



Leica FlexLine TS02 TS06 TS09 Mining Application

Version 1.0
English

- when it has to be **right**

Leica
Geosystems

Introduction



Symbols

To use equipment in the permitted manner, please refer to the detailed safety instructions in the FlexLine TS02 TS06 TS09 User Manual.

The symbols used in this manual have the following meanings:



Type	Description
	Important paragraphs which must be adhered to in practice as they enable the product to be used in a technically correct and efficient manner.
F1 - F4	Press the function button F1 to F4 .
	Navigation keys.

Table of Contents

In this manual	Chapter	Page
	1 Tolerances	5
	1.1 Defining Tolerances	5
	1.2 Selecting Tolerance Profiles	7
	1.3 PIN (Personal Identification Number)	8
	2 Peg Survey	9
	2.1 Overview	9
	2.2 Starting Peg Survey	11
	2.3 Measuring Peg Survey	15
	2.4 Peg Survey Results	19
	3 Line Peg	22
	4 Grades	23
	4.1 Overview	23
	4.2 Starting Grades	25
	4.3 Gradeline Marking	27
	4.4 Grade Results	30
	5 Offset	32
	5.1 Overview	32

5.2	Starting Offset	34
5.3	Offset Results	37
6	Mining Editor	38
<hr/>		
6.1	Overview	38
6.2	Functionality	39
Index		44

1

Tolerances

1.1

Defining Tolerances

Description

Before use of the mining applications, tolerance profiles have to be defined and selected. The definition of tolerances can be done either via the Mining Editor software or manually on the instrument. This chapter describes defining and selecting tolerances manually. Refer to "6 Mining Editor" for details on using the Mining Editor software.


Access

1. Select **Prog** from the **MAIN MENU**.
 2. Select **Define Tolerances** from the **PROGRAMS** menu.
 3. Enter the current PIN.
 4. Press **OK** to proceed to the tolerance profile screen.
-



If a wrong PIN has been typed in 5 times, a Personal UnblockCode (PUK) is required, which can be found on the instrument delivery papers. If the entered PUK code is correct, then the PIN code is reset to default value "123456".

Define tolerances step-by-step

Step	Description
1.	Select the tolerance profile to define. Primary , Secondary or Tertiary .
2.	Enter the limits for horizontal direction, horizontal distance and height.
3.	Select the preferred sequence BFFB , BFBF , or BBFF , and number of sets.  B = Backsight point. F = Foresight point.

Step	Description
4.	Repeat steps 1 to 3 for each of the three tolerance profiles.
5.	Set the defined tolerances by pressing SET .

1.2

Select tolerances step-by-step

Selecting Tolerance Profiles

Step	Description
1.	Start a mining application.
2.	Select Set Tolerances .
3.	Select Select Tolerances .
4.	Select either a Primary , Secondary or Tertiary tolerance profile to be applied.
5.	Press SET to set the selected profile.
6.	Press: ACCEPT to accept the profile in the tolerances summary screen. OR REJECT to reject the profile and return to the define tolerance profile screen.



- Tolerances themselves can be changed by using the PIN-protected **Define Tolerance** application. Refer to "1.1 Defining Tolerances".
- If a tolerance was uploaded by the Mining Editor software, this tolerance will appear as "Uploaded" and cannot be changed on the instrument.

1.3 PIN (Personal Identification Number)

Description

The definition of tolerances is PIN protected to prevent unauthorised changes. The PIN is definable by the user. If a wrong PIN has been typed in 5 times, a Personal UnblockKey code (PUK) is required, which can be found on the instrument delivery papers. If the entered PUK code is correct, then the PIN code is reset to default value "123456".

Set PIN code step-by-step

Step	Description
1.	Select Setting from the MAIN MENU .
2.	Select Mining from the SETTINGS MENU .
3.	Enter the current PIN in PIN-CODE: .
4.	Press OK .
5.	Enter a personal PIN Code (max. 6 characters numeric) in New PIN-Code: .
6.	Accept with OK .



The default PIN is "123456".

2

2.1

Peg Survey

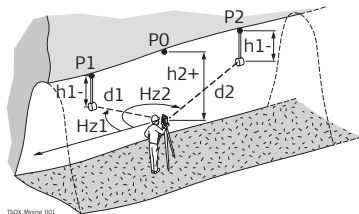
Overview

Description

The application Peg Survey is used:

- to establish a forward peg (point).
- to control the intermediate horizontal angle between backsight and foresight points.
- to check the horizontal distances and heights of the backsight and foresight points.
- to compute the coordinates of the foresight point.

Users can measure several sets in different sequences. The quality of measurement is controlled by the tolerances which are set before starting Peg Survey.



P0	Station
P1	Backsight point
P2	Foresight point
$h1-$	Height of the reflector
$h2+$	Height of the instrument
$d1$	Distance to backsight point
$d2$	Distance to foresight point
$HZ1$	Horizontal direction to backsight point
$HZ2$	Horizontal direction to foresight point

Known

- Coordinates of station
- Coordinates of backsight point

Unknown

- Coordinates of foresight point
-


2.2

Starting Peg Survey

Access

1. Select **Prog** from the **MAIN MENU**.
2. Select **Peg Survey** from the **PROGRAMS** menu.
3. Complete the application pre-settings by:
 - Selecting a job, and
 - Confirming the set of tolerances. Refer to "1.2 Selecting Tolerance Profiles".
4. Select **Start** to proceed to **Input Station**.

Input station step-by-step

Step	Description
1.	Enter the point ID (PtID).
2.	For manual entry of instrument height: <ul style="list-style-type: none">• Enter instrument height (hi) of the station. For measuring the instrument height: <ul style="list-style-type: none">• Turn the telescope to the azimuth with the help of the displayed vertical angle (V).• Press DIST to measure distance to the peg.  The sign for the instrument height is normally negative.
3.	Press SET to set the point ID and instrument height.

Messages

The following are important messages or warnings that may appear.

Messages	Description	Measures
Station or BS point has no valid coords !	The point ID entered is not available in the internal memory or it has invalid coordinates.	Re-enter point ID (Step 1.).

Next step

Press **SET** to proceed to the **TOLERANCE INFO** screen.

TOLERANCE INFO


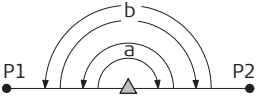

TOLERANCE INFO	
Survey will be executed acc. to the following settings:	
No. of Sets:	2
Sequence :	BFFB
dHz :	0° 00' 36"
dHD :	0.010 m
dH :	0.010 m
OK	

OK

To continue with Peg Survey.

Description of fields

Field	Description
No. of Sets	One set means to measure the backsight point (P1) twice and the foresight point (P2) twice, in both faces.

Field	Description
	<p data-bbox="562 168 671 194">One Set</p>  <p data-bbox="758 256 831 267"><small>TSCX_Mining_002</small></p> <p data-bbox="562 285 682 311">Two Sets</p>  <p data-bbox="758 438 831 448"><small>TSCX_Mining_003</small></p> <p data-bbox="562 458 630 495"></p> <p data-bbox="678 458 1362 552">The user must complete the number of sets as preset in the tolerance settings. A maximum number of 20 sets is supported by the application.</p>
Sequence	<p data-bbox="562 565 972 591">Displays the measuring sequence.</p> <p data-bbox="562 607 1253 632">BFFB Backsight-Foresight-Foresight-Backsight.</p> <p data-bbox="562 648 1253 674">BFBF Backsight-Foresight-Backsight-Foresight.</p> <p data-bbox="562 689 1253 715">BBFF Backsight-Backsight-Foresight-Foresight.</p>
dHz	Tolerated residual in horizontal direction.
dHD	Tolerated residual in horizontal distance.
dH	Tolerated residual in height.

Next step

Step	Description
1.	Press OK to proceed to the number of sets screen. The number of sets screen displays which set is about to be measured out of the total number of sets remaining. For example, Set 1 of total 3 means the measurement will be the first set of three.
2.	Press OK to proceed to the Measure Backsight Point screen. The Measure Backsight Point screen displays information about which backsight point the user has to measure.
3.	Press OK to proceed to the backsight point measurement screen.

2.3

Measuring Peg Survey

Access

Press **OK** from the **Measure Backsight Point** screen.

Backsight Point

Backsight Point 1/2	
PtID:	1
Hz :	100°47' 59"
V :	74°59' 16"
hr :	-1.236 m
HD :	----- m
MEASURE SEARCH [] EXIT	

MEASURE

To start angle and distance measurements and save the measured values.

SEARCH

To search for a different backsight point.

EXIT

To exit the application and return to the **PEG SURVEY** settings screen.

Foresight Point

Foresight Point 1/2	
PtID:	3
Hz :	190°48' 00"
V :	74°59' 16"
hr :	-1.632 m
HD :	----- m
MEASURE DIST GRADE EXIT	


DIST

To start distance and angle measurements without saving the measured values.

GRADE

To edit current grades. Refer to "4 Grades".

Measure points step-by-step

Step	Description
1.	Enter the reflector height (hr:) for the backsight point, if required.
2.	Aim at backsight point and press MEASURE .
3.	Depending on the measurement sequence selected, enter a desired backsight or foresight point ID (PtID:). OK saves the point ID and proceeds to the measurement screen.
4.	Enter the reflector height (hr:) for the point, if required.
5.	Aim at target point and press MEASURE .
6.	Decide whether to measure an additional point: <ul style="list-style-type: none"> • NO Repeat steps 2. and 5. until all sets are measured. • YES Repeat steps 3. to 5. with a new point.  A maximum of 7 additional points can be measured.
7.	If the tolerances after a set are not met, the user has the option to continue with the measurements or reject the data. <ul style="list-style-type: none"> • REJECT to reject the measurements and remeasure the set again. • ACCEPT to accept the result and continue with the next set.

Next step

After each set the **TOLERANCES MET**, or the **Out of tolerance** screen displays.

TOLERANCES MET

TOLERANCE INFO 1/2	
Tolerances met !	
FS ID :	3
dHz :	0°00' 25"
ToI. Hz :	0°00' 50"
dHD BS :	0.001 m
dHD FS :	0.003 m
ToI. HD :	0.006 m
OK	EXIT

OK

To proceed to the results screen.

EXIT

To exit the application and return to the **PEG SURVEY** settings screen.

Description of fields

Field	Description
BS/FS ID	Point ID for backsight and foresight points.
dHz	Horizontal angle residual.
ToI.Hz	Horizontal angle tolerance.
dHD BS/FS	Horizontal distance residual for the backsight and foresight points.
ToI.HD	Horizontal distance tolerance.
dH BS/FS	Height residual for the backsight and foresight points.
ToI.H	Height tolerance.
Set No	Set number.

Next step

Press **OK** to proceed to the results screen.

2.4

Peg Survey Results

Access

Press **OK** from the **TOLERANCES MET** screen.

TRAVERSE RESULT

TRAVERSE RESULT 1/2		
FS ID	:	1
BS ID	:	3
mHz	:	56° 36' 25"
mHD BS	:	56.465 m
mHBS	:	0.786 m
mHD FS	:	46.632 m
mHFS	:	1.236 m
OK		EXIT

OK

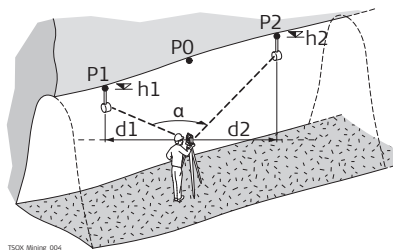
To save the data and exit the application.

EXIT

To exit the application and return to the **PEG SURVEY** settings screen.

Description of fields

Field	Description
BS/FS ID	Point ID for backsight and foresight points.
mHz	Average horizontal angle between backsight point and foresight point.
mHD BS/FS	Average horizontal distance to backsight and foresight points.
mH BS/FS	Average height to backsight and foresight points.
Sequence	Sequence of measurements.
No. of Sets	Number of sets.



TSCM_Mining_004

- P0 Station
 P1 Backsight point
 P2 Foresight point
 α mHz: Averaged horizontal angle
 d1 mHDBS: Average horizontal distance to the backsight point
 d2 mHDFS: Average horizontal distance to the foresight point
 h1 mHBS: Average height of the backsight point
 h2 mHFS: Average height of the foresight point

Saving the data

The following results are stored in the internal memory.

Field	Description
Result	
mHz	Average horizontal angle between backsight point and foresight point.
mHD	Average horizontal distance to backsight and foresight points.
mH	Average height to backsight and foresight points.
Residual	
dHz	Horizontal angle residual.
dHD	Horizontal distance residual.

Field	Description
dH	Height residual.
Coordinates foresight point	
E	Easting.
N	Northing.
H	Height point.
GrEl	Grade elevation.

Next step

Press **OK** to save the data and exit the application. The **CONTINUE WITH...** screen appears for access to the **GRADES** or **OFFSET** applications. Refer to "4.2 Starting Grades" and "5.2 Starting Offset".

3**Line Peg**

Description

The application Line Peg is used to mark a new line peg. This application is similar to Peg Survey except there is only one set of measurements required.

For the Line Peg application, follow the procedure described in "2 Peg Survey".

4

4.1

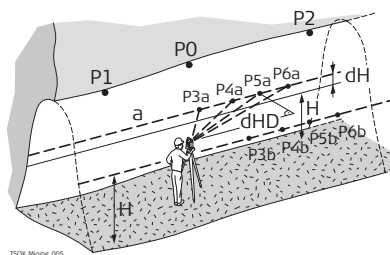
Description

Grades

Overview

The Grades application is used:

- to mark gradelines along the side walls of the mines or tunnels.
- to input the slope gradient and an offset concerning the grade point.
- to compute the stake out height difference.
- to map the positions of the grade points along the gradelines.



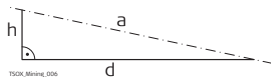
P0	Station
P1	Backsight point
P2	Foresight point
a	New gradeline
P3a - P6a	Measured points
P3b - P6b	New gradeline points
dHD	Horizontal distance along the foresight line.
H	Current height of gradeline above mine floor.
dH	Height difference to new gradeline.

Known

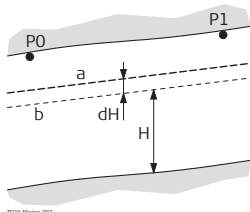
- Coordinates and grade elevation of station
- Coordinates and grade elevation of backsight point
- Slope gradient, station to foresight point
- Height difference (dH) between current gradeline and new gradeline

Unknown

- Stake out height difference (dHgt) between measured point and gradeline point
- Horizontal distance (dHD) along the foresight line

Slope gradient

- a Gradeline
- h Height
- d Vertical distance

Height difference

- P0 Station
- P1 Foresight point
- a New gradeline
- b Current gradeline
- H Current height of gradeline above mine floor
- dH Height difference between current gradeline and new gradeline

4.2

Starting Grades

Access

The Grades application is started by either selecting it in the **PROGRAMS** menu or after measuring in the applications **PEG SURVEY** and **LINE PEG**.

When started from the **PROGRAMS** menu, station data must be entered and a measurement made to backsight and foresight points first, before the Grade application can be used.

Starting grades step-by-step

Step	Description
1.	Select Prog from the MAIN MENU .
2.	Select GRADES & OFFSET from the PROGRAMS menu, and complete the application pre-settings by: <ul style="list-style-type: none">• Selecting a job, and• Confirming the set of tolerances. Refer to "1.2 Selecting Tolerance Profiles".
3.	Select Start to proceed to the Input Station screen.
4.	Input station data and measure to the backsight and foresight points. Refer to "2 Peg Survey" for details on this process.
5.	Accept the tolerances from the measurements.
6.	In the CONTINUE WITH screen, press GRADES to start the Grade application.

GRADES

Enter the slope gradient as a proportion, for example 1:150, and the height difference.

If the slope gradient from the station to the foresight point is the same as the slope gradient from the backsight point to the station then no gradient needs to be entered.

GRADES	
Grade (1:x):	1: 4.123
Grade (%):	24.25 %
Grade (Ang):	13°38'00"
Direction :	Down (-) (↓)
Height :	0.500 m
SET	CHAIN EXIT

SET

To save the current values.

CHAIN

To enter a chain length instead of a gradient.

EXIT

To exit the application and return to the **CONTINUE WITH** screen.

Next Step

Press **SET** to set the entered values and proceed to the **GRADELINE MARKING** screen.

4.3

Gradeline Marking

Access

Press **SET** from the **GRADES** screen.

GRADELINE MARKING

GRADELINE MARKING	
PtID:	FP10
dHgt:	0.552 m
dHD :	3.123 m
Hz :	126°56'45"
HD :	10.253 m
MEASURE	
DIST	
PREV	
EXIT	

MEASURE

To start angle and distance measurements and save the measured values.

DIST

To start distance and angle measurements without saving the measured values.

PREV



To return to the previous screen.

EXIT

To exit the application and return to the **GRADES** screen.

Description of fields

Field	Description
PtID	Point ID of the measured point.
dHgt	Difference in height between the measured point and the grade point.

Field	Description
	 If the sign is negative the stake out point is above the measured point. If the sign is positive the stake out point is below the measured point.
dHD	Difference in horizontal distance between the measured point and the grade point.  If the sign is negative the stake out point is further away than the measured point. If the sign is positive the stake out point is closer than the measured point.
Hz	Current horizontal angle.
HD	Measured horizontal distance.

Gradeline marking step-by-step

Step	Description
1.	Enter a desired point ID (PtID:).
2.	Aim at the target point and press MEASURE . The height difference (dHgt:) and horizontal distance difference (dHD:) will display.
3.	Turn the telescope until the height difference (dHgt:) is zero, then repeat the measurement.

Next step

Press **MEASURE** to measure and record data for the current point and proceed to measure another point.

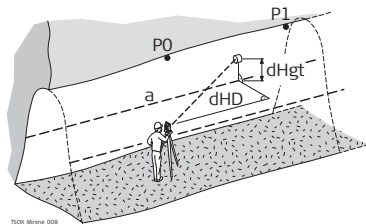
4.4

Grade Results

Description

The Grades application computes the height difference (dHgt) between the measured point and the stake out point, and the difference in horizontal distance (dHD) along the foresight line.

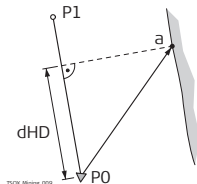
Profile view



TSCK, Mining 008

P0	Station
P1	Foresight point
a	Gradeline
dHgt	Difference in height
dHD	Difference in horizontal distance

Top view



TSCK, Mining 009

P0	Station
P1	Foresight point
a	New gradeline point
dHD	Difference in horizontal distance

Saving the data

The following results are stored in the internal memory.

Field	Description
Measurement data	
PtID	Point ID.
Hz	Horizontal angle.
V	Vertical angle.
HD	Horizontal distance.
SD	Slope distance.
dH	Height difference.
Coordinates of new gradeline point	
E	Easting.
N	Northing.
H	Height.
Grades Result	
daH	Stake out height difference.
daHD	Horizontal distance along the foresight line.
Grd	Slope gradient.
GE	Grade elevation.

5

Offset

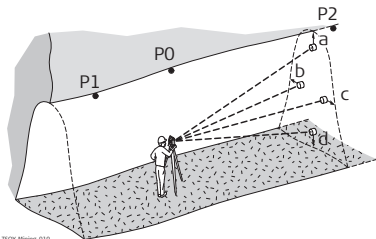
5.1

Overview

Description

The Offset application is used:

- to record sections of the tunnels for volume computation and mapping.
- to input an offset value, left, right, up or down.
- to compute, after measurement, the actual coordinates of the tunnel walls.



P0	Station
P1	Backsight point
P2	Foresight point
a	Up
b	Left
c	Right
d	Down

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Known

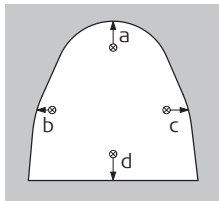
- Coordinates of station
- Coordinates of backsight point
- Offset value

Unknown

- Point coordinates of the tunnel walls

Offset

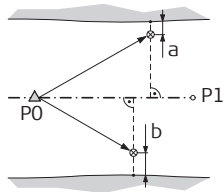
Profile view



TSOK_Mining_011

- a Up
- b Left
- c Right
- d Down

Top view



TSOK_Mining_012

- P0 Station
- P1 Foresight point
- a Offset left
- b Offset right

5.2 Starting Offset

Access

The Offset application is started by either selecting it in the **PROGRAMS** menu or after measuring in the applications **PEG SURVEY** and **LINE PEG**.

When started from the **PROGRAMS** menu, station data must be entered and a measurement made to backsight and foresight points first, before the Offset application can be used.

Starting offset step-by-step

Step	Description
1.	Select Prog from the MAIN MENU .
2.	Select GRADES & OFFSET from the PROGRAMS menu, and complete the application pre-settings by: <ul style="list-style-type: none"> • Selecting a job, and • Confirming the set of tolerances. Refer to "1.2 Selecting Tolerance Profiles".
3.	Select Start to proceed to the Input Station screen.
4.	Input station data and measure to the backsight and foresight points. Refer to "2 Peg Survey" for details on this process.
5.	Accept the tolerances from the measurements.
6.	In the CONTINUE WITH screen, press OFFSET to start the Offset application.

OFFSET

OFFSET	
PtID :	FP10
Offset:	1.500 m
	LEFT
Code :	-----
Hz :	123° 12' 35"
HD :	----- m
MEASURE	DIST
	EXIT

MEASURE

To start angle and distance measurements and save the measured values.


DIST

To start distance and angle measurements without saving the measured values.

EXIT

To exit the application and return to the **CONTINUE WITH** screen.

Offset step-by-step

Step	Description
1.	Enter a desired point ID (PtID:) and the offset value.
2.	Select the offset definition, Left , Right , Up or Down .
3.	Aim at the target point and press MEASURE . The measurement is triggered and stored.  After storing, the application returns to the OFFSET screen.
4.	To measure a new point, repeat steps 1. to 3.

Next step

Press **MEASURE** to measure and record data for the current point and proceed to measure another point.

5.3



Saving the data

Offset Results

The measurement data is already corrected according to the offset values.

The following results are stored in the internal memory.

Field	Description
Measurement data	
PtID	Point ID.
Hz	Horizontal angle.
V	Vertical angle.
HD	Horizontal distance.
SD	Slope distance.
Offset information	
Offset	Offset value.
OffsetDir	Offset direction (left, up, right, down).
Coordinates of new offset point	
E	Easting.
N	Northing.
H	Height.

6 Mining Editor

6.1 Overview

Description

The Mining Editor is a Windows-based program used for the data exchange between the instrument and a computer.

Installation on the computer

The installation program for the Mining Editor can be found on the CD-ROM supplied. Please note that the Mining Editor can only be installed under the operating systems MS Windows 95, 98, ME, NT4.0, WINDOWS2000, or WINDOWSXP. For the installation, select "setup.exe" in the directory "MiningEditor\Disk1" on the CD-ROM and follow the onscreen instructions to complete the installation.

Program content

The Mining Editor can be used for the following purposes:

Creating fixpoint files

Creating and editing of fixpoint files such as coordinates.

Defining and uploading tolerances

Defining, editing (password protected), and uploading tolerances.

Data import and export

Importing and exporting fixpoint files (ASCII format).

Data transfer between computer and instrument

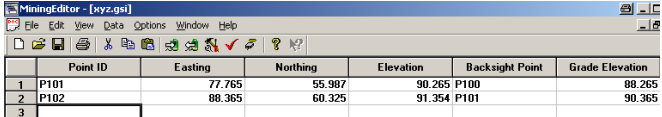
Uploading of fixpoint files and tolerances, downloading of fixpoint files and measurement data, and conversion of measurement data to various formats for peg calculation and archiving.

6.2

Creating fixpoint files step-by-step

Functionality



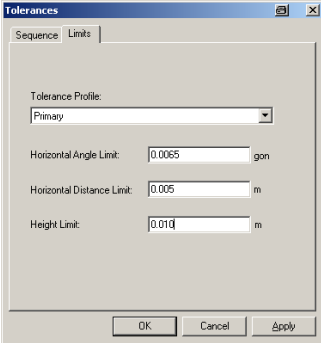
In the fixpoint entry module, the Mining Editor allows users to create, view, modify and save coordinate lists.

Step	Description																												
1.	Open a new file: File -> New .																												
2.	Enter point IDs, and for each one: coordinates, a backsight reference point, and a grade elevation.  <table border="1"><thead><tr><th></th><th>Point ID</th><th>Easting</th><th>Northing</th><th>Elevation</th><th>Backsight Point</th><th>Grade Elevation</th></tr></thead><tbody><tr><td>1</td><td>P101</td><td>77.765</td><td>55.987</td><td>90.265</td><td>P100</td><td>88.265</td></tr><tr><td>2</td><td>P102</td><td>88.365</td><td>60.325</td><td>91.354</td><td>P101</td><td>90.365</td></tr><tr><td>3</td><td></td><td></td><td></td><td></td><td></td><td></td></tr></tbody></table>		Point ID	Easting	Northing	Elevation	Backsight Point	Grade Elevation	1	P101	77.765	55.987	90.265	P100	88.265	2	P102	88.365	60.325	91.354	P101	90.365	3						
	Point ID	Easting	Northing	Elevation	Backsight Point	Grade Elevation																							
1	P101	77.765	55.987	90.265	P100	88.265																							
2	P102	88.365	60.325	91.354	P101	90.365																							
3																													
3.	Save the created coordinate list: File -> Save As .																												

Define tolerances step-by-step



For defining tolerances ensure that the unit setting on the instrument, select **Settings -> General**, is identical to the units set in the Mining Editor, select **Options -> Settings**.

Step	Description
1.	Open tolerances: Options -> Tolerances -> Edit .
2.	Enter the password.

Step	Description
	 To create a new password: Options -> Password .
3.	Select a measuring sequence: BFFB , BFBF or BBFF .  B = Backsight point. F= Foresight point.
4.	Enter the number of sets.
5.	On the Limits tab, select a tolerance type. Primary , Secondary , or Tertiary . 

Step	Description
6.	Enter the values for: <ul style="list-style-type: none"> • Horizontal Angle Limit: • Horizontal Distance Limit: • Height Limit:
7.	Press OK to save the tolerances.
8.	Refer to "Uploading step-by-step" to upload tolerances to the instrument.

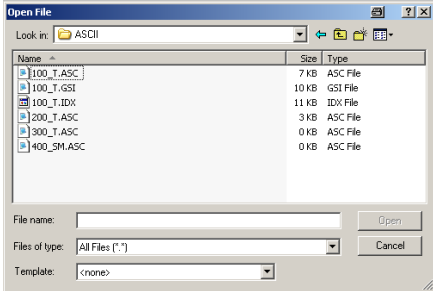
Uploading step-by-step

Step	Description
1.	Connect the instrument via the serial interface RS232 to the computer. The instrument communication settings must be set to Port: RS232 and Baudrate: 19200 .  To enable a higher data transfer speed at 19200 bauds, the baudrate must be entered manually in the Com-Port settings.
2.	In Mining Editor, open a fixpoint file: File - > Open .
3.	Choose Upload: Data - > Upload .
4.	Select a job folder on the instrument to save the data into.  If the selected job already has data, all existing data will be overwritten by the new file being uploaded.

Step	Description
5.	Enter a jobname, operator and comments. Operator and comments are optional.
6.	Select a tolerance type and select OK.
7.	The file uploading will begin and a status bar will indicate the progress.

Process imported fixpoint files step- by-step

The Mining Editor allows import of fixpoint files in ASCII format.

Step	Description
1.	<p>Open an ASCII formatted file: File -> Open.</p> 

Step	Description
2.	Search and select the ASCII-File.
3.	Open the selected file.
4.	Follow the wizard onscreen instructions to convert the ASCII file into the correct format.
5.	Save the created file: File - > Save as .

Index

A

Applications	
Grades	23
Line peg	22
Offset	32
Peg survey	9

H

Height difference, description	24
--------------------------------------	----

I

Installation, of mining editor	38
--------------------------------------	----

M

Mining editor	
Creating fixpoint files	39
Defining tolerances	39
Functionality	39
Installation	38
Process imported files	42
Software	38
Uploading	41

O

Offset, description of	33
------------------------------	----

P

PIN code, set	8
---------------------	---

S

Sequence, description	13
Sets, description	12
Slope gradient, description	24
Symbols, used in this manual	2

T

Tolerances	
Defining	5
Met	17
Select profile	7

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