Settop LevelMe
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Introduction

SETTOP Level Me is a "3rd party application" developed by Al-top Topografia for Trimble Access. It enables observation, calculation and altimetric compensation with Precision Trigonometric Leveling with the use of the TRIMBLE S Series Total Stations.
Open Job
It is necessary to open a job in order to store a Loop within it. There can only be a single Loop within a job.
Loop
New Loop
The first necessary step is that of creating a Loop in order to start a leveling. The first time one accesses Loop only permits the creation of a New Loop. A Loop is regarded as a two-way leveling line that closes at the same point. The Loop can close at another point of a known level, in which case it will be regarded as a one-way leveling Line.

At the next step, enter the name of the Loop to be measured. A new loop cannot be started if another Loop is currently open.

By pressing the Loop button after leveling, there is the option of creating a New Loop. In the event the loop is not closed, you will be informed that if you continue you will lose all the observations made because one job can only contain one loop.
Review Loop

The Review Loop option allows us to see all points and elevations measured so far, showing the Name – Target height – Vertical angle – Slope Distance – Elevation (without adjustment)
The Review Loop will appear after the first level has been finished (set of Backsight and Foresight sights)
On the pull-down, one can select whether to see the Loop or the Survey points.
The survey of the point that has not been compensated appears on the Backsight observations.

By pressing Edit, you can modify the Point Name, Init Elevation or Target height of a Loop.
On Survey View, we only can modify the Point Name and/or Target height.
Pressing the button **Check pts** makes it possible to observe and even reassign the set of sights used and discarded at any time. One may select between the **Backsight** and **Foresight** options and modify the **Temperature**. These observations can be exported by activating the "Export raw data" box in the export menu.

You can see the Standard Deviation in F1 (StdDev F1) and F2 (StdDev F2) in seconds, it shows the accuracy of the sight. The value is recalculated automatically when you disable some sights.
By pressing on Export, one can store the observations made so far in ASCII format (*.csv) whether on the Loop or the Setup. The names of the points, the prism height, the horizontal angle, the vertical angle and the slope distance will be recorded.

Upon activation of the Export raw data option, the whole set of sights will be exported as well as the corrections applied in each sight along with the temperature and pressure used.
**Note!!**: These points have not been compensated. For compensated exportation, it is necessary close before the *Loop* or *Line*.

**Delete**

If you press **Delete**, you can delete the last leveling composed of the backsight and foresight readings following due confirmation. When you delete a leveling, the points of survey associated with it are also deleted. If we choose *Survey* mode, we can individually delete the points selected.
Close Line

If you wish to close your level “loop” on a known point (not the initial backsight) you will be able to close the “line” rather than the loop since it will not have been possible to complete the loop. This option is available when the last PointName is not the initial PointName. When you press Close Line, the name of the last point measured will appear, as will a space for entering the known Closing Elevation. If the Closing Elevation lies within the tolerance margins, it will close the line; otherwise, a message will appear indicating the Closing margin.

The Adjustment is proportional to the number of levelings.
On the first screen one can see the information about the line:
- Name of Loop / Line
- Initial Elevation in meters
- Leveling Distance: The sum of all backsight and foresight distances, as expressed in meters.
- Slope: The average Vertical Angle value as expressed in %.
- Number of levels.
- Tolerance: Calculated on the basis of a 25-mm space by the square root of the leveled distance as expressed in Km.
- An Expected Error is the theoretical error calculated according to the tool with which connection has been made when starting the job for the first time, as expressed in meters, and according to the characteristics of the loop.
- Closure Error: The difference between the value measured and the closure value.
- The Loop will not be definitely closed until Store is pressed.

On the second screen appears:
- Elevation Increasing (Az)
- Elevation Difference (DZ)
- Elevation (without adjust)
- Adjust
- Adjust DZ
- Elevation (Adjusted)

1. Export

We can export both results to Complete ASCII file (*.csv), Trimble DiNi M5(*.dat) or export to the current job (*.job).
The whole set of sights (AH, AV and Ds) will be exported as will the corrections applied in each sight along with the temperature and pressure used upon activation of the Export raw data option.

When the points are exported to the current job, a code is added to identify if a point is part of the loop (LM_# Loopname#) or if it is part of the survey (LMP_ # Loopname #).

NOTE!!: The export checks duplication of names in the same loop, but not with the current job.
Close Loop

If the last point is the same as the initial point SETTOP Level Me will automatically detect this as a Loop. The button Loop allows you to Close Loop. It will be possible to close the loop if you have measured the starting point and the measurement lies within tolerance of the closure error. Otherwise you will get an error stating that it is not possible to close the loop. A closed loop is defined as the completion of the level loop measuring the first backsight as your last foresight.

If it can be closed, it compensates the leveling in proportion to the number of levels.

Once the loop is closed, you can review the results and export them to a Full Format ASCII file (extension *.csv), to Trimble Dini M5 (extension *.dat) or transfer the points to the current job (*.job) by pressing on Export.
On the first screen one can see the information about the line:

- Name of Loop / Line
- Initial Elevation in meters
- Leveling Distance: The sum of all backsight and foresight distances, as expressed in meters.
- Slope: The average Vertical Angle value as expressed in %.
- Number of levels.
- Tolerance: Calculated on the basis of a 25-mm space by the square root of the leveled distance as expressed in Km.
- An Expected Error is the theoretical error calculated according to the tool with which connection has been made when starting the job for the first time, as expressed in meters, and according to the characteristics of the loop.
- Closure Error: The difference between the value measured and the Closure value. The Loop will be closed definitely when we press Store.

On the second and third screen appears:
- Elevation Increasing (Az)
- Elevation Difference (DZ)
- Elevation (without adjust)
- Adjust
- Adjust DZ
- Elevation (Adjusted)

For the complete loop and subloops.

On the fourth screen appears:
- Point Name
- Prism height
- Vertical Angle
- Slope Distance
- Elevation Point

You can export the results to an ASCII file (extension *.csv), to Trimble Dini M5 (extension *.dat) or to the current job (*.job).
The whole set of sights (AH, AV and Dg) will be exported as will the corrections applied in each sight along with the temperature and pressure used upon activating the **Export raw data** option.

When the points are exported to the current job, a code is added to identify if a point is part of the loop (LM_ # Loopname#) or if it is part of the survey (LMP_ # Loopname #).

**NOTE!!**: The export checks duplication of names in the same loop, but not with the current job.
<table>
<thead>
<tr>
<th>Name</th>
<th>Nothing</th>
<th>Easting</th>
<th>Elevation</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>?</td>
<td>?</td>
<td>100.73LMP_070313</td>
<td></td>
</tr>
<tr>
<td>1.2</td>
<td>?</td>
<td>?</td>
<td>100.73LMP_070313</td>
<td></td>
</tr>
<tr>
<td>NAP3</td>
<td>?</td>
<td>?</td>
<td>102.21LMP_070313</td>
<td></td>
</tr>
<tr>
<td>NAP4</td>
<td>?</td>
<td>?</td>
<td>101.55LMP_070313</td>
<td></td>
</tr>
<tr>
<td>NAP5</td>
<td>?</td>
<td>?</td>
<td>101.02LMP_070313</td>
<td></td>
</tr>
<tr>
<td>NAP6</td>
<td>?</td>
<td>?</td>
<td>100.00LMP_070313</td>
<td></td>
</tr>
<tr>
<td>New_BS</td>
<td>?</td>
<td>?</td>
<td>?</td>
<td></td>
</tr>
</tbody>
</table>
Options

The Options button offers the possibility of editing the Tolerance of the subloops. One may edit a value of between 0.0 and 25.0. (See “Calculations and Compensations” section). These values make it possible for the software to interpret or not interpret a partial point as a subloop. For example, if we assign a 0.0 value, it will not read subloops at the closure, whereas if we assign 25, it will recognize partial points with a margin that is 25 times the Kilometric error of the distance of the subloop. By default, a value of 2.5 is assigned.

It also makes it possible to change measurement units. The units available are Meters, International Feet and U.S. Survey Feet. The equivalence with the meter is as follows: 1 Meter (m) = 3.280839895 International Feet (ift) = 3.2808333333357 U.S. Survey Feet.

The change of Units allows one to display the data in the units selected. Likewise, we can export the output formats in the units we have assigned except for the DiNI M5 format.

You can select the number of decimal places you want to view: 3 or 4.

You can also select whether you want to enter the temperature in degrees Celsius or Fahrenheit.
Leveling
Once the Loop has been created, the Leveling can be started.

The first set up page shows the Atmospheric Corrections to be applied to all of the sights. The pressure is that detected by the instrument - thanks to the barometer included in TRIMBLE S Series equipment - the temperature is defined by the user and the PPM’s appear calculated in accordance with the values entered (the possibility exists of directly entering the PPM’s, dispensing with the pressure and temperature). We can also activate or deactivate the Curvature correction and the Refraction Correction to be applied to the Vertical angle.

The process of observing the loop is based on the characteristic procedures of geometric leveling. The reference or initial observation is called the Backsight and the following observation is called the Foresight.

When you start the Loop at the first control point you have to enter the name and the elevation. You can also select the point from the current job. When you select the point, the Elevation field is automatically filled. The starting loop point allows you to change the elevation. The rod height and prism constant should be set in the corresponding section of the sidebar.
Before starting the measurement, you can configure the measurement **Options**.

After **Measure** is pressed, the measurement sequence begins. The top bar indicates the name of the loop and the point of measurement it is at (Face1 or Face2, (measurement) (rounds)). You can stop the measurement and you will be asked if you want to stop the observations. If so, the measurements will be discarded.

After measuring, you can press **Check points** and observe the vertical angles (in gradians) and the geometrical distances (in meters, international feet or US survey feet) to be used. If you press **Use** on an observation, you can decide whether or not that measurement is used. The program will recalculate the average differential of the active observations.

The value shown is the difference between the mean and the measured value using the average of all the observations selected for the final calculation. The mean Vertical angle, shown as the result of the set of readings, is the V Raw angle, that is, the angle without any application of the prism constants or meteorological corrections. There must be at least one active observation.
You can **Discard** all observations, thus losing the measurements. The program will activate the points screen again for a re-observation of the points.

**NOTE!!:**
If a series of measurements has been finished (Backsight, Foresight or Survey) has been finished and it has not been possible to complete the full set of prism measurements, a warning message will appear with the number of readings made. If you press on Yes to continue, the ordinary process will be resumed. Otherwise, the observations will be deleted and the start screen will return.

After the Backsight measurement is stored, you can press **Next** to proceed to measure your Foresight. The next step indicates that the observation to be made is the **Foresight** measurement. You must enter a **name** for the second measurement base. A question mark (?) will appear on the Elevation field. Once the measurement is complete, the elevation calculated will be shown without compensation.
In the Foresight measurement only, a new button called **Survey** will appear; now you can measure points outside the Loop. With **Double Leveling**, the **Survey** option will appear in the even levelings. These measurements will be calculated from the Backsight measurement.

After completing the Backsight and Foresight measurement, the program displays a message telling of the number of leveling made and returns to the main page.

Once the last leveling has been automatically recorded, you can exit the application to open other job which contains another loop or continue the current job. To continue with the current leveling, you must repeat the back and front measurements for all points until the end of the loop.
The measure screens (either Backsight or Foresight) now display a new button called Loop. From this screen you can see all the previously observed points that are part of the loop. This same screen also appears in Loop → Review Loop.
Options

Here you can configure the measurement options of the current leveling. Click *Enter* to save your options and return to the Measure screen.

1. **Face Order**
   
   The first option offers the possibility to select the Order of faces, as follows:
   - **Only F1** (in which only Face1 measurements will be made)
   - **F1/F2** (in which a point is to be consecutively measured in direct and in reverse circle)
   - **F1 ... F2 ...** (in which the point is to make all measurements in direct circle and then all in reverse circle)

2. **Double Leveling**
   
   Double leveling can allow "go and return" at the same time. Is available to check on the first and second leveling. After that is not possible change the way of measurements

3. **Observations per point**
   
   The number of observations per point.
Number of rounds

The number of rounds to be measured of the set of the observations per point and in the face order assigned.

Pressure and Temperature

The outside temperature in ° C and pressure to be applied for the atmospheric corrections. The latter can only be modified when a new stationing is carried out after exiting the SETTOP Level Me program.

Automatic Point Name

If the Automatic Point Name checkbox is active, the same name will be proposed in the following observations, increasing it by one unit (if it is an alphanumeric name, SETTOP Level Me will add an extension xxx_#).

Decimal places

Select the number of decimals that you need (3 or 4) for real-time display.

Subloop Tolerance

The Tolerance defined in the Loop --> Options.

Units

This makes it possible to change measurement units. The units available are Meters, International Feet and U.S. Survey Feet. The equivalence with the meter is as follows:

1 Meter (m) = 3.280839895 International Feet (ift) = 3.280833333357 U.S. Survey Feet.

Search Window

One can change the search window of the prism. It is advisable to enlarge the prism search box whenever using the robotic mode. At the moment of closing the SETTOP Level Me application, the search window defined in the General Survey module is recovered.
Electronic level

Show Electronic Level before Leveling:

If you active this check box, before every leveling, it will show the Electronic level automatically. It can adjust the level again.

NOTE: If Total Station is unleveled, it will show the Electronic Level in any case.
Survey

We need to introduce a name. In the elevation field will be shown a question mark (?) until the measure are finished. We can repeat the name and, following the measurement, the elevation appears without compensation.

After measurement, we can check the observations (Check points) and the point list in the survey mode.
For continuous surveying we can press **Store**. To finish the survey, we should press **Exit** and the software will return to the screen for Foresight measurement. If the leveling has not been recorded, we will lose all survey points made at the last leveling.

**NOTE:** If the *Double Leveling* is activated, the *Survey* option will only appear in the even levelings.
Recommendations

- It is advisable to use a fixed-height Trimble-brand surveying rod to fix its height along with a small tripod for establishing the rod verticality.
- Similarly, we recommend a rod height close to 2-2.5 meters with both Backsight and Foresight without any variation. At 2-2.5 meters, you can avoid level obstacles and establish a parallel of the terrain to reduce the effects of refraction.
- The best practice is to use the same rod for both backsight and foresight.
- If two rods are used, it is important to carry out an even number of levelings so that the rod placed on the starting point is the same as when the line or leveling loop is closed so as to avoid a possible “talon de mira” (staff difference) error.
- It is important to carry out leveling with equidistant sights so as to compensate for refraction and sphericity effects between the Backsight and the Foresight.
- Before starting work, it is advisable to study your route, identify the leveling points and make a sketch of the location of the bases.
- The measurement stations should be established between 50m and 100m away with angles not exceeding 15°.
- To carry out high-accuracy jobs, it is advisable to take a set of 5 or more readings of a same point in both Direct and Reverse Circle.
Calculations and Compensation

- **SETTOP Level Me** has no limitations with regards to distances and number of levels. Likewise, it can carry out levelings in which the program will automatically recognize identical points and will carry out a partial closure of these subloops within the main loop. For this purpose, the program will close all those points bearing the same name but internally identify whether it is indeed the same point due to a rod-comparison algorithm, by applying the corresponding tolerance margin. This means that if we give all levels the same name the program will identify which points coincide and which do not in order to close the subloops generated along the course.

- The names of the points observed do not require any particular order. Only in the event of one wanting to determine certain subloops will it be necessary for the point to have the same name. In this way, the program will assign the Partial Point quality.

- The compensation is carried out in proportion to the number of levels.

- One can make a single large-scale loop or subdivide the loop when passing through common points (Partial). The total error is unchanged, but the achievement of partial points allows us to close subloops where you can see the inherent errors of each subloop.
Study of Errors

What follows is a study of the random errors that can take place during a trigonometric leveling process. This study shows the high precisions a Trigonometric Leveling process can have when using the Midpoint methodology – without having to take the height of the instrument.

As can be seen in the study, the accuracies – which depend on the instrument type and the geometry of the level – can reach the level of the results of a Standard Geometric Leveling with the advantage of greatly improved performance. It is especially recommended for mountainous areas, where it can increase its performance fivefold.
Formulation

The accidental error produced by each sight is composed of:

- Angular error: \[ e_a = D_{med} \cdot \tan(\text{Angle}_\text{acc}) \]
- Distance error: \[ e_d = (\text{EDM}_\text{acc}) \cdot \sin(100 - V_{med}) \]
- Error in verticality of the rod: \[ e_m = m - m \cdot \cos(\text{Error}_\text{Rod}) \]
- Sign error: \[ e_s = \]

Where the following result is obtained:

\[ e_{\text{visual}} = \sqrt{e_z^2 + e_d^2 + e_m^2 + e_s^2} \]
\[ e_{\text{levelled}} = e_{\text{visual}} \cdot \sqrt{2} \]
\[ e_{\text{km}} = e_{\text{levelled}} \cdot \sqrt{\frac{n^2_{\text{levelled}}}{K_m}} \]

Likewise, the corrections applied to the instrument are:

- Sphericity correction:
  \[ C_v = 0.5 \times \frac{D_g}{R} \times \frac{r}{10000} \]
  - \( D_g \) = Slope distance
  - \( R \) = Earth radius
  - \( r \) = radians

Refraction Correction:

\[ C_r = \frac{K \times D_g}{R} \times \frac{r}{10000} \]

- \( K \) = Refraction coefficient.
- \( D_g \) = Slope distance
- \( R \) = Earth radius
- \( r \) = radians
Weather Correction:

\[ ppm = 274.41 - 79.39 \times \left( \frac{P}{273.15 + \circ C} \right) \]

\( P \) = Pressure
\( \circ C \) = Temperature

Distance Correction:

\[ D_c = \frac{ppm \times D}{1000000} \]

\( D \) = Distance
Errors according to instrument
In the following calculation example, we assume an average distance between sights of 100m – 200-m levels - and an average angle inclination of 5º with the use of autolock systems in all cases.

NOTE!!:
5º represents an 8.75 % slope, that is, 8.75 m in a 100-m sight and therefore 17.50 m with a level. With 40 m levels, we would have a slope of 3.5 m, which is approximately the maximum slope to be considered with a sight and level).

TRIMBLE S6 5" (3mm+2ppm)

\[ \begin{align*}
e_a &= 0.0024 \text{ m} \\
ed &= 0.0003 \text{ m} \\
em &= \text{N/A} \\
es &= \text{N/A} \\
e_{\text{visual}} &= 0.0024 \text{ m} \\
e_{\text{level}} &= 0.0035 \text{ m} \\
ek &= 0.0109 \text{ m}
\end{align*} \]

TRIMBLE S6 3" (3mm+2ppm)

\[ \begin{align*}
ea &= 0.0015 \text{ m} \\
ed &= 0.0003 \text{ m} \\
em &= \text{N/A} \\
es &= \text{N/A} \\
es &= 0.0015 \text{ m} \\
e_{\text{level}} &= 0.0021 \text{ m} \\
ek &= 0.0066 \text{ m}
\end{align*} \]

TRIMBLE S6 2" (3mm+2ppm)

\[ \begin{align*}
ea &= 0.0010 \text{ m} \\
ed &= 0.0003 \text{ m} \\
em &= \text{N/A} \\
es &= \text{N/A} \\
es &= 0.0010 \text{ m} \\
e_{\text{level}} &= 0.0014 \text{ m} \\
ek &= 0.0045 \text{ m}
\end{align*} \]

TRIMBLE S8 1" (1mm+1ppm)

\[ \begin{align*}
ea &= 0.0005 \text{ m} \\
ed &= 0.0001 \text{ m} \\
em &= \text{N/A} \\
es &= \text{N/A} \\
es &= 0.0005 \text{ m} \\
e_{\text{level}} &= 0.0007 \text{ m} \\
ek &= 0.0022 \text{ m} < 0.0035 \text{ m} \rightarrow \text{High precision}
\end{align*} \]

TRIMBLE S8 0.5" (1mm+1ppm)
$e_a = 0.0002 \text{ m}$
$e_d = 0.0001 \text{ m}$
$e_m = \text{N/A}$
$e_s = \text{N/A}$
$e_{\text{esight}} = 0.0003 \text{ m}$
$e_{\text{elevel}} = 0.0004 \text{ m}$
$e_{km} = 0.0012 \text{ m} < 0.0015 \rightarrow \text{Very High Precision}$

What follows is a table of Expected Errors according to the equipment features/level distances:

### Sights at 500m (1Km level)

<table>
<thead>
<tr>
<th>Ang. Precision</th>
<th>5&quot;</th>
<th>3&quot;</th>
<th>2&quot;</th>
<th>1&quot;</th>
<th>0.5&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>$e_a$</td>
<td>0.0121</td>
<td>0.0073</td>
<td>0.0048</td>
<td>0.0024</td>
<td>0.0012</td>
</tr>
<tr>
<td>$e_d$</td>
<td>0.0003</td>
<td>0.0003</td>
<td>0.0003</td>
<td>0.0001</td>
<td>0.0001</td>
</tr>
<tr>
<td>$e_{\text{esight}}$</td>
<td>0.0121</td>
<td>0.0073</td>
<td>0.0049</td>
<td>0.0024</td>
<td>0.0012</td>
</tr>
<tr>
<td>$e_{\text{elevel}}$</td>
<td>0.0171</td>
<td>0.0103</td>
<td>0.0069</td>
<td>0.0034</td>
<td>0.0017</td>
</tr>
<tr>
<td>$e_{km}$</td>
<td>0.0242</td>
<td>0.0146</td>
<td>0.0097</td>
<td>0.0049</td>
<td>0.0024</td>
</tr>
</tbody>
</table>

### Sights at 250m (500m level)

<table>
<thead>
<tr>
<th>Ang. Precision</th>
<th>5&quot;</th>
<th>3&quot;</th>
<th>2&quot;</th>
<th>1&quot;</th>
<th>0.5&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>$e_a$</td>
<td>0.0061</td>
<td>0.0036</td>
<td>0.0024</td>
<td>0.0012</td>
<td>0.0006</td>
</tr>
<tr>
<td>$e_d$</td>
<td>0.0003</td>
<td>0.0003</td>
<td>0.0003</td>
<td>0.0001</td>
<td>0.0001</td>
</tr>
<tr>
<td>$e_{\text{esight}}$</td>
<td>0.0061</td>
<td>0.0036</td>
<td>0.0024</td>
<td>0.0012</td>
<td>0.0006</td>
</tr>
<tr>
<td>$e_{\text{elevel}}$</td>
<td>0.0086</td>
<td>0.0052</td>
<td>0.0035</td>
<td>0.0017</td>
<td>0.0009</td>
</tr>
<tr>
<td>$e_{km}$</td>
<td>0.0172</td>
<td>0.0103</td>
<td>0.0069</td>
<td>0.0034</td>
<td>0.0017</td>
</tr>
</tbody>
</table>

### Sights at 100m (200m level)

<table>
<thead>
<tr>
<th>Ang. Precision</th>
<th>5&quot;</th>
<th>3&quot;</th>
<th>2&quot;</th>
<th>1&quot;</th>
<th>0.5&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>$e_a$</td>
<td>0.0024</td>
<td>0.0015</td>
<td>0.0010</td>
<td>0.0005</td>
<td>0.0002</td>
</tr>
<tr>
<td>$e_d$</td>
<td>0.0003</td>
<td>0.0003</td>
<td>0.0003</td>
<td>0.0001</td>
<td>0.0001</td>
</tr>
<tr>
<td>$e_{\text{esight}}$</td>
<td>0.0024</td>
<td>0.0015</td>
<td>0.0010</td>
<td>0.0005</td>
<td>0.0003</td>
</tr>
<tr>
<td>$e_{\text{elevel}}$</td>
<td>0.0035</td>
<td>0.0021</td>
<td>0.0014</td>
<td>0.0007</td>
<td>0.0004</td>
</tr>
<tr>
<td>$e_{km}$</td>
<td>0.0109</td>
<td>0.0066</td>
<td>0.0045</td>
<td>0.0022</td>
<td>0.0012</td>
</tr>
</tbody>
</table>

### Sights at 75m (150m level)

<table>
<thead>
<tr>
<th>Ang. Precision</th>
<th>5&quot;</th>
<th>3&quot;</th>
<th>2&quot;</th>
<th>1&quot;</th>
<th>0.5&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>$e_a$</td>
<td>0.0018</td>
<td>0.0011</td>
<td>0.0007</td>
<td>0.0004</td>
<td>0.0002</td>
</tr>
<tr>
<td>$e_d$</td>
<td>0.0003</td>
<td>0.0003</td>
<td>0.0003</td>
<td>0.0001</td>
<td>0.0001</td>
</tr>
<tr>
<td>$e_{\text{esight}}$</td>
<td>0.0018</td>
<td>0.0011</td>
<td>0.0008</td>
<td>0.0004</td>
<td>0.0002</td>
</tr>
<tr>
<td>$e_{\text{elevel}}$</td>
<td>0.0026</td>
<td>0.0016</td>
<td>0.0011</td>
<td>0.0005</td>
<td>0.0003</td>
</tr>
</tbody>
</table>
### Sights at 50 m (100m level)

<table>
<thead>
<tr>
<th>Ang. Precision</th>
<th>5&quot;</th>
<th>3&quot;</th>
<th>2&quot;</th>
<th>1&quot;</th>
<th>0.5&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>e_a=</td>
<td>0.0012</td>
<td>0.0007</td>
<td>0.0005</td>
<td>0.0002</td>
<td>0.0001</td>
</tr>
<tr>
<td>e_d=</td>
<td>0.0003</td>
<td>0.0003</td>
<td>0.0003</td>
<td>0.0001</td>
<td>0.0001</td>
</tr>
<tr>
<td>e_sight=</td>
<td>0.0012</td>
<td>0.0008</td>
<td>0.0006</td>
<td>0.0003</td>
<td>0.0002</td>
</tr>
<tr>
<td>e_level=</td>
<td>0.0018</td>
<td>0.0011</td>
<td>0.0008</td>
<td>0.0004</td>
<td>0.0002</td>
</tr>
<tr>
<td>e_km=</td>
<td>0.0079</td>
<td>0.0049</td>
<td>0.0035</td>
<td>0.0016</td>
<td>0.0010</td>
</tr>
</tbody>
</table>

### Sights at 25 m (50m level)

<table>
<thead>
<tr>
<th>Ang. Precision</th>
<th>5&quot;</th>
<th>3&quot;</th>
<th>2&quot;</th>
<th>1&quot;</th>
<th>0.5&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>e_a=</td>
<td>0.0006</td>
<td>0.0004</td>
<td>0.0002</td>
<td>0.0001</td>
<td>0.0001</td>
</tr>
<tr>
<td>e_d=</td>
<td>0.0003</td>
<td>0.0003</td>
<td>0.0003</td>
<td>0.0001</td>
<td>0.0001</td>
</tr>
<tr>
<td>e_sight=</td>
<td>0.0007</td>
<td>0.0005</td>
<td>0.0004</td>
<td>0.0002</td>
<td>0.0001</td>
</tr>
<tr>
<td>e_level=</td>
<td>0.0009</td>
<td>0.0006</td>
<td>0.0005</td>
<td>0.0002</td>
<td>0.0002</td>
</tr>
<tr>
<td>e_km=</td>
<td>0.0060</td>
<td>0.0041</td>
<td>0.0033</td>
<td>0.0014</td>
<td>0.0010</td>
</tr>
</tbody>
</table>
Geometric Leveling

According to the specifications of the DINI Electronic Level, taking 20-m levels into account we obtain:

**DiNi 0.7 mm (DINI 22)**

- Invar precision bar code staff: $e_{km} = 0.7$ mm
- Standard bar code staff: $e_{km} = 1.3$ mm

**DiNi 0.3 mm (DINI 12T)**

- Invar precision bar code staff: $e_{km} = 0.3$ mm
- Standard bar code staff: $e_{km} = 1.0$ mm

In both cases, we take electronic measurement into account.

What follows is a comparative graph of both systems, showing the obvious advantage represented by the use of High-Accuracy Trigonometric Leveling in relation to Geometric Leveling.
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About SETTOP

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Telf. +34 93 340 05 73
Fax +34 93 351 95 18
SETTOP : info@settopsurvey.com

Support Service:
support@settopsurvey.com
Where to buy?

If you are interested in buying **SETTOP Level Me**, contact your nearest Trimble Dealer.
FAQ

1. Can I get high precision results using trigonometric leveling?
Yes, using a high-precision total station you can get very satisfactory results. You can see the comparative study of expected errors according to the station used.

2. Can I carry out an elevation starting at one point and finishing at another one?
Yes, the SETTOP Level Me program automatically detects whether the name of the point is the same one or not in order to regard this as a line or a loop.

3. Can I export the observations made?
Yes, all observations can be exported to a full ASCII file format or a Trimble M5 format. Likewise, all points stored can be copied onto the current job (*.job).

4. Can I load the observations in the Trimble Business Center?
Yes, Trimble M5 format is an ASCII format that can be opened in the Trimble Business Center.

5. Can SETTOP Level Me be used with my Trimble 5600?
No, you can only use Trimble S Series Total Stations.

6. Can I install SETTOP Level Me in all Trimble controllers?
No, the models supported are: Trimble CU Model 3, TSC2, TSC3, Trimble Tablet.

7. I am interested to buy the SETTOP Level Me. What should I do?
Contact your Trimble Dealer.

8. Is SETTOP Level Me only in English?
No, SETTOP Level Me is now in English, Spanish, Polish, Czech, German, Finnish and Danish. If you interested in other languages, contact us.