

Leica TS03/TS07



Mining App
Version 1.0
English

- when it has to be **right**

Leica
Geosystems

Introduction



To use the product in a permitted manner, please refer to the detailed safety directions in the available User Manual.

Trademarks

- Windows is a registered trademark of Microsoft Corporation in the United States and other countries
- *Bluetooth®* is a registered trademark of Bluetooth SIG, Inc.

All other trademarks are the property of their respective owners.

Validity of this manual

This manual applies to the Mining app of FlexField running on the TS03/TS07. The app allows measuring and staking in mines.

Symbols

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.

Leica Geosystems address book

On the last page of this manual, you can find the address of Leica Geosystems headquarters. For a list of regional contacts, please visit http://leica-geosystems.com/contact-us/sales_support.



myWorld@Leica Geosystems (<https://myworld.leica-geosystems.com>) offers a wide range of services, information and training material.

With direct access to myWorld, you are able to access all relevant services whenever it is convenient for you.

Service	Description
myProducts	Add all products that you and your company own and explore your world of Leica Geosystems: View detailed information on your products and update your products with the latest software and keep up-to-date with the latest documentation.
myService	View the current service status and full service history of your products in Leica Geosystems service centres. Access detailed information on the services performed and download your latest calibration certificates and service reports.
mySupport	Create new support requests for your products that will be answered by your local Leica Geosystems Support Team. View the complete history of your support requests and view detailed information on each request in case you want to refer to previous support requests.
myTraining	Enhance your product knowledge with Leica Geosystems Campus - Information, Knowledge, Training. Study the latest online training material on your products and register for seminars or courses in your country.

Service	Description
myTrustedServices	Add your subscriptions and manage users for Leica Geosystems Trusted Services, the secure software services, that assist you to optimise your workflow and increase your efficiency.

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1 Tolerances

1.1 Defining

Description

Before using of the Mining app, tolerance profiles have to be defined and selected.

Define the tolerances manually on the instrument.

Access

1. Select **Apps** from the **Main Menu**.



2. Select the **Mining** tab.

3. Select **Tolerance**.



If defined in the settings, a PIN must be entered.

4. In **Mining Tolerances**, select **F2 Select Tolerances**.



If a wrong PIN has been typed in 5 times, a Personal Unblocking code (PUK) is required. The PUK has to be ordered from the selling unit or dealer. If the entered PUK code is correct, then the PIN code is reset to default value "123456".

Mining Tolerances

Enter the limits for all three tolerance profiles.

Mining Tolerances

Config.

Select Tolerances

Tol. Profile Primary

Hz Tol. 0.011 g

HD Tol. 0.0100m

H Tol. 0.0100m

Sequence B'F'F'B"

No.of Sets 2

Cont Quit

Key	Description
Cont	To set the defined tolerances. In the information window, Accept or Reject the settings.
Quit	To exit and return to the Mining Tolerances screen.

Description of fields



Field	Option	Description
Tol. Profile	Primary	Use this to define the tolerances for the highest precision.
	Secondary	Use this to define the tolerances for a medium precision.
	Tertiary	Use this to define the tolerances for the lowest precision.
Hz Tol.	Editable field	Tolerated residual in horizontal direction.

Field	Option	Description
HD Tol.	Editable field	Tolerated residual in horizontal distance.
H Tol.	Editable field	Tolerated residual in height.
Sequence		The measuring sequence. B = Backsight point F = Foresight point
	B'F'F'B"	All points are measured in face I, then all points are measured in face II in reverse sequential order.
	B'F'B"F"	All points are measured in face I, then measured in face II.
	B'B"F'F"	Backsight point is measured in face I immediately followed by face II. Other points are measured in face I, face II order.
No.of Sets	Editable field	One set means to measure the backsight point (P1) twice and the foresight point (P2) twice, in both faces. A maximum number of 10 sets is supported.

1.2

Selecting tolerances step-by-step

Selecting

1. Select **Apps** from the **Main Menu**.

2. Select the **Mining** tab.
3. Select **Tolerance**.

4. In **Mining Tolerances**, select **F2 Select Tolerances**.
5. Select either a **Primary**, **Secondary** or **Tertiary** tolerance profile to be applied.
6. Press **Cont** to set the selected profile.
7. 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 in Mining Tolerances. Refer to "1.1 Defining".


1.3


PIN (Personal Identification Number)

Description

The definition of tolerances, EDM and communication settings, can be protected by a PIN to prevent unauthorised changes. The Mining PIN is definable by the user. If a wrong PIN has been typed in 5 times, a Personal Unblocking code (PUK) is required. The PUK has to be ordered from the selling unit or dealer. If the entered PUK code is correct, then the Mining PIN code is reset to default value "123456".

Set PIN code step-by-step

1. Select **Settings** from the **Main Menu**.


2. Select the **Mining** tab.
3. Select **MiningPIN**.
4. Enter the current **Mining** PIN in **New PIN-Code**.
 The default PIN is **123456**.
5. Press **Cont.**
6. Enter a personal **Mining** PIN (max. six characters numeric) in **New PIN-Code**.
7. Accept with **Cont.**

2 Peg Survey

2.1 Overview

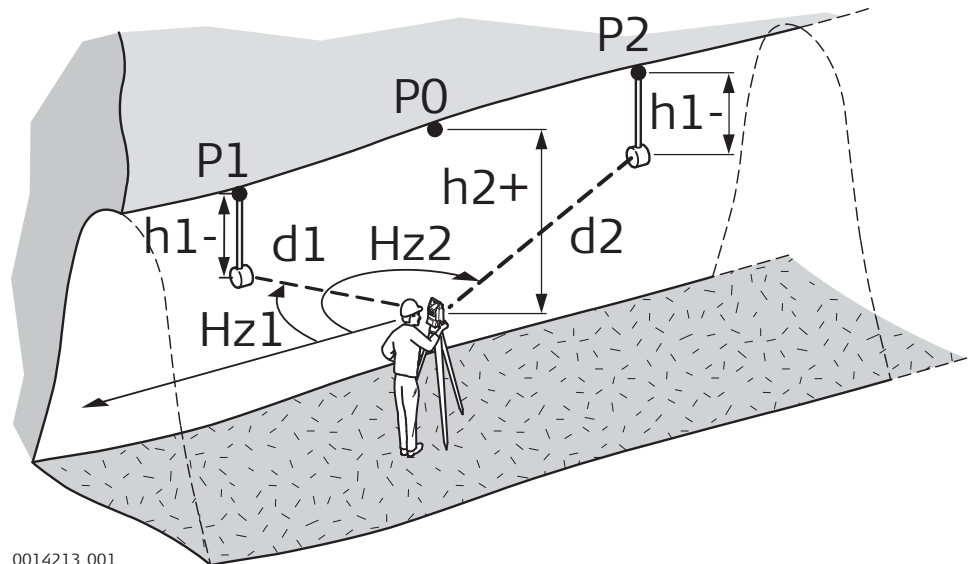
Description

Use:

- 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.

Several sets in different sequences can be measured.

The quality of measurement is controlled by the tolerances which are set before starting **PegSurvey**.



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

Access

1. Select **Apps** from the **Main Menu**.




2. Select the **Mining** tab.
3. Select **PegSurvey**.

4. **Peg Survey, Config.** page:
Complete the application pre-settings by:
 - Selecting a job, and
 - Confirming the set of tolerances. Refer to "1.2 Selecting".
5. Select **F4 Start**.

Enter Station Data

Key	Description
Cont	To set the station and instrument height.
Meas hi	To measure distance to the peg.
Map	To display the map.
↓ Laserpt	To activate/deactivate the visible laser beam for illuminating the target point.
↓ Find	To search for an entered point.
↓ List	To display the list of available points.
↓ EDM	To view and change EDM settings.

Description of fields

Field	Option	Description
Station	Editable field	Point ID of the station
hi	Editable field	Instrument height  The sign for the instrument height is normally negative. For manual entry of instrument height: <ul style="list-style-type: none"> • Enter instrument height of the station. For measuring the instrument height: <ul style="list-style-type: none"> • Turn the telescope to the zenith with the help of the displayed vertical angle V. • Press Meas hi to measure distance to the peg.
V	Display only	Vertical angle

Description

The following are important messages or warnings that may appear.

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

Nest step

Press **Cont** to proceed to the Information screen.




Survey will be executed acc. to the following settings:

Sequence	B'F'F"B"
No.of Sets	1
Hz Tol.	0.0111 g
HD Tol.	0.0100m
H Tol.	0.0100m

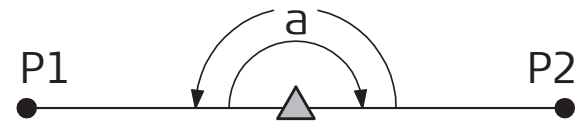
Cont | | |

Key	Description
Cont	To continue with PegSurvey.

Description of fields

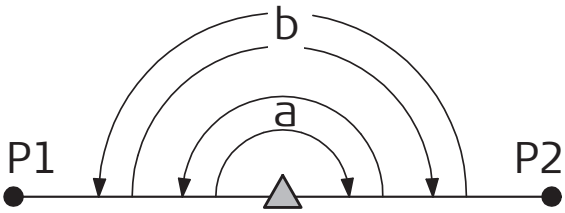
Field	Option	Description
Sequence	Display only	Displays the measuring sequence. B = Backsight point F = Foresight point
	B'F'F"B"	All points are measured in face I, then all points are measured in face II in reverse sequential order.
	B'F'B"F"	All points are measured in face I, then measured in face II.
	B'B"F'F"	Backsight point is measured in face I immediately followed by face II. Other points are measured in face I, face II order.
No.of Sets	Display only	One set means to measure the backsight point (P1) twice and the foresight point (P2) twice, in both faces.
		 The number of sets as defined in the tolerance settings must be completed. A maximum number of 10 sets is supported.

1



0014214_001

a I Set

Field	Option	Description
	2	 <p>0014215_001</p> <p>a I Set b II Set</p>
Hz Tol.	Display only	Tolerated residual in horizontal direction.
HD Tol.	Display only	Tolerated residual in horizontal distance.
H Tol.	Display only	Tolerated residual in height.

Next step

- Press **Cont** to proceed to the number of sets screen.
Displayed is:
 - The set to be measured next
 - The total number of sets remaining
 Example:
Set 1 of total 3
 The measurement will be the first set of three.
- To measure a backsight point directly** Continue with step 3..
 To enter a Hz value by which the direction should be rotated
 Press **BasePl** to access the **Change of Baseplate** screen.
- Press **Cont** to proceed to the **Measure Backsight Point!** screen. Information about which backsight point the user has to measure is displayed.

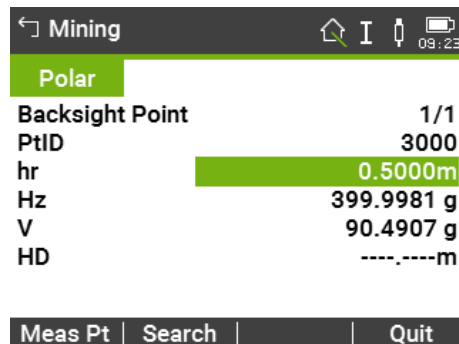
2.3

Measuring

Access

Press **Cont** from the **Measure Backsight Point!** screen.

Backsight Point



← Mining 09:23

Polar

Backsight Point 1/1

PtID 3000

hr 0.5000m

Hz 399.9981 g

V 90.4907 g

HD ----,----m

Meas Pt | Search | Quit

Key	Description
Meas Pt	To start distance and angle measurements and save the measured values.
Search	To search for a different backsight point.
Quit	To exit the application and return to the Peg Survey screen.

Foresight Point


Mining	
Polar	
Foresight Point	1/1
PtID	1001
hr	0.5000m
Hz	200.9494 g
V	96.9904 g
HD	----.----m


Meas Pt	Dist	Grade	Quit
---------	------	-------	------

Key	Description
Meas Pt	To start distance and angle measurements and save the measured values.
Dist	To start distance and angle measurements without saving the measured values.
Grade	To edit current grades. Refer to "4 Grades". Available after Dist was pressed.
Quit	To exit the application and return to the Peg Survey screen.





Measuring points step-by-step

1. Enter the reflector height (**hr**) for the backsight point, if required.
2. Aim at backsight point and press **Meas Pt**.
3. Depending on the measurement sequence selected, enter a desired backsight or foresight point ID (**PtID**).
Cont 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 **Meas Pt**.
6. Decide whether to measure an additional point:
 - **No** Repeat steps 2. and 5. until all sets are measured.
 - **Yes** Repeat steps 3. to 5. with a new point.

 A maximum of seven 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.
 - **Reject** to reject the measurements and remeasure the set again.
 - **Accept** to accept the result and continue with the next set.

 After each set the **Tolerances met!**, or the **Out of Tolerance!** screen displays.

Tolerances met!

    09:26

Data 1 **Data 2**

Tolerances met!

FS ID	1001
dHz	0.0025 g
Hz Tol.	0.0111 g
dHD BS	0.0010m
dHD FS	0.0010m
HD Tol.	0.0100m

Cont | | | **Quit**

Key	Description
Cont	To proceed to the results screen.
Quit	To exit the application and return to the Peg Survey screen.

Description of fields

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

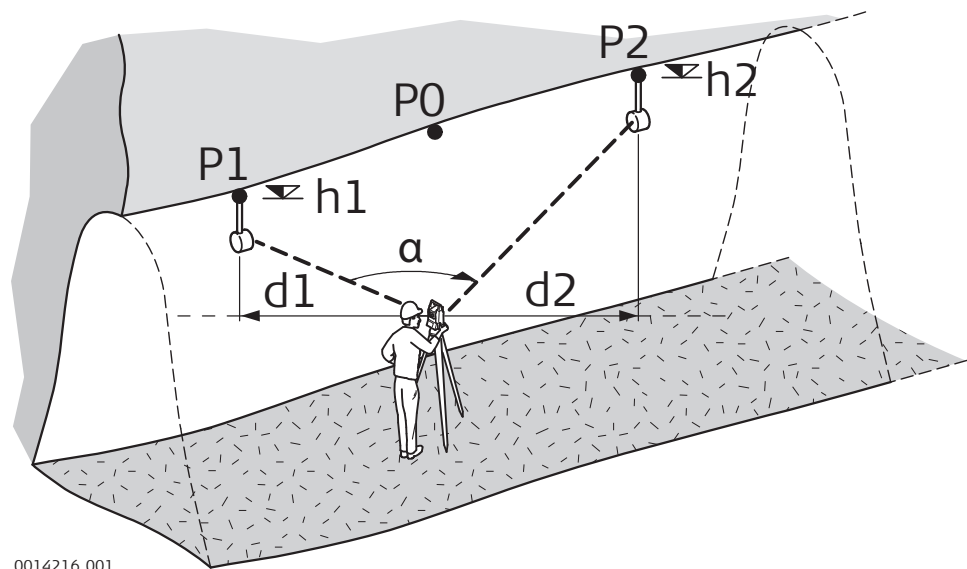
2.4

Results

Access

Press **Cont** from the **Tolerances met!** screen.

Diagram



0014216_001

- P0 Station
- P1 Backsight point
- P2 Foresight point
- α Avg. Hz
- d1 Avg. HD BS
- d2 Avg. HD FS
- h1 Avg. H BS
- h2 Avg. H FS

Traverse Results

← Traverse Results

Result1

Result2

FS ID

1001

BS ID

3000

Avg. Hz

200.9480 g

Avg. HD BS

6.9199m

Avg. H BS

99.9445m

Avg. HD FS

14.5859m

Avg. H FS

99.5931m

Cont

Quit

Key	Description
Cont	To save the data and exit the application.
Quit	To exit the application and return to the Peg Survey screen.

Description of fields

Field	Option	Description
BS ID FS ID	Display only	Point ID for backsight and foresight points.
Avg. Hz	Display only	Average horizontal angle between backsight point and foresight point.
Avg. HD BS Avg. HD FS	Display only	Average horizontal distance to backsight and foresight points.

Field	Option	Description
Avg. H BS Avg. H FS	Display only	Average height to backsight and foresight points.
Sequence	Display only	Sequence of measurements.
Set No.	Display only	Number of sets.

Next step

Press **Cont** to save the data and exit the app.

The **Continue with...** screen appears for access to **Grade&Off**. Refer to "4 Grades" and "5 Offset".

Data saved

The following results are stored in the internal memory.

Field	Description
Result	
Avg. Hz	Average horizontal angle between backsight point and foresight point.
Avg. HD BS Avg. HD FS	Average horizontal distance to backsight and foresight points.
Avg. H BS Avg. H FS	Average height to backsight and foresight points.
Residual	
dHz	Horizontal angle residual
dHD BS dHD FS	Horizontal distance residual
dH BS dH FS	Height residual
Coordinates foresight point	
E	Easting
N	Northing
H	Height
GrElev	Grade elevation

Description

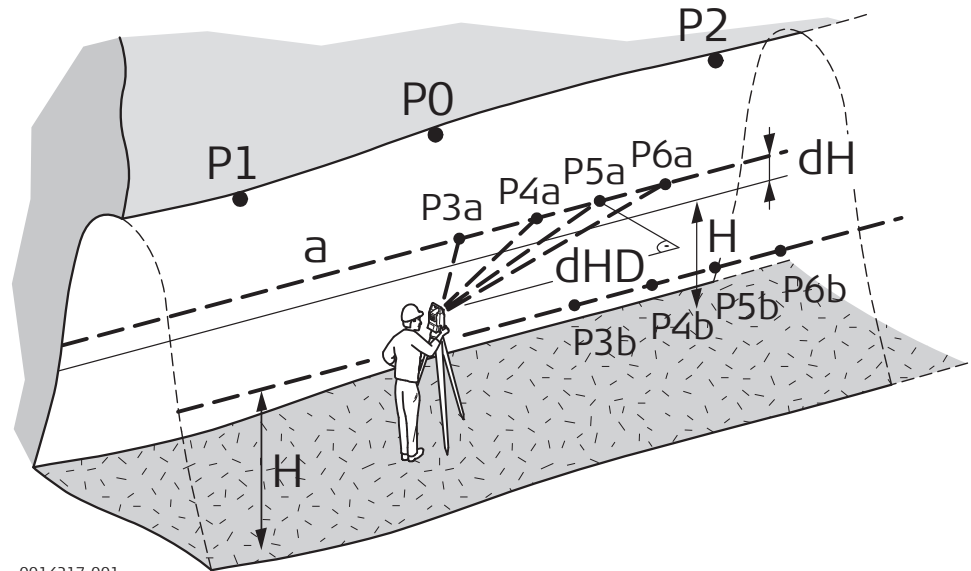
The application LinePeg is used to mark a new line peg. This application is similar to PegSurvey except there is only one set of measurements required.

Refer to "2 Peg Survey".

Description

Use:

- 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.



0014217_001

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

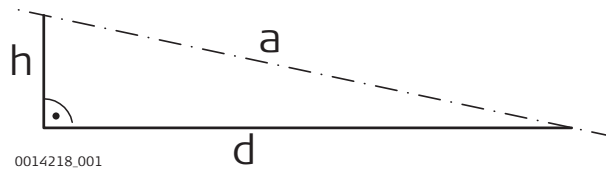
Known

- 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

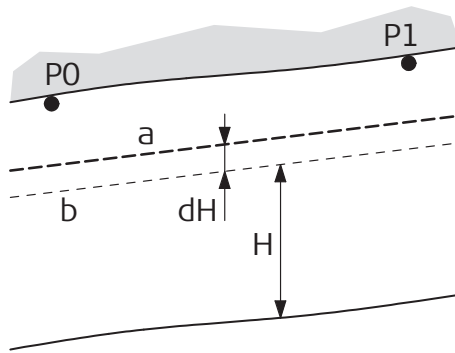
- Stake out height difference (**dH**) between measured point and gradeline point
- Horizontal distance (**dHD**) along the foresight line

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

Access

Grades is started by either selection in the **Programs** menu or after measuring in **PegSurvey** and **LinePeg**.

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

1. Select **Apps** from the **Main Menu**.



2. Select the **Mining** tab.

3. Select **Grades, PegSurvey**.



4. **Grades & Offset, Config.** page:
Complete the application pre-settings by:
 - Selecting a job, and
 - Confirming the set of tolerances. Refer to "1.2 Selecting".

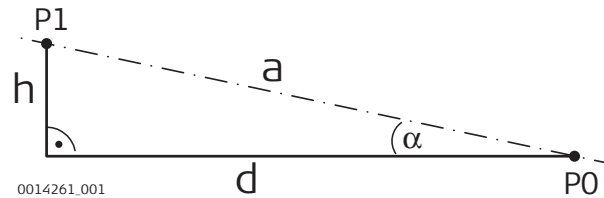
5. Select **F4 Start** to proceed to the **Enter Station Data** screen.

6. Enter the station data and measure to the backsight and foresight points. Refer to "2 Peg Survey".
7. Accept the tolerances from the measurements.
8. In the **Continue with...** screen, press **Grades**.

Enter Grade Values



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.



P0 Station
P1 Backsight point or foresight point
a Chain length of the gradeline
h Height
d Vertical distance
 α **Grade (Ang):**

← Mining
🏠 I 📶 09:28

Data

Enter Grade Values

Grade (1:x): 1: 1.050

Grade (%): % 95.24

Grade (Ang): 48.4476 g

Direction : Up (+) <>

Height : 0.0000m

Set
Chain
Quit

Key	Description
Set	To set the entered values and proceed to the Mark Grade-line screen.
Chain	To enter a chain length instead of a gradient. Refer to the illustration.
Quit	To exit and return to the Continue with... screen.

Description of fields

Field	Option	Description
Grade (1:x): 1:	Editable filed	Slope gradient as portion. Type in the value for the vertical distance that applies to one meter height difference. Example: 1:8000 = 1 m height (h) : 8.000 m distance (d) Refer to the illustration.

Field	Option	Description
Grade (%): %	Editable filed	Slope gradient in percent: (h:d) * 100 Refer to the illustration. Example: (1 m : 8.000 m) * 100 = 12.5%
Grade (Ang):	Editable filed	Slope gradient as angle $\tan \alpha = (1:8.000) \rightarrow \alpha = 7.125^\circ = 7^\circ 07' 30''$ Refer to the illustration.
Direction :	Up (+)	The next point is higher than the station.
	Down (-)	The next point is lower than the station.
Height :	Editable filed	Height difference between the station and the next point.




4.3

Gradeline Marking

Access

Press **Set** from the **Enter Grade Values** screen.

Mark Gradeline

← Mining    09:29

Polar

Mark Gradeline

PtID **4789**

dHD **1.1763m**

dH **-1.2186m**


Hz **171.2435 g**


HD **1.3171m**

Meas Pt | Dist | Back | Quit

Key	Description
Meas Pt	To start angle and distance measurements and save the measured values.
Dist	To start distance and angle measurements without saving the measured values.
Back	To return to the previous screen.
Quit	To exit the application and return to the Enter Grade Values screen.


Description of fields

Field	Option	Description
PtID	Editable filed	Point ID of the measured point.
dHD	Display only	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.

Field	Option	Description
dH	Display only	Difference in height between the measured point and the grade point. <div>  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. </div>
H_z	Display only	Current horizontal angle.
HD	Display only	Measured horizontal distance.

Gradeline marking step-by-step

1. Enter a desired **PtID**.
2. Aim at the target point and press **Meas Pt**.


 The height difference (**dH**) and horizontal distance difference (**dHD**) are display.
3. Turn the telescope until the height difference (**dH**) is zero.
4. Repeat the measurement.
5. Press **Meas Pt** to measure and record data for the current point and proceed to measure another point.

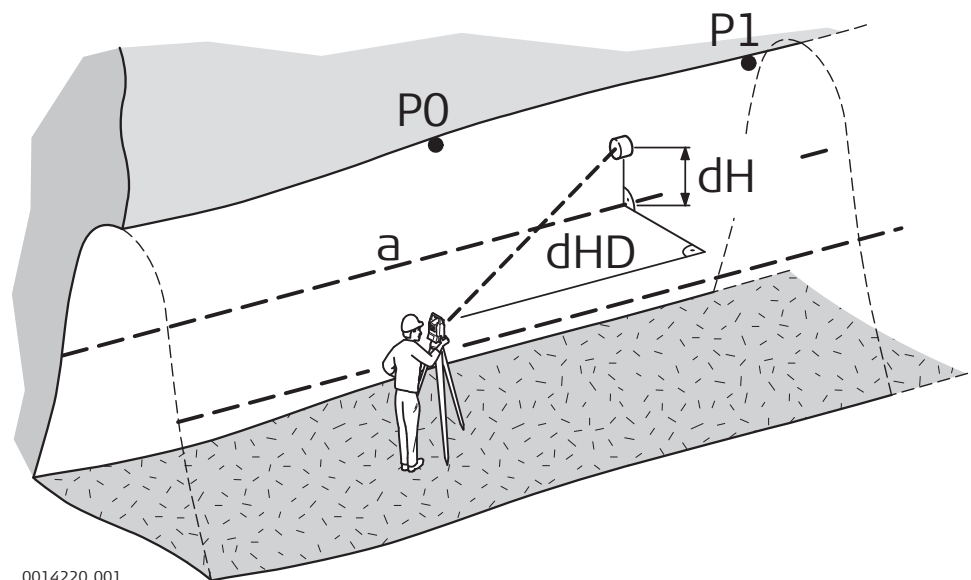
4.4

Results

Description

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

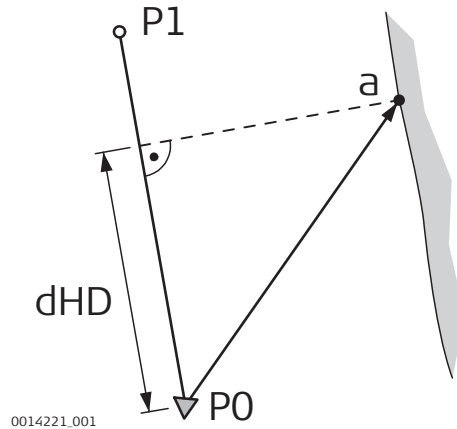
Profile view



0014220_001

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

Top view



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

Data saved

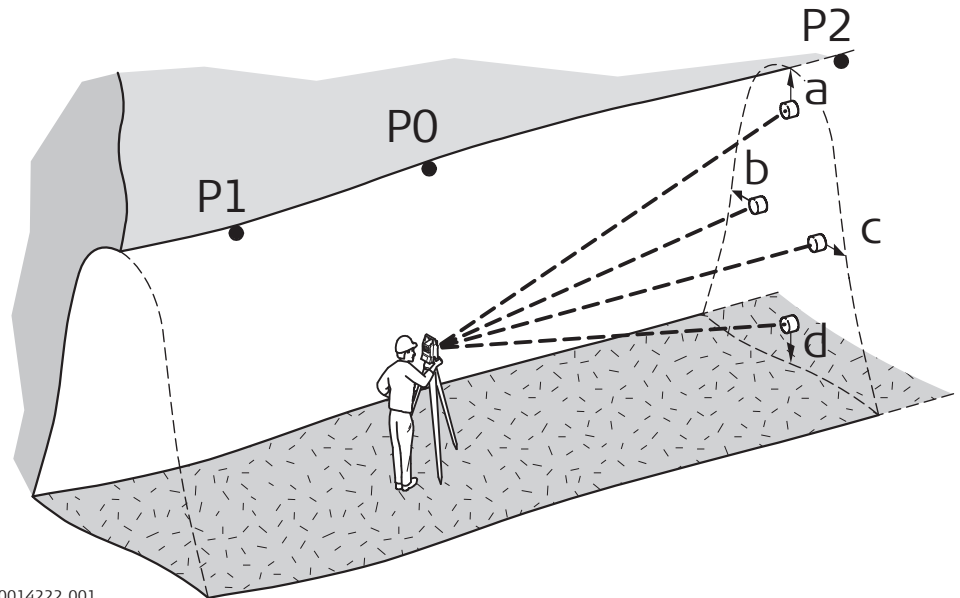
The following results are stored in the internal memory.

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

Description

Use:

- 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.



0014222.001

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

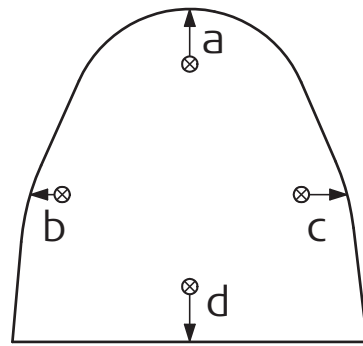
Known

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

Unknown

- Point coordinates of the tunnel walls

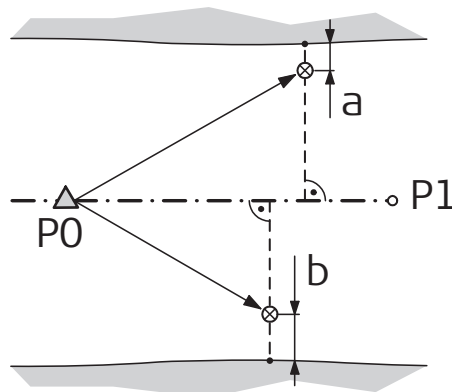
Profile view



0014223_001

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

Top view



0014224_001

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


5.2


Starting

Access

Offset is started by either selection in the **Programs** menu or after measuring in **PegSurvey** and **LinePeg**.

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

1. Select **Apps** from the **Main Menu**.

2. Select the **Mining** tab.

3. Select **Grades, PegSurvey**.

4. **Grades & Offset, Config.** page:
Complete the application pre-settings by:
 - Selecting a job, and
 - Confirming the set of tolerances. Refer to "1.2 Selecting".
5. Select **F4 Start** to proceed to the **Enter Station Data** screen.
6. Enter the station data and measure to the backsight and foresight points. Refer to "2 Peg Survey".
7. Accept the tolerances from the measurements.
8. In the **Continue with...** screen, press **Offset**.

Offset

← Mining
🏠 I 📶 09:30

Polar

Offset

PtID 8965

Offset 1.0500m

Offset Dir. Left<>

Code -----

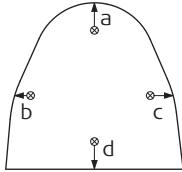
Hz 171.2386 g

HD 3.4136m

Meas Pt
Dist
Quit


Key	Description
Meas Pt	To start angle and distance measurements and save the measured values.
Dist	To start distance and angle measurements without saving the measured values.
Quit	To exit the application and return to the Continue with... screen.

Description of fields

Field	Option	Description
PtID	Editable filed	Point ID of the offset point.
Offset	Editable filed	Offset distance of the reflector from the actual point to be measured
Offset Dir.	Left, Up, Right or Down	 <p style="font-size: small; margin-top: 5px;">0014223.001</p> <p style="margin-top: 10px;">a Up b Left c Right d Down</p>
Code	Editable filed	Code for the offset point

Field	Option	Description
Hz	Display only	Measured horizontal angle to the reflector
HD	Display only	Measured horizontal distance to the reflector

Offset step-by-step

1. Enter a desired **PtID**.
2. Enter a the offset value.
3. Select the offset definition.
4. Aim at the target point and press **Meas Pt**.
 After storing the measurements, the **Offset** screen is in the foreground again.
5. To measure a new point, repeat steps 1. to 3..

5.3

Results



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

Data saved

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	Vertical distance
Offset Information	
Offset	Offset value
Offset Dir.	Offset direction (left, up, right, down)
Coordinates of new offset point	
E	Easting
N	Northing
H	Height

6 Data Manager

6.1 Overview

Description

The Mining Data Manager is part of Leica Instrument Tools.

Fixpoints can be entered and exported to gsi format. The points can be transferred to the instrument with a USB stick or an SD card.

Use the file viewer to view the exported files on the PC and to export them further to other formats.

Installation on a computer

The installation program can be found on the USB documentation card supplied. Insert the USB documentation card and follow the on-screen instructions. Please note that Instrument Tools can only be installed on computers with MS Windows 2000, XP, Vista, Windows 7 and Windows 10 operating systems.

Content

Use:

- Creating and editing of fixpoint files such as coordinates.
- Importing and exporting fixpoint files (ASCII format).

6.2 Functionality

Creating fixpoint files step-by-step

In the Data Input module, the Mining Data Manager allows users to create, view, modify and save coordinate lists.

1. Open a new project: **File -> New Project....**
Enter the project name and file location.
2. Enter point IDs, and for each one: coordinates, a backsight reference point, and a grade elevation.

Points

Point Id	Date/Time	Easting	Northing	Ortho. Height	Backsight Id	Grade Elevation
100	03/16/2011 13:57:12	100.0000	100.0000	100.0000		0.0000
120	03/16/2011 12:57:51	100.0000	100.0000	100.0000	12	20.0000

3. Transfer the exported *.gsi file to the instrument via USB stick or SD card.

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- when it has to be **right**

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