

MONITORING

USER GUIDE

Monitoring Version 1.1.x
Trimble Access Version 2019.01
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Introduction

The specialized application for the Monitoring software extends the functionality of the Trimble Access software to expedite data collection for monitoring applications.

The workflow is streamlined for regular, but not necessarily continuous, control and deformation surveys. You can:

- Easily set up a station.
- Measure the backsight and all foresight targets and save their details to the job for subsequent site visits.
- Define the measurement parameters such as epoch interval and tolerance.
- View reports of movement above the specified tolerance – there is no need for major analysis in the field.
- View information on the measurement epoch while still in the field and then output reports that compare known coordinates with measurements over time.

Typical monitoring workflow

The typical workflow when using the Monitoring software is to:

1. Create a new job or open an existing job.
2. If required, import known points.
3. Start the survey.
4. Complete the station setup.
5. If required, add monitoring points.
6. Start monitoring. Typical uses are:
 - Recurrent (daily, weekly) monitoring of one epoch where the total station is detached.
 - Long term monitoring (for example, a whole day) where the total station is not removed.
7. During monitoring the software shows measurement progress and temporary translations/results.
8. On completion, the software shows the final translations/results.
9. If required, end monitoring and end the survey.
10. Use the Monitoring software to view displacements and export data to different report formats.

Monitoring site setup

To begin monitoring, you must have created a job, and connected to the instrument and completed a station setup. Tap  and select **Measure / <survey style> / <station setup>**. To learn more about survey styles and performing a station setup, refer to the appropriate topics in the *Trimble Access Help*.

If you have opened an existing job, you must reorient to the backsight.

Monitoring jobs

The Monitoring software can use any Trimble Access job. Store the job in the appropriate project folder in the **Trimble Data** folder. To be able to use the job for monitoring, you must switch to the Monitoring app. To switch between applications, tap the application icon in the status bar and then select the application to switch to.

When opening an existing job, you must set your orientation to a backsight before you can continue. The backsight measurement is used only to orient the instrument so the points can be measured successfully. The station setup is calculated for each monitoring epoch. See [To reorient to the backsight](#).

To reorient to the backsight

To orient the instrument to a backsight in the current job:

1. Tap **☰** and select **Measure / Orientation**.

If you have not yet started a survey, select the survey style in the **Measure** menu and then select **Orientation**.

2. Check that the station details are correct. If necessary, edit the **Instrument height**.
3. If you have more than one backsight, tap the arrow next to the **Backsight** field to select a different backsight.
4. Tap **Measure**.
5. In the **Measure backsight** form, make sure the target details are correct, aim the instrument at the backsight and then tap **Measure**.

Once the instrument has measured the backsight, the results screen appears showing the measured horizontal and vertical distances, calculated horizontal and vertical distances, and the differences.

6. Tap **Accept**.

To import station reference information

To import the monitoring station from another job:


1. Tap **☰** and select **Site / Station from reference job**.
2. Select the reference job.
3. Select the station.
4. Tap **Import**.

The station point and all related points observed from the station are copied into the job.

5. To edit the imported station and measurement points, tap **☰** and select **Site / Edit reference**.

To measure new points


To measure new topo points and add them to the job, you must have completed a station setup.

1. Tap  and select **Measure / Add point**.
The **Measure topo** form appears.
2. Enter the **Point name**.
3. Enter or select the **Code**.
4. In the **Method** field, select a measurement method.
5. Enter a value in the **Target height** field.
6. Tap **Measure**.
7. Tap **Store**.

Monitoring points

To monitor points you must be connected to a conventional survey instrument and have completed a station setup.

To add a monitoring point and complete a monitoring measurement, tap  and select **Measure / Add point**.


To start a monitoring epoch guided by the software, tap  and select **Measure / Monitoring**. You can set up your monitoring point list and define different monitoring options. Once monitoring starts, select the appropriate view to get access to different types of information about your monitoring epoch:

- **Statistics** view shows monitoring progress for the current epoch
- **Station setup** view shows the result for the current station setup
- **Residuals** view shows the backsight residuals
- **List** view shows the current measured points
- **Deltas** view shows temporary translations results
- **Warnings** view shows measurements which are out of tolerance or failed

After the monitoring epoch(s) are finished you get a overview of the observed translations results.

To start monitoring using the wizard

To start monitoring, you must have opened a job and connected to the instrument.

1. Tap  and select **Measure / Monitoring**.
2. Use the softkeys below the **Point list** to add points, import points from a CSV file, edit, or delete points.
See [To define the list of points to monitor](#).
3. To start a monitoring epoch, tap **Next**.

Each day, a new epoch containing observations is created and stored in the job.

Epoch names are generated using the date and time defined in the operating system on the controller, so make sure these are set correctly.

4. To configure options such as measurement tolerances, idle time between epochs, and face order, tap **Options**. See [Monitoring options](#).

5. Tap **Next**.

The **Monitoring status** form appears.

The **Next epoch start time** field is updated and the status bar begins counting down the time until the survey starts.

To start the next epoch immediately, tap **Start now**.

When a job is defined to use **Idle time** between epochs, the survey starts immediately.

The map shows the points being monitored, and the current orientation of the instrument.

NOTE –

- *If the instrument supports FineLock or Long Range FineLock technology, then before measuring, the appropriate mode is automatically set based on the distance to the target to give the most reliable results.*
- *If you selected **Manual** as the target lock method, the instrument automatically turns to the target and pauses to allow you to sight the target. You must manually sight the target and then tap **Measure** to continue.*

To define the list of points to monitor

To define the list of points to monitor, you must have opened a job, connected to the instrument and completed a station setup.

1. Tap **≡** and select **Measure / Monitoring**.
2. Use the softkeys below the **Point list** to add points to the list using one of these methods:
 - [Select points in the job and add them to the list](#)
 - [Import points from a csv file](#)
3. Once all of the monitoring points are added to the list, check the following requirements:
 - The points must have 3D coordinates.
 - At least one of the points is defined as the backsight.
 - The monitoring list is in the same order that you want the points to be observed. To sort points by azimuth, select the **Azimuth** check box.


To turn the instrument to the selected point, tap **Turn to**.

To remove a point from the list, select it and tap **Delete**.

To change the columns displayed in the list, tap the Up arrow softkey and then tap **Display**. Select or clear the check boxes as required. To return to the **Points list**, tap **OK**.

4. Tap **Next**.
5. Complete the steps required to start the epoch. See [To start monitoring using the wizard](#).

Select points in the job and add them to the list

1. Tap **Add**.
2. Enter the **Point name**, or tap  and select **List** to select the point from the list of points in the job.
3. If the point is a backsight point, select the **Backsight** check box. At least one of the points must be selected as a backsight.
4. Select the **Prism type**, and enter the **Target height** and, if required, the **Prism constant**.
When measuring to reflectorless (DR) targets, set the **Prism type** to **DR**.
5. Select the **Working mode**. This setting is used for all subsequent measurements in the epoch.
In prism mode, select **Autolock**, **FineLock** or **Long Range FineLock** to lock on to the remote prism. The status bar indicates when the instrument is locked to a prism.
A search is automatically performed if a measurement is initiated when Autolock is enabled but the instrument is not locked to the target.
6. Tap **Add**.

Import points from a csv file

1. Tap **ASCII (CSV) file**.
2. Select the *.csv file from the list. For a list of information that the CSV file must contain see [CSV import file format requirements](#).
3. Tap **OK**.
The system shows the number of points imported. The points are added to the monitoring list.

CSV import file format requirements

The comma delimited file imported into the **Points list** can contain the following information:

Field...	Contains...
1	Point name
2	First ordinate (Northing)
3	Second ordinate (Easting)
4	Elevation
5	Code
6	Description 1
7	Description 2

Field...	Contains...
8	Target height (true vertical)
9	Target type or Prism constant
10	Target mode

The file **must contain** the first four fields. All other fields are optional. If fields 8 to 10 are null, the file can still be imported but the targets must be manually edited in the Monitoring software before you can continue. To do this, select the point in the list and tap **Edit**.

The Northing, Easting, Elevation, Target height, and Prism constant must be in the same units as the current job.

Field 9 shows the prism name if you are using a Trimble target, or the prism constant if you are using a custom target. The following table shows the allowable prism types and the applicable prism constants:

Prism type	Prism constant
VXSeriesMultiTrack	0.010
SSeries360Prism	0.002
SSeriesTraversePrism	-0.035
Small318mmTiltablePrism	0.000
Large635mmTiltablePrism	0.000
MiniPrism	-0.018
SuperPrism	0.000
Monitoring25mmPrism	-0.017
Monitoring62mmPrism	-0.040
Controlpoint62mmTiltablePrism	0.000

The Target mode field may contain one of the following:

Field 10 options	Details
DR	DR on
AutolockOff	Autolock off
AutolockOn	Autolock on, Target ID off
a number between [1] and [8]	Autolock always on, using the specified Target ID . Note that Target ID is not used by the Monitoring software so this is ignored and Autolock is used.
FineLock	FineLock on
LongRange FineLock	LR FineLock on

If you import a point, and a point of the same name already exists in the **Points list**, the imported point has **_1** appended to the name.

Monitoring options

To configure Monitoring options, tap **≡** and select **Options**.

Epoch start

- **Idle time (min)** – defines the wait time between the end of one epoch and the start of the next.
- **Interval time (min)** – defines the wait time between the start of one epoch and the start of the next. The minimum time varies depending on the time taken to complete each epoch; that is, the interval time must be longer than the time taken to measure an epoch.

Measurement settings

Face order

- **Face 1 only** – observations are taken only on face 1
- **Face 1...face 2...** – all face 1 observations are taken to all points and then all face 2 observations are taken to all points
- **Face 1/face 2...** – face 1 and then face 2 observations are taken to the first point, face 1 and then face 2 observations are taken to the next point, and so on

Observation order

When the **Face order** is set to **Face 1...face 2...**, set the **Observation order** to:

- **123...123** – to take observations on face 2 in the same order as the observations on face 1
- **123...321** – to take observations on face 2 in the reverse order to the observations on face 1

When the **Face order** is set to **Face 1 only** or **Face 1/face 2...**, set the **Observation order** to:

- **123...123** – to take each round of observations in the same order
- **123...321** – to take every alternate round of observations in the opposite order

Number of measurements

Enter the number of measurements for each point in each round.

Number of rounds

Enter the number of rounds in each epoch.

Adjust EDM settings for distance

Set accuracy depending on the connected instrument.

Set instrument mode for distance

Set the best available working mode depending on the connected instrument and distance.

Auto-measure passive targets

If this check box is not selected, then you must manually aim to passive targets.

Skip obstructed foresights

Foresights are automatically skipped, if measurement is not possible, for example the prism is obstructed.

Laser pointer

Select the check box to enable the laser pointer during DR measurement.

Compare with

First epoch: Compare the result with first epoch.

Previous epoch: Compare the results with the previously measured epoch.

First and previous epoch: Compare the results with the first and previously measured epoch.

Displacement tolerances

Define the tolerance value for monitoring points. If the tolerance is exceeded the software shows a warning.

Backsight residual tolerances

Define the tolerance value for backsight points. If the tolerance is exceeded the software shows a warning.

Atmospheric corrections

The Monitoring software applies an atmospheric parts per million (PPM) correction that is applied to measured slope distances to correct for the effects of the earth's atmosphere. PPM is determined from observed pressure and temperature readings together with specific instrument constants.

The pressure and instrument constant is obtained directly from the instrument, but you must manually enter the temperature. To change these settings during monitoring, tap **Pause** and then tap **Atmosphere**. The Monitoring software automatically calculates the atmospheric correction based on the entered values.

NOTE -

- *If you prefer to use an alternative pressure reading, you can overwrite the barometric pressure from the instrument.*
- *If you enter an atmospheric pressure and want to return to using the internal atmospheric pressure of the instrument, you must restart the Monitoring application.*

The temperature and pressure (and therefore, atmospheric correction) is saved in the job with the measurements for every epoch. You can update the temperature at any time during monitoring—the corrections will apply to the next epoch.

Out of tolerance measurements

After each measurement, the Monitoring software checks to see if the measurement is within the tolerance specified in the job. The software warns if it is out of tolerance and the deltas are shown.

Two types of tolerances are set in the job:

- Horizontal and vertical foresight displacement tolerances.
If any of the points have moved more than the specified tolerance, the deltas are shown in the **Deltas** view and the point is listed in the **Warnings** view. You can also see this information in the **Displacements** report
- Horizontal and vertical backsight residual tolerances.
 - If the backsight observations are outside the residual tolerance, the backsight information is shown in the Residuals view.

NOTE – If an alert appears at the end of an epoch for backsight residuals, the Monitoring software will not show a point alert for any displacements in the foresight measurements for the observed epoch.

Failed measurements

The instrument tries to measure each point and if the prism is obstructed, the measurement fails. You can choose to try again or skip the measurement.

TIP – To continue automatically with the next foresight, select the **Skip obstructed foresights** check box in the **Options** screen.

- If a point is skipped on face 1, the face 2 measurement automatically skips.
- If a point is skipped in one epoch (in either face 1 or face 2), the instrument still tries to measure the point in all subsequent epochs.
- All observations are recorded in the job file. When face order F1 F2 or F1/F2 is being used, all points must be measured on both faces for the Monitoring software to detect any displacements in the epoch.
- When face order F1 F2 or F1/F2 is being used, the backsight must be measured on both faces for the monitoring software to calculate coordinates or displacements for any of the foresight points in the epoch. If the backsight is not measured in both faces, coordinates are not calculated for any of the foresights.

The list view indicates the measurement progress for each point in the current epoch:

Icon	Measurement status...
...	Measurement in progress
✓	Measurement successful

Icon	Measurement status...
×	Measurement failed

To stop monitoring

To stop monitoring, tap **Esc** in the **Monitoring status** screen.

If measurements are not in progress the survey is stopped immediately.

If measurements are in progress monitoring stops after completing the current measurement.

Reports

You can generate a report for measured points including any point movement. View these reports to check data while still in the field or to transfer data from the field to your client or to the office for further processing with the office software.

Reviewing displacements

To view displacement translations of monitoring points:

1. Tap **≡** and select **Reports / Displacements**.
2. Select the epoch(s) you want to compare. Selected epochs are indicated with a small arrow. If you select:
 - **two epochs** then they are compared to each other.
 - **one epoch** it is compared with the reference values (from the initial observation).

Generating reports on points measured

You can generate a report for measured points including any point translations. View these reports to check data while still in the field or to transfer data from the field to your client or to the office.

1. Tap **≡** and select **Reports / Reports**.
2. Select the required file format. The following formats are available by default:

Select...	To create...
Epoch Reference Compare Report	A report that shows the movement of every point in every epoch, compared with the first set of observations. Any displacements that are above the tolerances specified in the job are highlighted in red.
Point report	A report that shows the movement of one predefined point, compared with the first set of observations. Any displacements that are above the tolerances specified in the job are highlighted in red.

Select...	To create...
Word report	A report that displays a scatter plot and trend chart for each point, showing the displacements over time. This report can be viewed using Microsoft Word.

Transferring files to the office

You can transfer various types of monitoring files between a Trimble controller and the office computer, however, not all formats can be opened directly with your office software.

Viewing your monitoring data using Trimble Business Center

If you have exported your monitoring data to a JobXML (*.jxl) file, you can import this into the Trimble Business Center software.

All monitoring observations are imported into the project and the coordinates used by the project are derived from the first epoch.

TIP –

- Use the Project Explorer to view the observations from each epoch.
- Generate a point derivation report to view the coordinates for each epoch.
- Use the **Point Tolerances** option in **Project Settings** to define the point movement tolerances. Any coordinates outside these tolerances will be highlighted red in the reports and flagged as out of tolerance in the map window.