User Manual Mining Application Program

English
Version 1.0

Leica Geosystems

To use equipment in the permitted manner, please refer to the detailed safety instructions in the TPS400 User Manual (English version).

Contents

How to use this manual

This manual describes the basic operation of the TPS400 Mining field programs. It shall be used together with a TPS400 instrument.

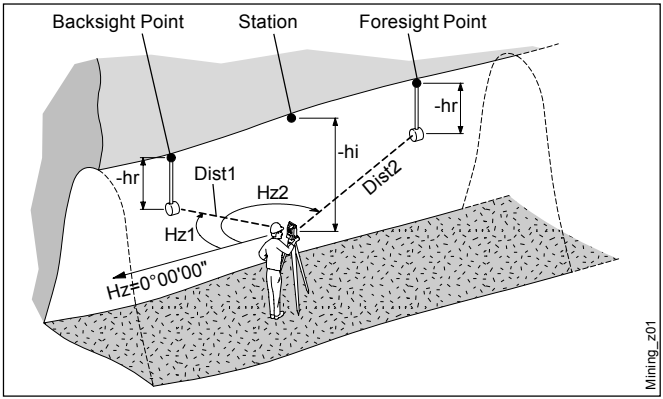
For detailed description about the whole functionality of the TPS400 instrument please refer to the TPS400 User Manual.

Symbols used in the sequence of operation

[MENU]	Press the [MENU] button
F1 - F4	Press the function button [F1-F4]
	Navigation keys
	Repeat operation
	User input is necessary
	Important paragraphs which must be adhered to in practice as they enable the product to be used in a technically correct and efficient manner.

Introduction

The application "Peg Survey" is used to establish a forward peg (point). It is used to control the intermediate horizontal angle between backsight and foresight points. It also checks the horizontal distances and heights of the backsight and foresight points. It computes the coordinates of the foresight point. "Peg Survey" allows users to measure several sets in different sequences. (The quality of measurement is controlled by the tolerances which are set before starting "Peg Survey").



Known:

- Coordinates of station
- Coordinates of backsight point

Unknown:

- Coordinates of foresight point

Data uploading using "Mining Editor"

- Station coordinates (East, North, Height, Grade elevation)
- Backsight point coordinates (East, North, Height, Grade elevation)
- Tolerances, sequence, number of sets
- Job definition

Uploading of fixpoint coordinates, tolerances, sequence and number of sets is mandatory to enable the operation of "Peg Survey".

To create new jobs on board the instrument, a set of tolerance must be available.

Start and execution Peg Survey

- Press [MENU] and [F1] for programs.
- Press [F1] for Peg Survey.

> Step 1 Select a job.

> Step 2 Confirm the set of tolerances.

> Step 3 Choose "Start" by pressing [F4], then enter point number (PtID) and instrument height (hi) for the station.

The sign for the instrument height (hi) is normally negative.

> Step 4 **[SET]** Set Point number (PtID) and instrument height (hi).

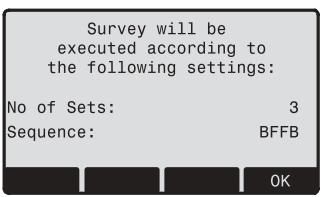
[EXIT] Leaves "Input Station" and returns to the start-up menu.

Station or BS point has no valid coords !

- The point number entered is not available in the internal memory or it has invalid coordinates.

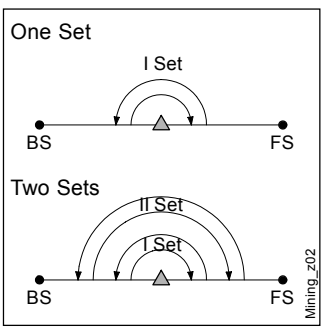
Re-enter point number (**> Step 3**).

Sample dialog:



Number of sets:
One set means to measure two times the backsight point and two times the foresight point in both faces.

The meaning of set is described:



The user must complete the number of sets as preset in the tolerance setting.

Sequence:

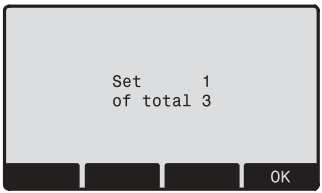
It defines the measuring sequence.

Options:

- **BFFB**
  Backsight-Foresight-Foresight-Backsight
- **BFBF**
  Backsight-Foresight-Backsight-Foresight
- **BBFF**
  Backsight-Backsight-Foresight-Foresight

[OK] Leaves this dialog and proceed to the next dialog.

Sample dialog:



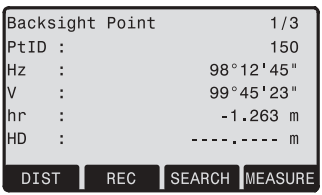
Set 1 of total 3
Start with measurement first set of three.

[OK] Leaves this dialog and proceed to the next dialog.

Measure Backsight Point
Information about which backsight point the user has to measure.

[OK] Leaves this dialog and proceed to the measure dialog.

Sample dialog:



> Step 5 Enter the reflector height (hr) for the backsight point, if required.

> Step 6 Aim at backsight point and measure.

[MEASURE] or **[DIST]/[REC]** Angle and distance measurements are triggered and stored in the internal memory.

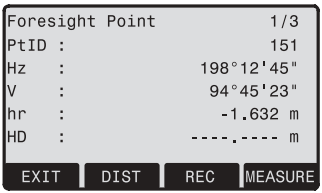
[SEARCH] Allows users to search and choose a different backsight point.

[EXIT] Terminates the program and returns to the start-up menu.

> Step 7 Enter a desired foresight point number (PtID).

[OK] Saves the foresight point number and proceed to the measure dialog.

Sample dialog:



> Step 8 Enter the reflector height (hr) for the foresight point, if required.

> Step 9 Aim at foresight point and measure.

[MEASURE] or **[DIST]/[REC]** Angle and distance measurements are triggered and stored in the internal memory.

[EXIT] Terminates the program and returns to the start-up menu.

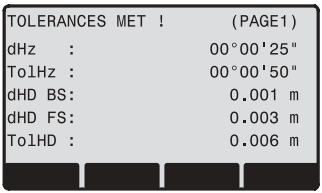
Repeat **> Step 6** and **> Step 9** until all sets are measured.

If the tolerances after a set are not met, the user has the option to continue with the measuring or rejecting the data.

[REJECT] Reject the measurement and measure the set again.

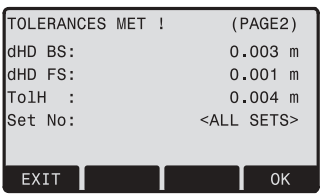
[ACCEPT] Accept the result and continue with the next set.

Sample dialog:



[PAGE]

Sample dialog:



Tolerances dialog:

- **dHz:** Residual on the horizontal angle
- **dHD:** Residual on the horizontal distance
- **dH:** Height residual
- **TolHz, TolHD, TolH:** Tolerances horizontal angle, horizontal distance and height
- **Set No:** Set number

[OK] Leaves this dialog and proceed to the result dialog.

[EXIT] Terminates the measurement and returns to the start-up menu.

Sample dialog:

```
TRAVERSE RESULT (PAGE1)
mHz   :          56°36'25"
mHDBS:            56.465 m
mHBS  :             0.786 m
mHDFS:            46.632 m
mHFS  :             1.236 m
```

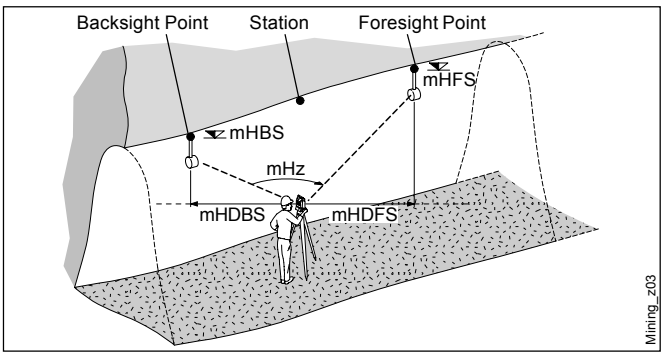
[PAGE]

Sample dialog:

```
TRAVERSE RESULT (PAGE2)
Pt BS:                 101
Pt FS:                 102
mHz   :          56°36'25"
Seq   :               BFFB
Num   :                  2
 EXIT                   OK
```

Result dialog:

- **mHz:** Average intermediate horizontal angle between backsight point and foresight point
- **mHDBS/FS:** Average horizontal distance (Backsight and Foresight)
- **mHBS/FS:** Average height (Backsight and Foresight)
- **Pt BS/FS:** Point number (Backsight and Foresight)
- **Seq:** Sequence
- **Num:** Number of sets



[OK] Quits the program.

[EXIT] Terminates the measurement and returns to the start-up menu.

Saving data

The following result data are stored in the internal memory:

Result:

mHz: Average intermediate horizontal angle between backsight point and foresight point

mHD: Average horizontal distance (backsight and foresight)

mH: Average height (backsight and foresight)

Residual:

dHz: Residual on the horizontal angle

dHD: Residual on the horizontal distance

dH: Height residual

Coordinates foresight point:

E: Easting

N: Northing

H: Height point

GrEl: Grade Elevation

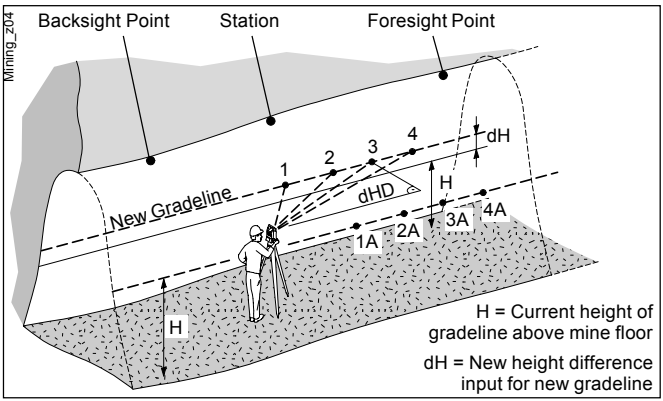
Introduction

The application "FLP" is used to mark a new line peg (Front line peg). This application is similar to "Peg Survey" and **there is only one set of measurement required**.

For a more detail explanation of "FLP", please refer to chapter "Peg Survey".

Introduction

"Grades" application is used to mark gradelines along the side walls of the mines (tunnels). It allows users to input the slope gradient and an offset concerning the grade point. It computes the stake out height difference. The program allows also to map the positions of the grades points along the gradelines.



Known:

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

Unknown:

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

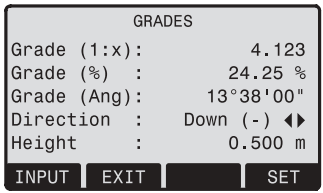
Start and execution Grades

You can start Grades either by selecting it in the program or after measuring in the application "Front Line Pag".

When you start it from programs you have to enter station data and measure to back- and foresight point first.

Menu dialog of "FLP":

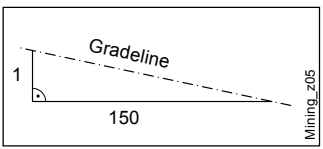
Sample dialog:



If the slope gradient (station until foresight point) is the same like the slope gradient (backsight point until station) then continue direct with **> Step 3**.

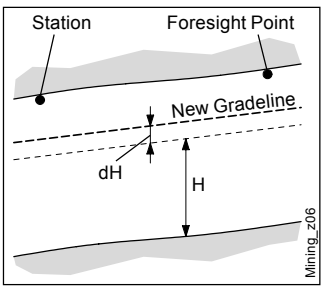
> Step 1 Enter the slope gradient (proportion e.g. 1:150).

Slope gradient explained:



> Step 2 Enter the height difference.

Height difference explained:



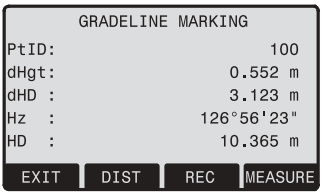
H: Current height of gradeline above mine floor

dH: Height difference

> Step 3 **[SET]** Set the entered values and proceeds to the gradeline marking dialog.

[EXIT] Leaves the application "Grades" and return to the menu dialog of "FLP".

Sample dialog:



> Step 4 Enter a desired point number (PtID).

> Step 5 Aim at target point and measure.

[MEASURE] or **[DIST]/[REC]** Measurement is triggered and stored in the internal memory.

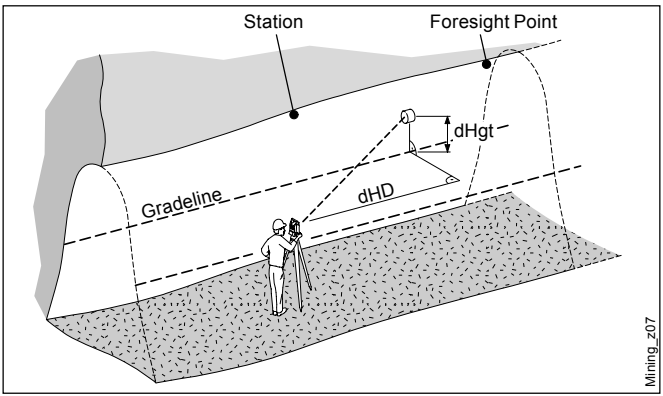
[PREV] Returns to the start of "Grades" application. For a new definition of slope gradient and height difference repeat **> Step 1** until **> Step 3**.

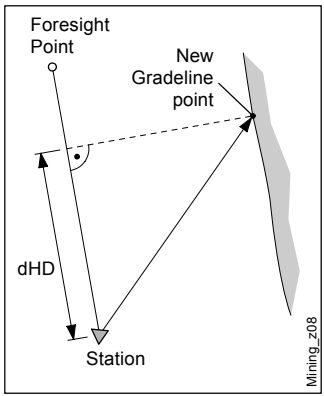
[EXIT] Leaves the application "Grades" and return to the menu dialog of "FLP".

Results

Grades computes the height difference (dHgt) between measure point and stake out point and the horizontal distance (dHD) along the foresight line.

Height difference (dHgt) and horizontal distance (dHD) explained:





If the sign is negative the grade point are above the measure point.

If the sign is positive the grade point are below the measure point.

> Step 6 Turn the telescope until the height difference (dHgt) is zero, then repeat the measurement (**> Step 5**).

Saving data

The following result data are stored in the internal memory:

Measurement data:

PtID:	Point number
Hz:	Horizontal angle
V:	Vertical angle
HD:	Horizontal distance
SD:	Slope distance
dH:	Height difference

Coordinates of new gradeline point:

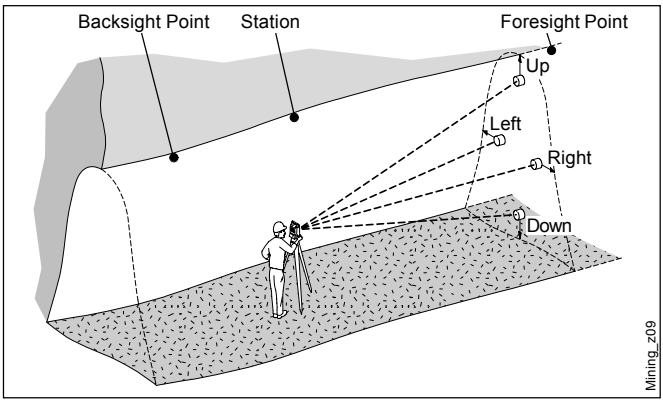
E:	Easting
N:	Northing
H:	Height

Grades Result:

daH:	Stake out height difference
daHD:	Horizontal distance along the foresight line
Grd:	Slope gradient
GE:	Grade elevation

Introduction

"Offset" application is generally used to obtain sections of the tunnels for volume computation as well as mapping of the tunnels. It allows users to input offset value (left, right, up and down) and computes after measurement the actual coordinates of the tunnel walls.



Known:

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

Unknown:

- Point coordinates of the tunnel walls

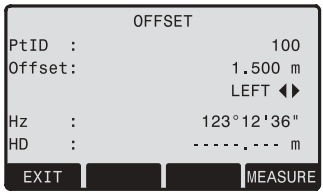
Start and execution Offset

You can start Offset either by selecting it in the program or after measuring in the application "Front Line Pag".

When you start it from programs you have to enter station data and measure to back- and foresight point first.

Menu dialog of "FLP":

Sample dialog:



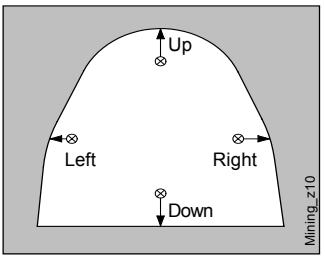
> Step 1 Enter a desired point number (PtID) and the offset value.

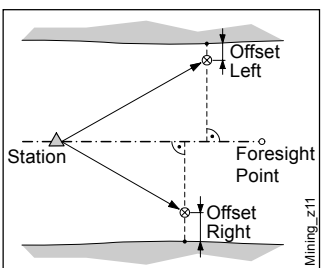
> Step 2 Using ◂ ▸ for the offset definition.

▸ (Left, Up, Right, Down)

◂ (Left, Down, Right, Up)

Definition of offset explained:





> Step 3 Aim at target point and measure.

[MEASURE] or **[DIST]/[REC]**
Measurement is triggered and stored in the internal memory.

[EXIT] Leaves the application Offset and return to the menu dialog of "FLP".

After storing, the program returns to the measuring dialog.

If you want to measure a new point repeat **> Step 1** until **> Step 3**.

Saving data

The following result data are stored in the internal memory:

Measurement data:

PtID:	Point number
Hz:	Horizontal Angle
V:	Vertical Angle
HD:	Horizontal distance
SD:	Slope distance

The measurement data are already corrected.

Offset information:

Offset:	Offset value
OffsetDir:	Offset direction (left, up, right, down)

Coordinates of new offset point:

E:	Easting
N:	Northing
H:	Height

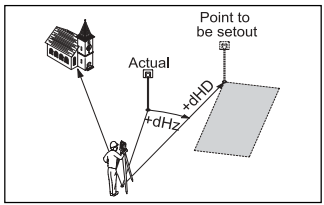
Polar setout

This program calculates the required elements to stakeout points from coordinates or manualy entered angles, horizontal distances and heights. Setting out differences can be displayed continuously.

Setting out coordinates from memory
Procedure:

◀ ▶	Select the point.
[DIST]	Starts measurement and calculation of the stake-out elements.
[REC]	Saves the displayed values.
[B&D]	Input direction and Hz-distance of stake out point.
[MANUAL]	Enables simplified input of a point without ptID and without the possibility of storing the data of the point.

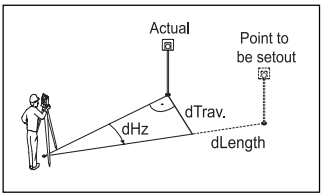
Normal indication of polar setout offsets dHz, dHD, ddH.



dHz:	Angle offset: positive if point to be set-out is to the right of the actual direction.
dHD:	Longitudinal offset: positive if point to be setout is further away.
ddH:	Height offset: positive if point to be setout is higher than measured point.

Orthogonal setout

The position offset between measured point and setout point is indicated in a longitudinal and transversal element.



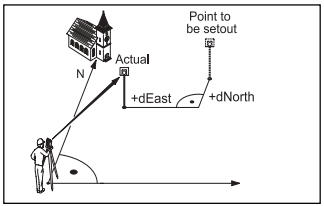
dLength: Longitudinal offset: positive if nominal point further away.

dTrav.: Transversal offset, perpendicular to line-of-sight: positive if nominal point is to the right of measured point.

dHeight: Height offset: positive if point to be setout is higher than measured point.

Cartesian setout

Setting out is based on a coordinate system and the offset is divided into a north and east element.



dEast Easting offset between setout and actual point.

dNorth Northing offset between setout and actual point.

dHeight: Height offset: positive if point to be setout is higher than measured point.

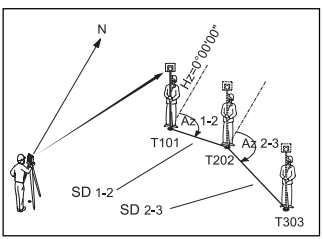
Tie Distance

The application **Tie Distance** computes slope distance, horizontal distance, height difference and azimuth of two target points measured **online**, selected from the **Memory** or entered using the **Keypad**.
The user can choose between two different methods:

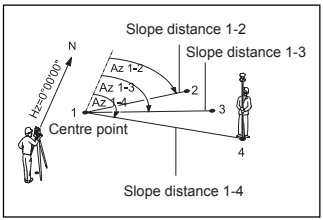
F1 Polygonal (A-B, B-C)

F2 Radial (A-B, A-C)

Polygonal Method:



Radial Method:



In principal both methods are the same.
Any differences will be described.

Procedure:

1. **Determine first target point.**

[ALL] Starts measurement to the target point.

[FIND] Searches internal memory for point entered.

2. **Determine second target point.**
   Proceed as with first target point.

3. **Result is displayed.**

Brg Azimuth between point1 and point2.

dSD Slope distance between point1 and point2.

dHD Horizontal distance between point1 and point2.

ddH Height difference between point1 and point2.

Softkeys - polygonal method:

[NewPt 1] An additional missing line is computed. Program starts again (at point 1).

[NewPt 2] Point 2 is set as starting point of a new missing line. New point (Pt 2) must be measured.

[RADIAL] Switches to radial method.

Softkeys - radial method:

[NewPt 1] Determine new central point.

[NewPt 2] Determine new radial point.

[POLY] Switch to polygonal method.

Introduction

"Mining Editor" (PC Program Package) is a Windows-based program used for the data exchange between the TPS400 Series and the PC.

Installation on the PC

The installation program for the "Mining Editor" can be found on the CD-ROM supplied. Please note that the "Mining Editor" program can only be installed under the operating systems MS Windows 95, 98, ME, NT4.0, WINDOWS2000, XP.
For the installation call program "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:

- **Data Import & Export**
  Import and export fixpoint files (ASCII format).
- **Data Transfer between PC and TPS400 instrument**
  Upload and download of fixpoint files, upload of tolerances, download of measurement data and conversion of measurement data to various formats for peg calculation and archiving.

Practical Examples

- **Define and upload Tolerances**
  Defining tolerances, editing tolerances (password protected), uploading tolerances
- **Creating fixpoint files**
  Creating and editing of fixpoint files (Coordinates)

The following pages of the manual describe the functionality of "Mining Editor" with two practical examples.

- **Example1:**
  Creating fixpoint files, Define tolerances, Uploading them to the instrument
- **Example2:**
  Importing of fixpoints in ASCII format

Creating fixpoint files

> Step 1 Open a new file: ***File → New***

> Step 2 Enter point number, coordinates, backsight reference point, grade elevation.

Mining.gsi

	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						

> Step 3 Save the created coordinate list: ***File → Save As***

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

Define tolerances

> Step 1 Open tolerances: ***Options → Tolerances → Edit***

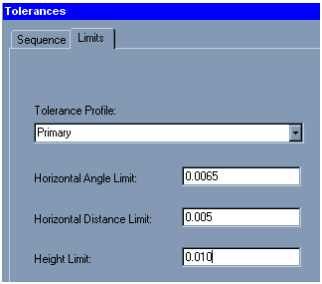
> Step 2 Enter a password.

Create a new password: ***Options → Password***

> Step 3 Select a measuring sequence (BFFB, BFBF or BBFF).

(B = Backsight point and F= Foresight point).

> Step 4 Enter number of sets.



> Step 5

a) Select a tolerance type (Primary, Secondary, Tertiary).

b) Enter the values for:
- Horizontal Angle Limit
- Horizontal Distance Limit
- Height Limit

Upload Fixpoints and Tolerances to the instrument

Ensure that the unit setting on the instrument (Menu / All Settings / Unit Settings) is identical to the units set in the "Mining Editor" (***Options → Settings***).

> Step 1 Open a fixpoint file: ***File → Open***

> Step 2 Choose Upload: ***Data → Upload***

> Step 3 Select a job.

> Step 4 Enter jobname, operator and comments.

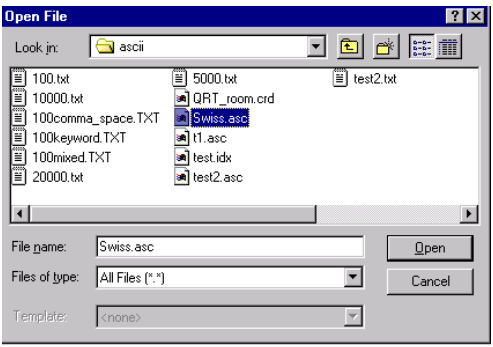
Operator and comments are optional.

> Step 5 Select a tolerance type.

Process import fixpoint files

The "Mining Editor" allows to import fixpoint files in ASCII format.

> Step 1 ***File → Open***



> Step 2 ASCII-File search and select.

> Step 3 Open the selected file.

Follow the wizard onscreen instructions to produce the correct format.

> Step 4 Save the created file:
File → Save as

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

Total Quality Management- Our commitment to total customer satisfaction

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

734337-1.0.0en

Leica Geosystems

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