

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



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User Manual	Trimble 3600 Zeiss Eltas 2nd Part
Software Packages <i>Special</i> and <i>Professional</i>	
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5 Coordinates		PROJECT	
Detail Points	1	Transformation	6
Setting Out	2	RoadLine Lite	7
Traverse	3		
Intersect. Lines	4		
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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

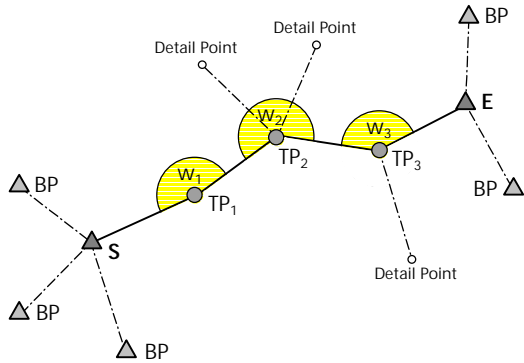
Traverse

Coordinates 5

Traverse 3

Measurement of a Traverse through back and fore-sights, 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
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$1 \leq TP_i \leq 20$

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
Ref1. :	1.655 m	Press. :	1013 hPa
R.Type :	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 Start point	TRAVERSE
Stationing on a known point	1
Free Stationing	2
Use current Stationing	3



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 TP₁.

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:

Traverse
Use existing Traverse ?
Yes No



Measure Traverse

Yes To go further with continuing the existing unfinished traverse ,



Finish Traverse

No Then the unfinished traverse will be deleted after confirmation:

Traverse
Delete existing Traverse ?
Yes No

Traverse



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 :

Traverse Foresight 1				Adr: 180
S	1.000000	HD	57.812 m	
ih	1.555 m	HZ	15.5644 gon	
th	1.655 m	h	-0.283 m	
1001		TP07.1		
<----PNr----->		><----Info----->		
Zon		Info		Inpt Code →2

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

or to measure the foresight to TP₁.

After the measurement comes the Traverse Menu:

Station Menu Start Point

Traverse Start Point	TRAVERSE
Further foresight measurments	1
Measure detail Points/Side shots	2
View Traverse	3
Finish Traverse Point	4

Further foresight measurment. 1

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

Measuring further points to the traverse point TP.

FURTHER MEASUREMENTS	
2-Face-Measure	On
Round Number	4

select On / Off.

More Further Measurement

± P Point on/off

Del Delete Measurement



Cfg Configuration

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

Measure Detail Points 2

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

 **Coordinates**
Detail Points

 or  to start further measurements.

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

Residuals at Start Point			TRAVERSE
Nr.	vHD [m]	vHz [gon]	vh [m]
1	0.000	0.0000	-0.001
2	-0.001	0.0004	0.001
3	0.000	-0.0001	-0.001
4	-0.001	-0.0003	0.001

More ±P Del Cfg Rslt


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.

Next Point	
Y	4449693.423 m
X	5640434.724 m
Z	270.607 m

1001 TP07.1
 <---PNr---><---Info--->
 Press any key to continue...

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.

S1 Detail Points		Adr: 195
S 1.000000	Y 4449693.422 m	   
ih 1.555 m	X 5640434.724 m	
th 1.655 m	Z 270.608 m	

7010 Side Shot
 <---PNr---><---Info--->
 Mode Rec Ion R-MC Ecc HidP Inpt Code →2

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.

Traverse

View Traverse 3

Display of the traverse up to this point.

Traverse Coordinates			TRAVERSE
Nr.	Y[m]	X[m]	Z[m]
S	4449679.429	5640378.632	270.890
1	4449693.423	5640434.725	270.611
2	4449765.826	5640531.970	269.999
3	4449753.036	5640617.948	269.805

Mode

Mode Toggle the results

Display of the TP coordinates.

Travers Angle+Distance			TRAVERSE
Nr.	ER[m]	w[gon]	EV[m]
1	57.812	225.1794	121.239
2	121.239	149.8548	43.462
3	43.462	0.0000	0.000

Mode

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

Traverse Foresight			TRAVERSE
Nr.	HD[m]	H _z [gon]	h[m]
S	57.812	15.5643	-0.282
1	121.239	40.7437	-0.608
2	86.925	390.5986	-0.194

Mode Back

Fore Back Toggles between foresight and backsight

HD Horizontal distance - mean value in [m]
 H_z H_z - 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.

Traverse		TRAVERSE
Continue to next Traverse Point		1
Continue to End Point		2

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:

Backsight Start		Adr: 196
s 1.000000	HD 57.813 m	
ih 1.655 m	H _z 215.5644 gon	
th 1.555 m	h 0.275 m	
270800 TP71 <----PNr----><----Info---->		
Zon Info Inpt Code →2		

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!

Traverse Foresight 2			Adr: 198
S	1.000000	HD	121.239 m
ih	1.655 m	HZ	40.7436 son
th	1.560 m	h	-0.606 m
1002		TP07.2	
<---PNr--->		<---Info--->	
Zon	Info	Inpt	Code
			→2

 to input the reflectorheight of the foresight.

 or  to measure the foresight.

Afterwards the Traverse Point menu will be displayed for TP₁:

Traverse Point menu

Traverse Point 1	TRAVERSE
Further measurements	1
Measure Detail Points/Side shots	2
View Traverse	3
Finish Traverse Point	4

It is possible to finish the Traverse Point here. Although further (additional) measurements are possible for foresight and backsight 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.

Traverse
Use current Stationing ?
Yes No

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:

Traverse	TRAVERSE
Exit Traverse Program	1
Direct to the next point	2

At this point it is possible to exit the Traverse

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.

Esc is possible in every menu.

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

Traverse End Point	TRAVERSE
Further backsight measurements	1
Stationing on a known Point	2
Free Stationing	3
Open Traverse	4
Display Traverse	5

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

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:

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.

Traverse
Use current Stationing ?
Yes No

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.

 **Stationing**

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

Result of the Stationing

417 Stationing OK?			
S	0.999982	Y	4449753.0359 m
ih	1.6600 m	X	5640617.9511 m
		Z	269.8046 m
1002	PP07.2		Yes No
<----PNr----->		<---Info---	

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

End Traverse	TRAVERSE
Measure Polar/Detail Points	1
View Traverse	2
Adjustment of Traverse	3



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.

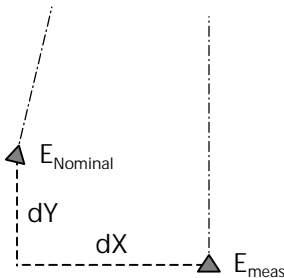
Traverse Adjustment	TRAVERSE
Bowditch Adjustment	1
Transit Adjustment	2
Transformation	3
View Traverse	4



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:

Traverse	
Distribute Angle Misclosure ?	
<input type="checkbox"/>	Yes
<input type="checkbox"/>	No

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.

Bowditch Adjustment 1

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

$$vX_i = \frac{dX_{clos.error}}{\sum S} * S_i$$

$$vY_i = \frac{dY_{clos.error}}{\sum S} * S_i$$

$$vZ_i = \frac{dZ_{clos.error}}{\sum S} * S_i$$

Adjust Traverse				TRAVERSE	
Nr.	Y[m]	X[m]	Z[m]		
S	4449679.4290	5640378.6320	270.8900		
1	4449687.7696	5640437.2857	270.6108		
2	4449755.0268	5640525.7844	270.0016		
E	4449753.0364	5640617.9509	269.8046		
Mode					

Display of the adjusted coordinates.

Mode Toggle between the results

Adjust Traverse				TRAVERSE	
Nr.	vY[m]	vX[m]	vZ[m]		
S	0.0000	0.0000	0.0000		
1	0.0005	-0.0005	0.0000		
2	0.0025	0.0025	0.0000		
E	-0.0005	0.0002	0.0000		
Mode					

Display of the coordinate adjustments vX_i , vY_i , vZ_i .

Rslt To display the misclosure errors

Traverse Misclosure			TRAVERSE	
dY	0.0034 m	dL	0.0057 m	
dX	0.0034 m	dD	0.0057 m	
dZ	0.0000 m	dR	0.0081 m	
Winkel	0.0076 gon			
Press any key to continue...				

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

Adjust Traverse		TRAVERSE	
N	Traverse		
	Save Traverse ?	000	000
		000	000
		000	000
		000	000
Mode			

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

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

Traverse	
Re-compute Polar/Detail Points	
Yes No	

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

No Detail points will remain with the measured coordinates.

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

Transit Adjustment

2

The Transit adjustment computes the adjustment of the coordinate closing error proportionally 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:

Error	Traverse Measurements inconsistent
Difference between fore- and backsigh	
Press any key to continue...	

Cfg

Softkey Link Configuration Traverse



Configuration
Programs
Coordinates
Traverse

Traverse Error Limits	
Coord. Misclos. dY :	0.0030 m
Coord. Misclos. dX :	0.0030 m
Height Error	0.0030 m
Distance Error	0.0030 m
Cross Error	0.0030 m
Angle Error	0.0050 gon

If configured error limits are exceeded, 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 be 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

Traverse	TRAVERSE
Exit Traverse Program	1
Direct to the next point	2

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.



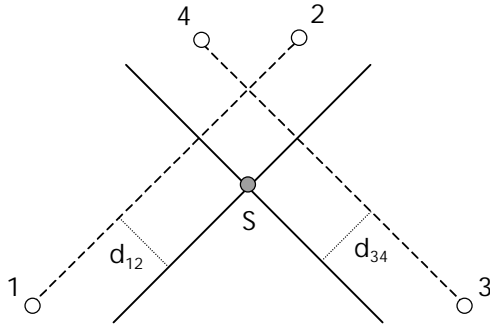
Intersection of Lines

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.

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



Intersection of lines	
Configuration	1
Local System	2
Coordinate system	3
Check Station	4

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.

Configuration Line Intersect	
	Line 1 P-P
	Other Parame None
	Line 2 P-P
	Other Parame None

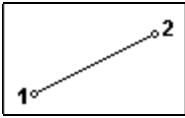


to toggle the choices.



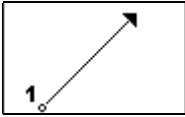
confirm the selected options.

Intersection of Lines



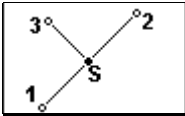
PP

Point-Point



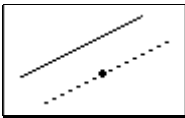
PD

Point-Direction



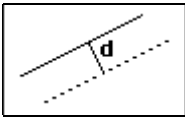
PL

Perpendicular Point



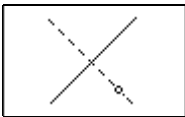
PaP

Parallel through Point



PaA

Parallel with offset



SeP

Perpendicular through Point

Line Element defined through

Line L1

Point – Point
Point – Direction

Other parameters

None
Parallel through point
Parallel with offset
Perpendicular through point

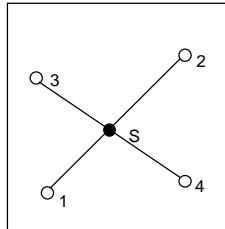
Line L2

Point – Point
Point – Direction
Perpendicular Point

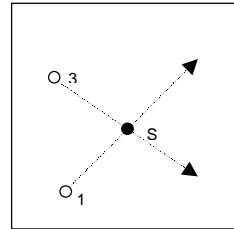
Other parameters

None
Parallel through Point
Parallel through Offset

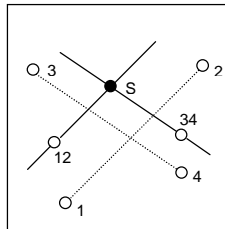
Here are 4 common examples of the various configuration possibilities:



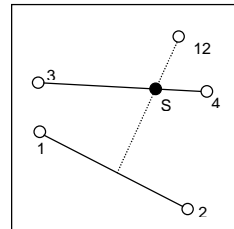
PP (-) x PP (-)



PD (-) x PD (-)



PP (PaP) x PP (PaP)



PP (SeP) x PP (-)

Intersection of Lines

Measuring in a Local System



Local System 2

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

Line 1:		Point 1	Adr: 321
s	1.000000	y	112.2360 m
ih	1.5800 m	x	55.4790 m
th	1.5800 m		
1001		Line 1	
<---PNr---		>---Info---	
Mode	Rec	Ion	R-MC Ecc HidP Inpt Code

or to measure point P₁.

Mode Toggle the measure mode DHZV / y x z

Line 1:		Point 2	Adr: 323
s	1.000000	y	57.3450 m
ih	1.5800 m	x	122.5810 m
th	1.5800 m		
1002		Line 1	
<---PNr---		>---Info---	
Mode	Rec	Ion	R-MC Ecc HidP Inpt Code

or to measure point P₂.

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

Line 2:	Direction
Orientation Hz:	112.4570 gon

to confirm the input.



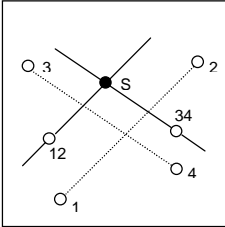
Measure in a local System

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.

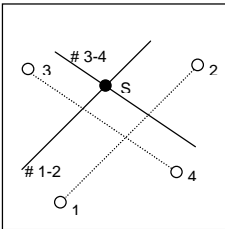
Intersection of Lines



Parallel 1		Point 12	Adr: 333
s	1.000000	y	4.3243 m
ih	1.5800 m	x	55.2345 m
th	1.5800 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).

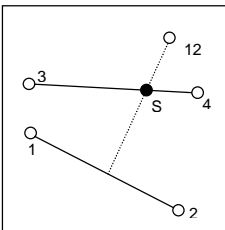


Parallel 1:	Offset
Offset:	2.5000 m
Posit.:	left

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	y	112.0000 m
ih	1.5800 m	x	49.0000 m
th	1.5800 m		
1011		Senkrechte 12	
<---PNr---		>---Info---	
Mode	Rec	Ion	R-MC Ecc HidP Inpt Code
			→2

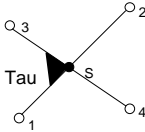
e.g. perpendicular through point (SeP).

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:



Intersect Pt:			
Intersect. Ang.	es	86.1802 m	
309.7154 gon	ns	83.9582 m	
<---PNr---><---Info--->			
P->S Info Mark Code			

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

Offset A:			
P1-S	43.4596 m	P1-P2	100.9912 m
P2-S	57.5316 m	P3-P4	95.0733 m
P3-S	48.5018 m	Tau	309.7154 gon
P4-S	46.5715 m		
Rec Cfg Rslt			

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

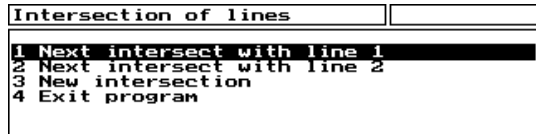
Tip

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.

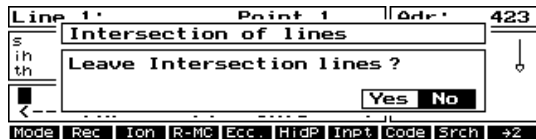
Intersection of Lines

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



- Choose 1 New intersection by redefining 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

Intersection of Lines

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--->X---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.

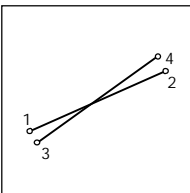
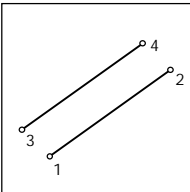
Intersection of Lines

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

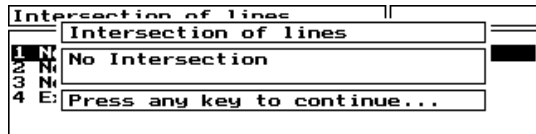


- Yes** The point will be set out in the setting out program as normal
- No** No setting out, further with the program.

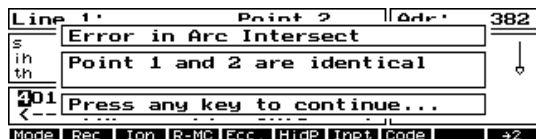
Error Messages



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:



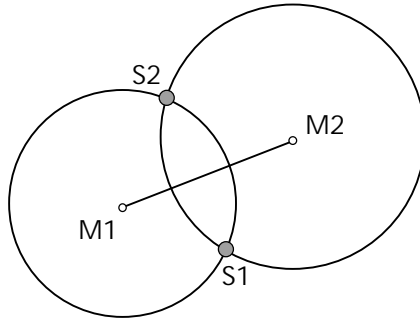
Intersection of Arcs

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.

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



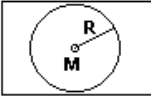
Arc Intersect		PROJECT	
Configuration	1		
Local System	2		
Coordinate system	3		
Check Station	4		



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

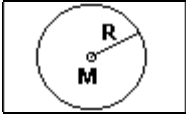
Under this menu, there are many available definitions

Configuration Arc Intersect	
	Arc 1 MP-Radius Other Parame None Element 2 Arc Geometry 2 MP-Radius Other Parame None

  to toggle the choices.

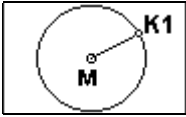
 to confirm the selections.

Intersection of Arcs



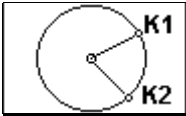
MP-R

Middle Point - Radius



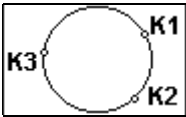
MP-K1

Middle Point - Arc point



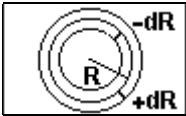
2KP-R

2 Arc points - Radius



3KP

3 Arc points



PaR

Parallel offset of the radius

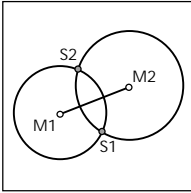
<u>Intersect Element</u>	<u>defined through</u>
Circle 1	Middle Point – Radius Middle Point – Arc point 2 Arc points - Radius 3 Arc Points
Other elements	None Parallel offset of radius
Element 2	Arc 2 Line
<u>Geometry Element 2</u>	
Arc 2	Middle Point – Radius Middle Point – Arc Point 2 Arc Points -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

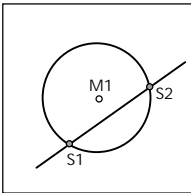
Here are examples of 4 possibilities for intersections:



Intersection Arc – Arc

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

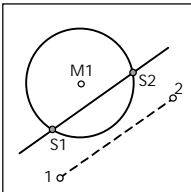
The second intersection point will be displayed with the softkey S-2 .



Intersection of Arc – Line

First the intersection point S1 will be calculated.

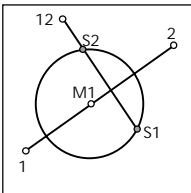
The second intersection point will be displayed with the softkey S-2.



Intersection Arc – Parallel

First the intersection point S1 will be calculated.

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

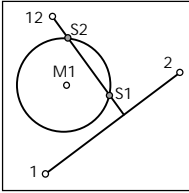


Intersection Arc – Perpendicular

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

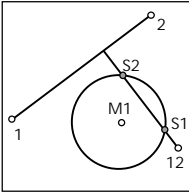
Intersection of Arcs



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.

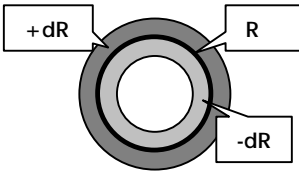
Arc 1: Middle Point				Adr: 408	
S	1.000000	Y	123.3450 m		
ih	1.5000 m	X	26.8216 m		
th	1.5000 m				
1000		Circle Centre			
<-----PNr----->		>-----Info----->			
Mode	Rec	Ion	R-MC	Ecc	HidP
Inpt	Code			+2	

or to measure M₁.

Then input the radius of Arc 1:

Arc 1	
Radius:	10.7500 m

to confirm the input.



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

Arc 1	
Parallel meas Radius dR	2.75 m

← to confirm the parallel offset.



Intersection of Lines

Definition of Element 2

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:

Intersect Pt:	
Intersect Pt S1	Es 133.8649 m Ns 34.8047 m
2000 Intersect Pn3 <---PNr---><---Info--->	
P→S	S-2 Info Mark Code

← to record the intersection point.

S - 2 to see the second intersection point

P→S to display the other offset distances

Offset A:	
M1-S 13.2060 m	M1-M2 10.0000 m
M2-S 8.0000 m	Tau 54.5339 gon
Rec	Cfg Rslt

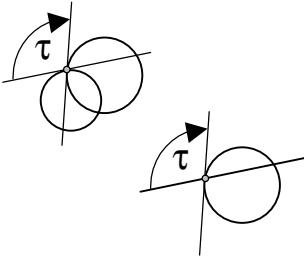
Rec Record the offsets

Cfg Configuration of the intersection angle

Rslt Back to the intersection point

Tau Intersection angles

Intersection of Arcs



Configuration
Programs
Coordinates

Rslt

Back to the inter-
section display

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.

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

Intersect Pt:		
Intersect Pt S1	Es	133.8649 m
	Ns	34.8047 m
2000	Intersect Pn	
<---PNr----->		<---Info---->
P->S	S-2	Info
		Mark Code

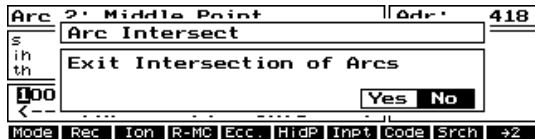
to confirm and record.

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

Arc Intersect
1 Next intersect with Arc 1
2 Next intersect with Arc 2
3 New intersection
4 Exit program

- 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:



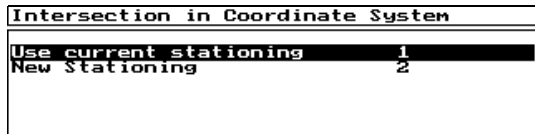
- No** back and further with the program,
- Yes** Escape without saving.

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.

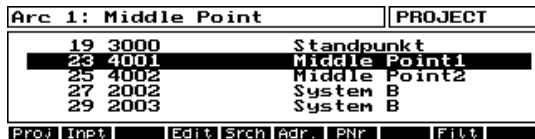
Definition of Lines

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 M₁ in Editor.

Intersection of Arcs

Arc 2: Middle Point				Adr: 425				
S	1.000000	SD	15.1150 m					
ih	1.5300 m	HZ	242.5200 gon					
th	1.5300 m	V1	100.3455 gon					
4002		Middle Point						
<---PNr--->		>---Info---						
Mode	Rec	Ion	R-M	Ecc	HidP	Inpt	Code	→2

or to measure point M₂.

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

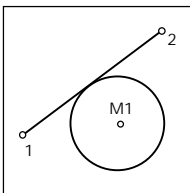
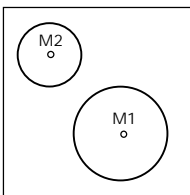
However, after confirming and recording the intersection point you will be asked if you want to set out (stake out) the point:

Schnittpunkt	
Schn	Schnittpunkt
102.4	Schnittpunkt abstecken
Ja Nein	
P->S	Info
Mark	Code

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:

Arc Intersect	
Arc Intersect	
1 N	No Intersection
2 N	
3 N	
4 E	Press any key to continue...
P->S	Info
Mark	Code

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

Intersect Pt	
Arc Intersect	
Inte	Line touches Arc
Press any key to continue...	
P->S	Info
Mark	Code

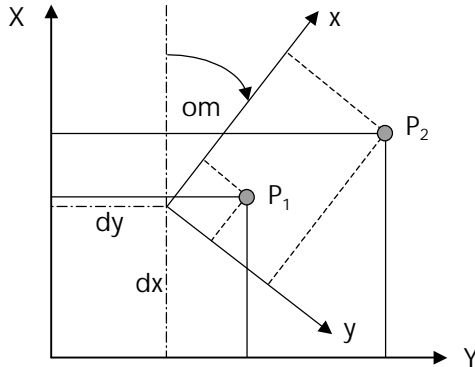
Transformations

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.

5 Coordinates		PROJECT
Detail Points	1	Transformation 6
Setting Out	2	HeadLine Lite
Traverse	3	
Intersect. Lines	4	
Intersect Arcs	5	



Selection of Transformation type

56 Transformations	
Helmert Transformation	1
Distance and offset	2
Transformation on a line	3

Helmert Transformation

Helmert Transformation 1

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

$$2 \leq P_T \leq 20$$

561 Helmert Transformation	
Transformation definition	1
System B->A	2
System A->B	3
Check Transformation	4

The Helmert Transformation Menu.

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

Transformations

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.

System A: Select Point Y/X		TRANS1
1	a1	
2	a2	
3	a3	
4	a4	
5	1001	

Proj Inpt Edit Srch Agr. PNr Filt

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


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

   to select and confirm.

Select System A			TRANS2
Nr.	Y	X	
1	400.000	100.000	
2	500.000	50.000	
3	400.000	0.000	
4	300.000	50.000	

More Del

Up to 20 points can be selected

 to continue to select system B points

Select System A		TRANS2
Nr	Select System A	
	To select System B change ?	<input type="button" value="Yes"/> <input type="button" value="No"/>

More Del

No to return to the system A list

Yes to go further and select common points in system B

Filt Select Filter

Mode Toggle to the local System

More to add more points from the editor

Del to delete a point from the list

Transformations

Esc to return to Helmert Transformation menu

System B: Select Point Y/X		TRANS1
7	1003	
8	b1	
9	b2	
10	b3	
11	b4	

Proj. Inpt. Edit Srch Adr. PNR Filt

← to add points to the system B list

More to add more points from the editor

Select System B			TRANS2
Nr.	Y	X	
1	949.995	900.002	
2	1000.002	1000.001	
3	1049.999	899.998	
4	1000.002	800.002	

More Del

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

Select System B		TRANS2
Helmert Transformation		
Nr.	Transformation calculate ?	
	Yes No	

More Del

No to escape to the Transform menu

Yes To compute the Helmert Transformation

 Stationing

Adjustment L2			s=free
Nr.	vy(m)	vx(m)	
1	-0.004	0.001	
2	0.002	0.000	
3	-0.001	-0.002	
4	0.003	0.002	

+P Del New Sclt Rslt L1-A

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

Result		s=fix	
o=	-63.6622	dy	1049.997 m
a=	0.0005	dx	499.999 m
s=	1.000000	ep	300.0005 eon
		m0	0.008 m
Transformation Okay ?		Yes	No

dy, dx Coordinate shift

Om Orientations angle

s Scale factor

o, a Transformation parameters

If only 2 points are transformed 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

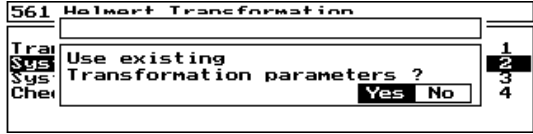
This allows the transformation of points in system B to the coordinates system A

561 Helmert Transformation	
Transformation definition	1
System B->A	2
System A->B	3
Check Transformation	4

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

Esc to return to Helmert Transformation menu




Filt Select Filter

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

Mode Toggle to the local System

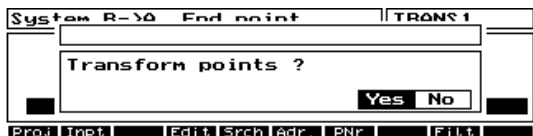
Proj Change the project



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

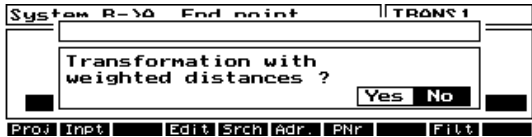
Tip

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 !

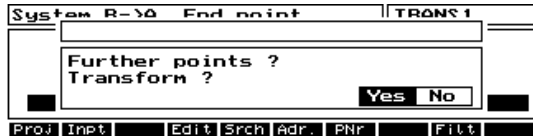
For a weighted distances computation of neighbourhood points a minimum of 3 identical points are needed.

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

561 Helmert Transformation	
Transformation definition	1
System B->A	2
System A->B	3
Check Transformation	4

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.

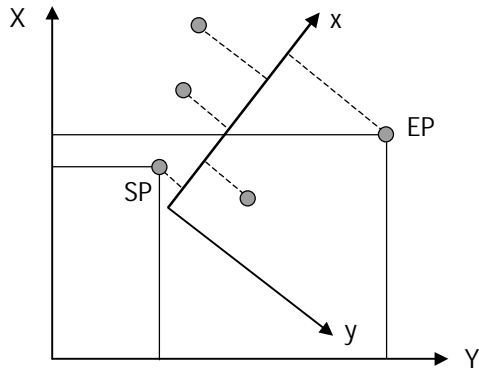
Transformations

Distance and offset

Distance and Offset 2

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

56 Transformations	
Helmert Transformation	1
Distance and offset	2
Transformation on a line	3



$P_T = 2$

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


Select Start Point SP	TRANS1
9 b2	
10 b3	
11 b4	
12 2100 start	
13 2101 end	

Proj Inpt Edit Srch Adr. PNr Fil

← to select.

Select End Point EP in the same way:

Select End Point EP	TRANS1
9 b2	
10 b3	
11 b4	
12 2100	start
13 2101	end
Proj Inpt	Edit Srch Adr. PNr Filt



 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 Transformation menu

Input Dist. and Off. for SP	Adr: 12
y 20.000 n	
x -5.000 n	
2100	start
<----PNr----->	<---Info--->

Input the Distance and Offset for the Start Point SP.


 or  to switch between inputs

 to confirm.

Input Dist. and Off. for EP	Adr: 12
y 220.855 n	
x -5.005 n	
2100	start
<----PNr----->	<---Info--->

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.

Transformations

Esc to return to the Transformation menu

The following screen will display the comparison:

5622 Distance Comparison	
\$ (computed)	200.838
\$ (measured)	200.855
dS	-0.017

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 Dist. and Offset	Adr:				
<table border="1"> <tr> <td>y</td> <td>105.223 m</td> </tr> <tr> <td>x</td> <td>4.550 m</td> </tr> </table>	y	105.223 m	x	4.550 m	
y	105.223 m				
x	4.550 m				
<---PNr---><---Info--->					
Mark Code					

Input the Distance and Offset to the Point

← to continue

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

Computed Coordinates	Adr: 438				
<table border="1"> <tr> <td>Y</td> <td>8.5845 m</td> </tr> <tr> <td>X</td> <td>8.3840 m</td> </tr> </table>	Y	8.5845 m	X	8.3840 m	
Y	8.5845 m				
X	8.3840 m				
2000 Offset					
<---PNr---><---Info--->					
Mark Code					

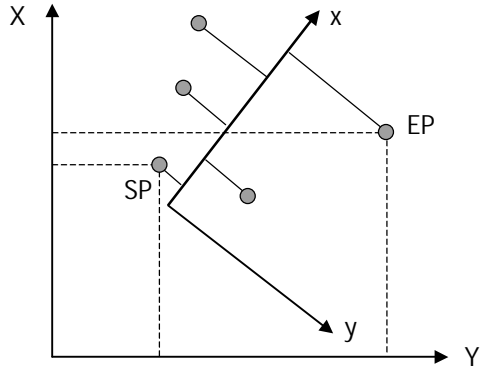
Enter the required Point Identification PI.

← to record the coordinate and PI in the current project

Transformation on a line

Transformation on a line 3

56 Transformations	
Helmert Transformation	1
Distance and offset	2
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.

Select Coordinates		TRANS 1
10	b3	
11	b4	
12	2100	start
13	2101	end
14	3555	house2

Proj Inpt Edit Srch Adr. PNr Filt


Identify the required coordinate in the usual way.

Transformations

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

Computed Distance and Offset		Adr: 438
y	6.9118 m	
x	17.5868 m	
4006	Dist. Offset	
<---PNr--->	>---Info---	
		Mark Code

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

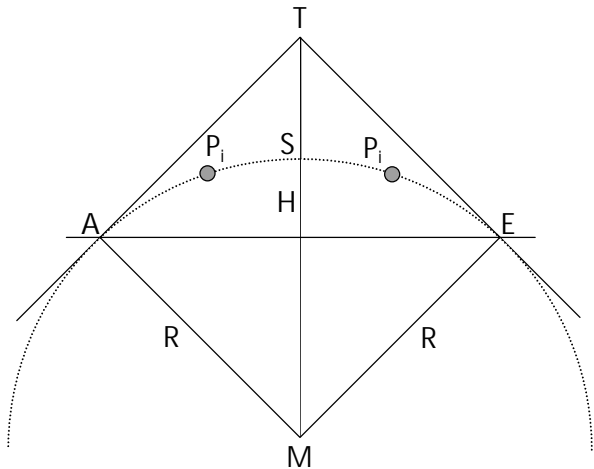
RoadLine Lite

Coordinates 5

Roadline Lite 7

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

5 Coordinates		PROJECT
Detail Points	1	Transformation
Setting Out	2	RoadLine Lite
Traverse	3	
Intersect. Lines	4	
Intersect. Arcs	5	



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

Stationing		
s	1.000000	Y
ih	0.000 m	X
		Z
		200.000 m
		500.000 m
		50.000 m
stat		
<---PNr-----><---Info---->		
Press any key to continue...		

Check the current stationing.

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

57	Choose element	PROJECT
	Roadline Lite	
Lin	Use last line ?	
Arc		
Spi		
		Yes No

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

No The following Element menu will be displayed:

57 Choose element		NONAME
Line	1	
Arc	2	
Spiral	3	

   Choose and confirm.

Esc Exit program.

Definition of a Line

Line 1

571 Line	Y[m]	X[m]
Start Point	-9999.000	-9999.000
End Point	-9999.000	-9999.000


Meas Edit

Editor menu of the Line element.

Meas Measure the defined point.

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

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

 to confirm

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

Error	Roadline Lite
Inputs are inconsistent !	
Press any key to continue...	

Definition of an Arc

Arc 2

5721 Arc	Y[m]	X[m]
Start Point	100.000	200.000
End point	200.000	500.50
Middle point	-9999.000	-9999.000
T.Intersect.	-9999.000	-9999.000



Meas Edit Grph

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

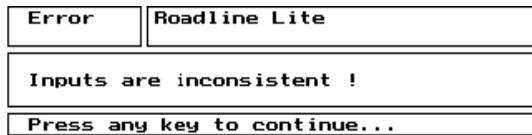
5722 Arc elements [m][gon]		
Radius	0.000	Directio Right
Arc 1.	0.000	MidOrd. 0.000
Tangent	0.000	External 0.000
Chord L	316.702	Center A 0.0000

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

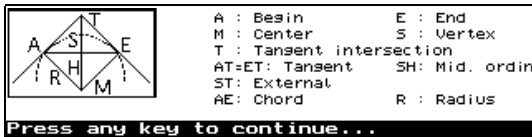
-  to toggle the direction.
-  to confirm.

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

5731 Spiral	Y[m]	X[m]
Start point	100.000	200.000
End point	200.000	500.500

Meas Edit Grph

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 = ∞

5732 Spiral elements [m]	
Parameter	0.000
Radius Start	600.000
Radius End	200.00
Direction	Right
Arc length	320.499

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

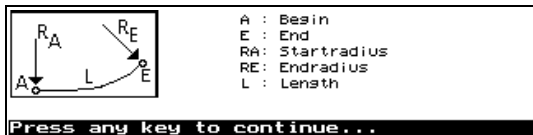
 to toggle the direction.

 to confirm and continue.

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

Error	Roadline Lite
Inputs are inconsistent !	
Press any key to continue...	

Grph for a graphic display of the allowed elements




Graphic display of the allowed elements.

Definition of the Start and End Stations

574 Input Stations	
Station Start	0.000
Station End	100.000

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

 to confirm.

Esc back to the RoadLine Elements

574 Input Stations	
Roadline Lite	
Sta	Difference in Length -11.000 m
Sta	Accept Input ?
	<input type="button" value="Yes"/> <input type="button" value="No"/>

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.

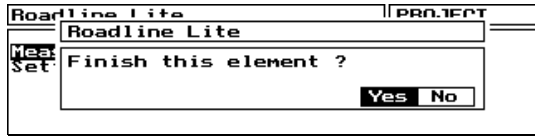
Measurement of Points

Roadline Lite	PROJECT
Measure	1
Setting out	2

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

 +  to select and start, or

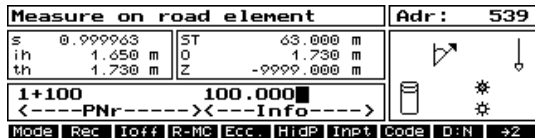
Esc to finish the roadline element.



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 **Mode**

The measured point will be computed referring 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

- loff** to increment the station and offset elements after each point is set out.
- lon**

Input SetOut point	
Station	10.000 n
Offset	5.000 n
Height	-9999.000 n







  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.

522 Setting Out		Adr: 307
dl -295.001 m	HD 527.376 m	 
da 490.000 m	da 0.0000 son	
th 0.000 m		
 +10.000 +5.000		 
 --- PNr ----- > < --- Info ---->		

-  **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.

Input SetOut point	
Roadline Lite	
Sta	Finish this element ?
Off:	
Hei:	
<input type="button" value="Yes"/> <input type="button" value="No"/>	

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 verification is not needed, it's better to turn it off. For large project files it could be a time consuming search function.

Automatic search for



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



Verify identical Point Numbers

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:

Residuals Verification Point			PROJECT
Adr.	vr [m]	vZ [m]	
f 1327	0.880	0.130	
1329	0.005	-0.006	
1330	0.005	0.006	
e Act	0.014	-0.008	

Mode: *BP Skip Cfs

  to scroll in list.

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

vr radiale difference

vZ height difference

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.



Configuration Menu 922111

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

Residuals Verification Point				PROJECT
Adr.	vY [m]	vX [m]	vZ [m]	
f 1327	-0.731	0.490	0.130	
1329	0.001	0.005	-0.006	
1330	-0.002	-0.005	0.006	
e Act	0.006	0.012	-0.008	

Mode: *BP Skip Cfs

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

Detail Points

± 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 computation.

Cfg Link to Configuration Verification Points

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

 **Configuration**
Menu 92211

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

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


Verification by search radius

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 independent 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

Residuals Verification Point			PROJECT
Adr.	v1[m]	va[gon]	vq[m]
f 1327	0.858	0.1254	0.197
1329	0.002	-0.0028	-0.004
1330	0.002	-0.0028	0.004
e Act	0.004	-0.0082	-0.013

Mode ±BP Skip Cfg

 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	Vl	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	Vl	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	Vl	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 registered 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 registered 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 registered 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::

? Editor		PROJECT
1328	COORDINATES/DETAIL PNTS/	
1329	666777	A
1330	666777	M
1331	666777	M
1332	COORDINATES/DETAIL PNTS/	
Pro.	Inpt.	Del. Edit. Srch. Adr. PNr. Repl. Filt. →2

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:

Error	Verification Point Over run
Too many identical points !	
Press any key to continue...	

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.

Error	Verification Point Over run
Index list is overrun !	
Press any key to continue...	

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.

☛ Important Note !

Points, registered with the **Rec** Softkey, will not be used for verification control.

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

This chapter describes 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

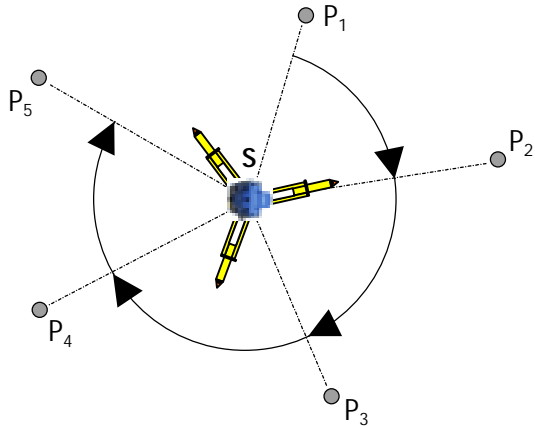
Multiple Rounds

Special 6

Multiple Rounds 1

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

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



$2 \leq P_i \leq 50$

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).

Station		PROJECT	
S	1.000000	Y	200.000 m
ih	0.000 m	X	500.000 m
		Z	50.000 m
Stat			
<---Pnr---		>---Info---	
Info		Inpt	Mark
Code		Swtp	

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

Multiple Rounds


Preparation

Choose the measure method and recording requirement

Multiple Rounds	
2-Face-Measure	On
Recording of rounds	Off

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

HDHzV, YXZ or Off.

 to select

 to confirm and continue



Configuration Programs Special

Configuration of the round differences

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

92331 Multiple Rounds differences	
Azimuth Difference	da : 0.0050 gon
UA Difference	dv : 0.0050 gon
Distance Difference	d1 : 0.040 m
Orthogonal Deviation	dq : 0.040 m

Configuration of the standard deviations

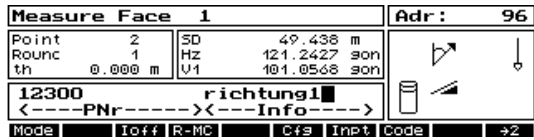
92332 Multiple Rounds Stand. Deviation	
Error Limits for Single Observations	
s(Hz) :	0.0050 gon
s(U) :	0.0050 gon
s(SD) :	0.005 m

Standard deviation for a single measurement.

Multiples Rounds

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

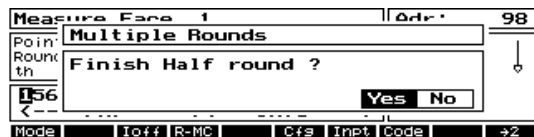
to input a reflector height

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 asks to abort. If more than one point was measured, it 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..

Multiple Rounds

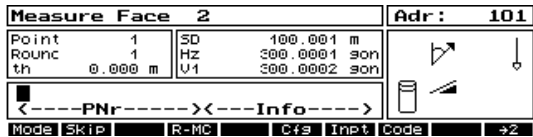
Measuring in two faces

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

Turn instrument to Pos. 2 !

Press any key to continue...

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



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.

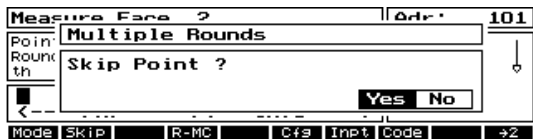


to measure in manual mode.

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.

Multiple Rounds

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

Error	Measure in 2 Faces Tolerance exceeded
Repeat measurement ? <input type="button" value="Yes"/> <input type="button" value="No"/>	

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:

Multiple Rounds	PROJECT
Further Round 1 Result 2	

Further Rounds 1

Result 2

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

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

Esc to finish the measuring and compute the averages.

Multiple Rounds	PROJECT
Multiple Rounds	
Fur	Exit Program ? <input type="button" value="Yes"/> <input type="button" value="No"/>
Res	

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

Standard deviation		PROJECT	
Average value		Single Measurement	
SD	0.000 m	SD	0.000 m
SHz	0.0001 gon	SH	0.0001 gon
SV	0.0001 gon	SV	0.0001 gon

Totl Rnd Cfs

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

Totl To show the total average

Total average			PROJECT
Nr.	SD[m]	Hz [gon]	U[gon]
1	100.001	100.0001	99.9999
2	100.001	200.0001	100.0000
3	100.001	300.0000	100.0000
4	100.001	200.0001	99.9999

Mode

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

Rnd to show the round average.

Round average 1			PROJECT
Nr.	SD[m]	Hz [gon]	U[gon]
1	100.001	100.0000	99.9999
2	100.001	200.0000	100.0000
3	100.001	300.0001	99.9999
4	100.001	200.0002	99.9999

Mode Corr ±P DelR DelP Rnd- Rnd+

± 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.



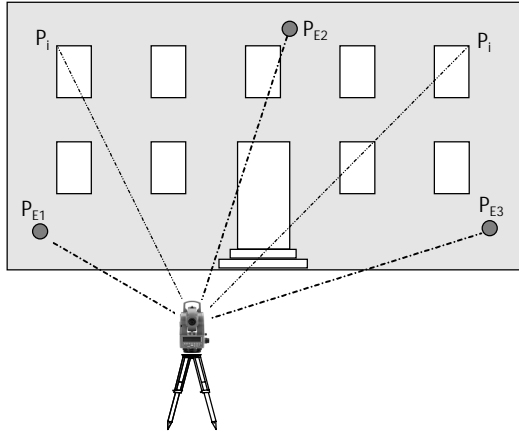
3D Plane

Special 6



3D Plane 3

Establish a remote 2D or 3D plane, and then measure detail points in the plane without using a prism

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



$2 \leq P_E \leq 30$

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.

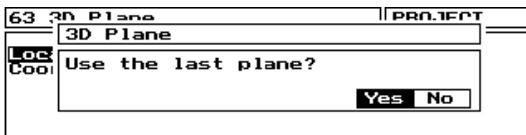
If measuring in a coordinate system, the 3D Plane defining points P_E can be called up from the project file.

63 3D Plane	PROJECT
Local System	1
Coordinate System	2

Choose the system required to define the plane.

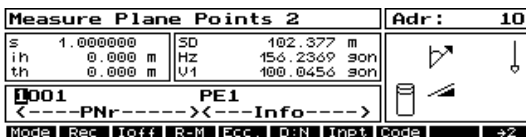
3D Plane

Working in a local system



- Yes** the last defined plane will be used,
- No** to continue defining a new plane.

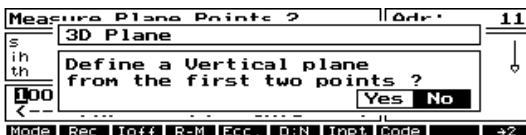
Definition of the 3D Plane



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.

More to measure further plane points

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

3D Plane - Results		PROJECT	
ih	0.000 m	Y	0.000 m
No.	3	X	0.000 m
s0	0.000 m	Z	0.000 m

More

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.

3D Plane - Results		PROJECT	
ih	0.000 m	Y	0.000 m
No.	6	X	0.000 m
s0	0.001 m	Z	0.000 m

More **Conn**

Measuring further points will allow an adjustment of the plane.

Corr To display the residual corrections

Residuals L2	
Nr.	d[m]
3	0.000
4	0.000
5	0.001
6	-0.001

±BP **Del.** **L1-A**

L1-A L1-Norm Adjustment to find gross errors

±AP Point out- / in- from calculation

Del Delete point

d[m] Orthogonal offset of the adjusted points.

⚠ Attention !

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

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

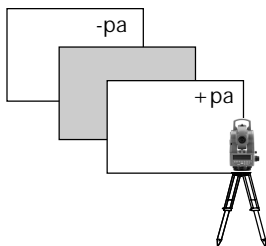
Error	3D Plane
Further points necessary !	
Press any key to continue...	


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	SD	107.736 m
pa	0.000 m	tz	191.2233 30n
		J1	105.4376 30n
2005		Facade	
<----PNr----->		<----Info---->	
Mode	Rec	loff	R-MR
Inpt	Code	CtrlP	+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 $\pm pa$.

 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
- loff** Incrementation
- Mark** Marking
- Rec** Repeat save
- R-MR** Registration mode

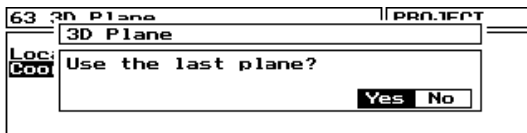
3D Plane

Measure in a coordinate system



Coordinate System 2

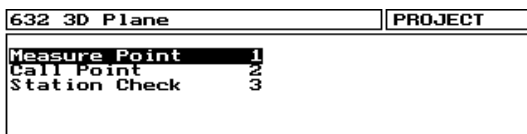
After a position and height stationing, the 3D plane can be defined, and will allow measuring within the same coordinate system



Yes to use the existing definition,

No further to redefine the plane.

Measure Point 1

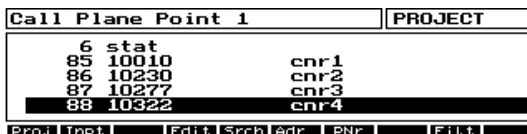


To measure the points in the given coordinate system.

Measure in a local system

Call Point 2

To recall the points from the coordinate editor.



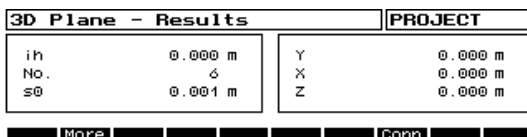
Data management Editor

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:



3D Plane

Check Station 3

Before measurement the current stationing can be checked

Stationing			
S	1.000000	Y	200.000 m
ih	0.000 m	X	500.000 m
		Z	50.000 m

stat
<---PNr---><---Info--->
Press any key to continue...

⚠ Attention !


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

Area Calculation

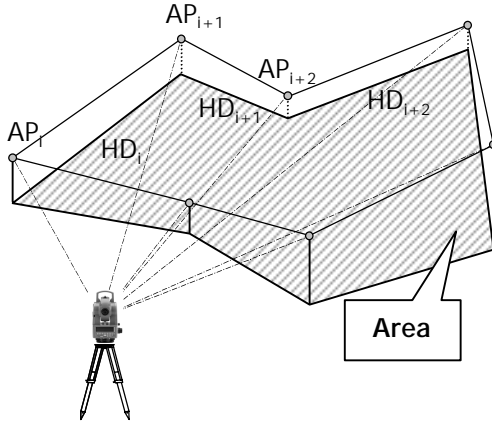
Special 6



Area Computation 4



Allows an horizontal 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 Filt		

   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.

Area Calculation

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:

643 List cnr. points			AREA
Nr		HD[m]	
1	1001	Corner Poi	30.0000
2	1002	Radius beg	28.2843
3	1003	Radius End	30.0000
4	1004	Radius beg	50.0000

More Del View N Ar Crv2 Crv3 Rslt

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)

643 List cnr. points		AREA
Nr	Input Nominal Area	
1		100
2		43
3	Nominal area 2298.0000 m ²	100
4		100

More Del View N Ar Crv2 Crv3 Rslt

 to enter the nominal area.

Rslt to see an interim result

Area Result		
NA	2298.0000 m ²	Ar 2300.0000 m ²
dA	-2.0000 m ²	
pA	-0.0870 %	np 5
4711 Area Result		
<----PNr-----><---Info----		

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:

643 List cnr. points		AREA
Nr	Area calculation	1.00
1	Save Area ?	43.00
3		100.00
4	Yes No	100.00

More Del View N Ar Crv2 Crv3 Rslt

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.

643 List cnr. points		AREA
Nr		HD[m]
1	1001 Corner Poi	30.0000
2	1002 Radius beg	28.2843
3	1003 Radius End	30.0000
4	1004 Radius beg	50.0000

More Del View N Ar Crv2 Crv3 Rslt

List of Area Points.


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

643 List cnr. points		AREA
Nr	Arc information	1.00
2	Radius	20.0000 m
3	Arc	positive
4		100.00

More Del View N Ar Crv2 Crv3 Rslt

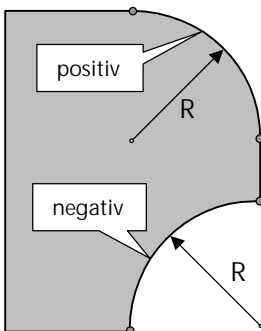
The cursor has to be set on the curve starting point in the list. The next point in list will be automatically the end point of the curve .

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:



Area Calculation

Crv2 again on start point to cancel a 2 point curve

Crv3 defines a 3 point curve

643 List cnr. points				AREA
Nr				HD[m]
1	1001	Corner Poi		30.0000
2c	1002	Radius beg		28.2843
3c	1003	Radius End		30.0000
4	1004	Radius beg		50.0000

More Del View N Ar Crv2 Crv3 Rslt



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.

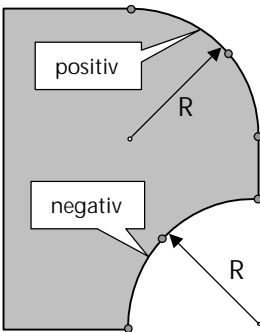
643 List cnr. points				AREA
Arc information				
1				00
2		Radius	38.0789 m	43
3		Arc	positive	00
4				00

More Del View N Ar Crv2 Crv3 Rslt

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:

643 List cnr. points				AREA
Nr				HD[m]
1c	1001	Corner Poi		30.0000
2c	1002	Radius beg		28.2843
3c	1003	Radius End		30.0000
4	1004	Radius beg		50.0000

More Del View N Ar Crv2 Crv3 Rslt

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:

Error	Area calculation Point already exists
Point will not used !	
Press any key to continue...	

The point will be ignored.

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

Error	
Weak Configuration	
Press any key to continue...	

will be displayed and the curve will be ignored.



Connecting Distances

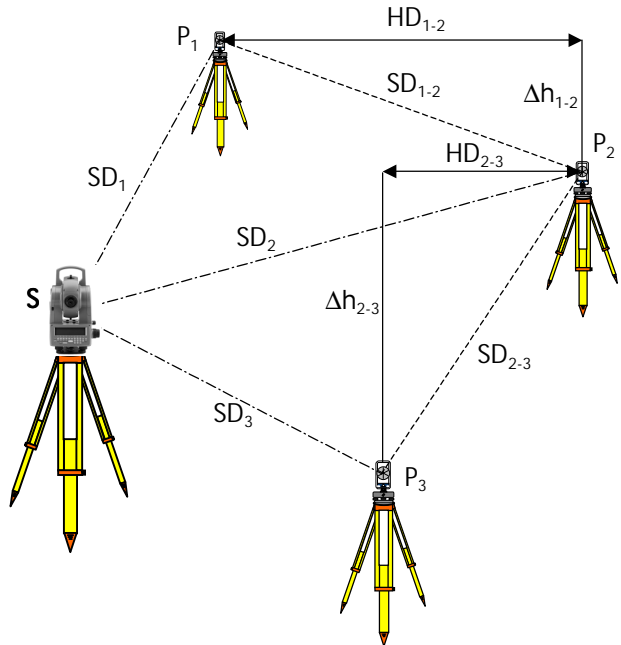
Special 6

Connecting Distances 5

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

- between the first measured point P_1 and further points ($P_1 \rightarrow P_i$)
- or
- between successive points ($P_i \rightarrow P_{i+1}$)
- by
- Measure in a local system.
- or
- Measure or call up points from project file in the stationed coordinate system.

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



- ⊕ : $SD_{HzV_{S,P_i}}$
- 📏 : $SD_{1-i}, HD_{1-i}, \Delta h_{1-i}$ or
- 📏 : $SD_{i-i+1}, HD_{i-i+1}, \Delta h_{i-i+1}$

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

65 Connecting Distances	PROJECT
Local System	1
Coordinate System	2
Station Check	3

⬆️ ⬇️ ⬅️ to select the coordinate system.

Local System

Local System 1

The connecting distances will be calculated only by measured points.

Local System	PROJECT
With Heightstationing	1
Without Heightstationing	2

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 referring to the Z-height of the stationing. Selecting with Heightstationing, the last stationing will be displayed for control:

417 Stationing OK?								
ih	1.650 m	<table border="1"> <tr> <td>Y</td> <td>3398809.264 m</td> </tr> <tr> <td>X</td> <td>5589314.299 m</td> </tr> <tr> <td>Z</td> <td>111.435 m</td> </tr> </table>	Y	3398809.264 m	X	5589314.299 m	Z	111.435 m
Y	3398809.264 m							
X	5589314.299 m							
Z	111.435 m							
1000 Free Station		Yes No						
<----PNr-----><---Info---								

- No** Back to the last menu.
- Yes** The Heightstationing will be accepted. Further with measurement of the connecting distances:

651 Measure P1		Adr: 574
s	1.000000	SD 130.001 m
ih	1.690 m	HZ 40.8368 soh
th	1.560 m	V1 97.4000 soh
1000 Start Point		
<----PNr-----><---Info---		
Mode Rec Io+f R-MC 1+P Edit Inpt Code →2		

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** :

Connecting Distances

1→P Conn. Dist. $P_1 \rightarrow P_i$

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

651 Measure 1 → P_i				Adr: 556	
S	1.000000	SD	85.695 m		
ih	1.690 m	HD	85.674 m		
th	1.560 m	h	-1.878 m		
3001 Connect.Dist.					
<---PNr---><---Info--->					
Mode	Rec	Io+I	R-MC	1→P	Edit Inpt Code
					→2

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.

651 Measure P → P_i				Adr: 569	
S	1.000000	SD	161.061 m		
ih	1.690 m	HD	160.974 m		
th	1.560 m	h	5.306 m		
3001 Connect.Dist.					
<---PNr---><---Info--->					
Mode	Rec	Io+I	R-MC	P→P	Edit Inpt Code
					→2

or to measure.

Tip

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

Switch for display of further measurement results

651 Measure 1 → P_i				Adr: 578	
S	1.000000	y	77.786 m		
ih	1.690 m	x	104.156 m		
th	1.560 m	Z	429.345 m		
3001 Connect.Dist.					
<---PNr---><---Info--->					
Mode	Rec	Io+I	R-MC	1→P	Edit Inpt Code
					→2

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 (Heightstaging)
 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.

Connecting Distances

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

Call Point P1		PROJECT
11	1004	System A
13	1005	System A
14	1000	Startpoint
19	3000	Standpunkt
23	4001	Middle Point1

Proj Inpt Edit Srch Adr. PNr Filt

The program goes automatically into the Editor to call up the start point P₁ from project file.



to select, or

Esc

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

651 Measure P1		Adr: 585
s	1.000049	SD 112.457 m
ih	1.690 m	HZ 397.5156 gon
th	1.560 m	V1 100.0034 gon
1000 Startpoint		
<---PNr---><---Info---		

Mode Rec Io+f R-MC 1>P Edit Inpt Code →2



to measure.

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

651 Measure 1 → Pi		Adr: 586
s	1.000049	SD 112.001 m
ih	1.690 m	HZ 248.8368 gon
th	1.560 m	V1 100.0000 gon
2000 Connect.Dist		
<---PNr---><---Info---		

Mode Rec Io+f R-MC 1>P Edit Inpt Code →2



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 :

Call Point P_i		PROJECT
369	23r3r	
371	4009	Line Point 2
373	4010	Line Point 2
375	4011	Line Point 2
377	4012	Line Point 2

Pro: Inpt: Edit: Srch Adr.: PNr Filt:

   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:

651 Result 1 → P_i			Adr: 588
m	1.000000	SD	173.7766 m
ih	1.5800 m	HD	173.7377 m
th	1.6900 m	Z	124.3904 m

2000 Connect Dist

<----PNr-----> <---Info--->

Mode: Rec Ie in 1→P Code

 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 .

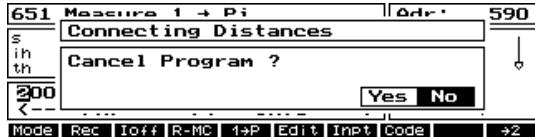
P→P Connect. Distance
 $P_i \rightarrow P_{i+1}$

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

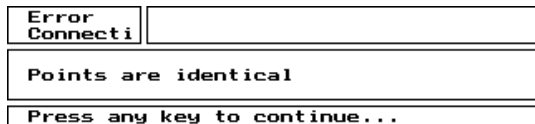


No Back to the measurement menu.

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..



92 Program Configuration				
Stationing	1			
Coordinates	2			
Special	3			
Gen. Functions	4			
Project Info	5	Default	Set.	0

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

Configuration Coordinates

Configuration Special

Configuration Coordinates

Programs 2

Coordinates 2

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

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.

$$\begin{aligned} & 0.000 \leq da < 1 \text{ gon} \\ & 0 \leq dr/dq/dl/dh < 1 \text{ m} \end{aligned}$$

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.

Configuration Coordinates

Detail Points 1

Search Radius 3

Input of a search radius.

 $0.000 \leq SR \leq 1 \text{ m}$

Detail Points 1


Switch 4

Switch On / Off Verification Point.

Selection if search for point number or search radius.


Verification Points	
Search radius	<input type="text" value="0.050 m"/>

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

 to accept.

Switch Verification Pts.	
Verification Points On Selection	<input type="checkbox"/> Point number

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 verification is not needed, it's better to turn it off. For large project files it could be a time consuming search function.

Configuration Coordinates

Traverse 3

Definition of error limits for the results of traverse measurement.

Traverse Error Limits	
Coord. Misclos. dY :	0.0020 m
Coord. Misclos. dX :	0.0020 m
Height Error	0.0010 m
Distance Error	0.0020 m
Cross Error	0.0020 m
Angle Error	0.0040 gon



  to the input fields.

 to accept the entry.

Intersections 4

Definition of limits for weak geometry.

9224 Configuration for Intersections	
Limits for	
Intersection, Weak geom. :	1.0 gon
Intersec.-Extr. weak geom:	20 gon

  to the input fields.

 to accept the entry.

Helmert Transformation 6

Configuration of Helmert Transformation.

9226 Helmert Transformation	
Error Limits	1
Adjustment	2
Scale Range	3



Configuration menu Helmert Transformation.


This configuration is similar to the free stationing.

 **Configuration**
Stationing

92261 Helmert Trans. Error Limits				
		s=fix	s=free	
Radial Dev.	vr	0.0400	0.0300	m

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

  to the input fields.

 to accept the entry.

Configuration Special

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(U) :	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.



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