≤ 1 m



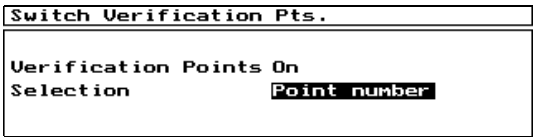
Input of a search radius, where the program searches for multiple points.

 to accept.

Detail Points 1

Switch 4

Switch On / Off Verification Point.
Selection if search for point number or search radius.



 to toggle.

 to accept.

☞ Note

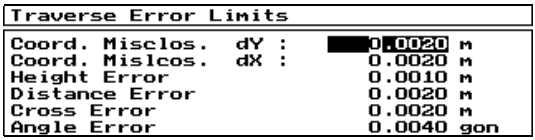
If Verification Point is switched on you will be asked additionally when the detail point measurement program starts for activation of this function.

If Verification Point is switched off you not will be asked for it.

If the point verfication is not needed, it´s better to turn it off. For large project files it could be a time consuming search function.

Traverse **3**

Definition of error limits for the results of traverse measurement.



↑ ↓ to the input fields.

↵ to accept the entry.

Intersections **4**

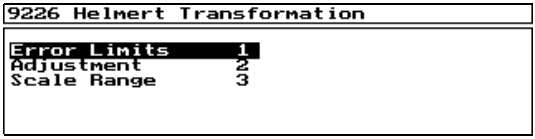
Definition of limits for weak geometry.

↑ ↓ to the input fields.

↵ to accept the entry.

Helmert Transformation **6**

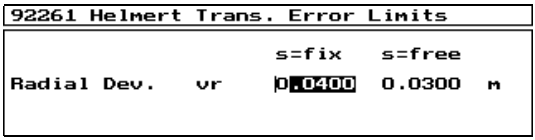
Configuration of Helmert Transformation.



Configuration menu Helmert Transformation.

This configuration is similar to the free stationing.

📖 **Configuration** Stationing



Definition of error limits of the linear deviation for the transformed points.

 to the input fields.

 to accept the entry.

Programs 2

Special 3

```
923 Special Programs
Point to Line    1
Multiple Rounds  3
```

Menu Configuration of application programs in the *Special* menu.

Multiple Rounds 3

Definition of admissible differences and standard deviations for multiple round measurement.

```
9233 Multiple Rounds
Differences      1
Stand. Deviation 2
```

Menu Configuration Multiple Rounds.

```
92331 Multiple Rounds differences
Azimuth Difference    da :  0.0050 gon
VA Difference         dv :  0.0050 gon
Distance Difference   dl :  0.0400 m
Orthogonal Deviation  dq :  0.0400 m
```

Admissible differences of the calculated round average to the calculated average of all rounds.

```
92332 Multiple Rounds Stand. Deviation
Error Limits for Single Observations
    s(Hz) :   0.0050 gon
    s(V)  :   0.0050 gon
    s(SD) :   0.0050 m
```

Error limits for single observations in multiple round measurement.

 to the input fields.

 to accept the entry.

ZSP Geodetic Systems GmbH
Carl-Zeiss-Promenade 10
D-07745 Jena
Germany

Phone: +49 3641 64-3200
Fax: + 49 3641 64-3229
email: surveying@zspjena.de
www.trimble.com