Trimble SX12 Scanning Total Station

Field Guide

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Trimble.

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Introducing the SX12

Key features

The key features of the Trimble® SX12 scanning total station are:

- Premium robotic total station capabilities combined with the power of a high speed scanner.
- Trimble Lightning™ 3DM technology combines the most accurate survey measurements and the fastest scanning speed available.
- Enhanced Trimble VISION™ technology to capture the site more clearly than ever before.
- Works with Trimble Access™, Trimble Business Center, and Trimble RealWorks® software to provide the most powerful geospatial solution on the market.
- Built on legendary and trusted Trimble technologies.

Power and versatility in a single scanning total station

The Trimble SX12 scanning total station combines the best robotic total station and scanning technologies from the optical survey worlds into one powerful, versatile piece of equipment.

- 1" accuracy for the most demanding projects and applications.
- EDM accuracy of 1.5 mm + 2 ppm to prism.
- Familiar survey workflow with the added benefits of high speed scanning and detailed imaging.
- Ideal for the most detail-demanding projects with high accuracy requirements.

Trimble Lightning 3DM technology

Trimble Lightning 3DM technology provides:

- Ultra-clean point clouds at up to 26,600 points per second.
- Four scan settings for capturing the required scan density.
- Flexibility to use the SX12 as a pure scanner.
- Atmospheric and scale factor corrections for both survey and scan data.

Trimble VISION technology

Trimble VISION technology gives you the power to direct your survey using live video images, view all your data overlaid in the field and create a wide variety of deliverables in the office:

- Live streaming video enables the instrument to be aimed simply by tapping the location on the image. This reduces aiming time and operator fatigue.

- The enhanced camera systems of the SX12 allow users to zoom in up to 84x to visualize, point, and measure further than ever before.

- Avoid unnecessary rework by using video data overlay to visually confirm that all points and scans have been measured before moving the station setup.

- Fully-calibrated cameras allow for measurement of inaccessible points in the office using terrestrial photogrammetry workflows provided in Trimble Business Center.

- Annotate captured images with notes in Trimble Access to communicate information alongside meaningful context.

Built on legendary and trusted Trimble technologies

In addition to new technologies developed for the SX12, it uses several technologies that were developed for Trimble S Series instruments. These features provide improved instrument quality and productivity gains for instrument users.

- The SX12 incorporates Trimble MagDrive™ servo technology, which provides for exceptional speed and accuracy with smooth, silent operation.

- Trimble SurePoint™ technology ensures accurate measurements by automatically correcting for unwanted movement due to wind, sinkage, and other factors.

- Trimble Lightning technology provides consistent range noise over the entire scan data range.

Physical features

Physical features of the SX12 include:

- Fully coaxial telescope including optics, Lightning 3DM (EDM), advanced Autolock® technology and coaxial telescope camera

- Green focussable laser pointer, with a spot size of just 3mm @ 50m.

- Fully calibrated Overview and Primary cameras offset below the main optics

- Internal video plummet allowing for high-accuracy instrument centering and setup capture

- Internal 2.4 GHz license-free, frequency-hopping, spread-spectrum robotic radio – environmentally-sealed for all-weather usage for long range robotic communications

- Wi-Fi communications for close range robotic operations allowing for high speed data transfer

- Dual on/off key and radio configuration key

- Easy access battery bay and Smart-Battery with power indicator

Features of the SX12, shown in the Face 2 position
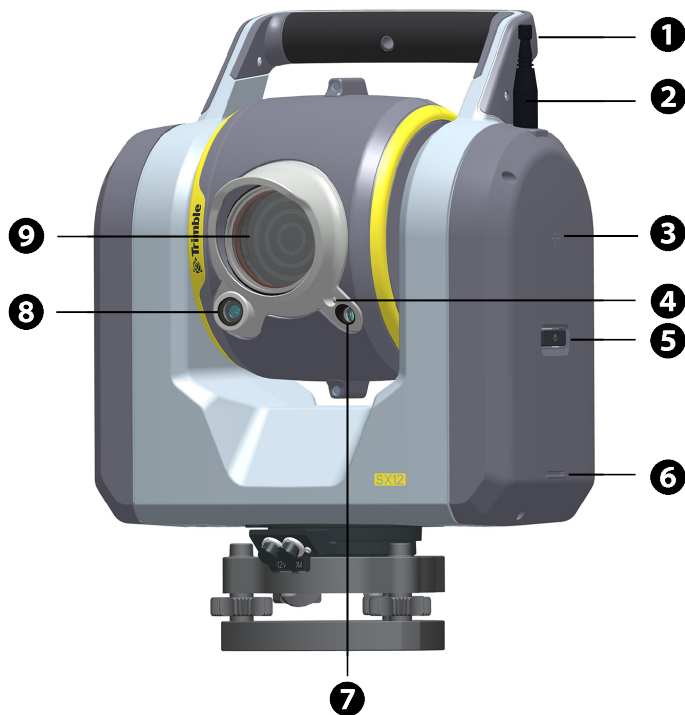
1	Carry handle
2	Long Range Radio (LRR)/Wi-Fi antenna
3	True Height mark
4	Target illumination light (TIL)
5	On/Off key and status indicator
6	Bottom Notch mark
7	Optics for primary camera
8	Optics for overview camera
9	Optics for distance measurement, Autolock and tele camera

Features of the SX12, shown in the Face 1 position
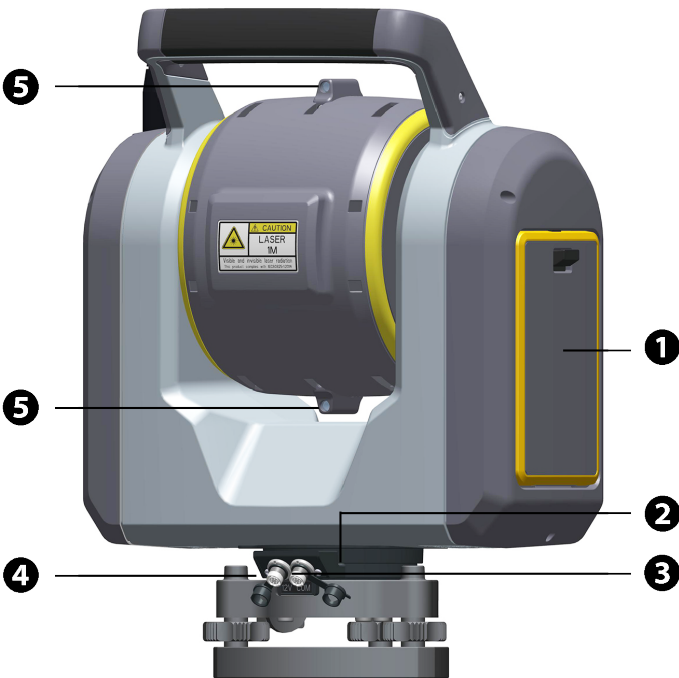
1	Battery compartment
2	Plummet camera
3	Communication (COM) connector
4	Power (12V) connector
5	Coarse sight (x2)

Specifications	Value
Distance accuracy	Prism: 1 mm + 1.5 ppm
	DR: 2 mm + 1.5 ppm
Angular accuracy	1"
Scanning speed (EDM sampling rate)	26.6 kHz
Range	Prism: 5500 m
	DR: 800 m
	Autolock: 800 m
	Scanning: 600 m
Imaging	Fully calibrated camera system
	Overview, primary, and telescope cameras (5 MP each)
	FOV: 57°, 13°, 2.6°

For more information, refer to the Trimble SX12 Scanning Total Station datasheet.

Connections

- 6-pin Hirose to USB/serial (COM) connector for wired communication
- 6-pin Hirose 12V power (PWR) connector

Instrument operation

Because the SX12 is designed specifically to maximize productivity during a robotic workflow, the SX12 is only available in a robotic configuration. The optics of the instrument are specifically designed to allow pointing capabilities without the need for an eye piece. There is no on board display. To operate the SX12, you must use a Trimble controller or a Windows tablet running Trimble Access software.

Height measurement marks

Use one of the following marks to determine the instrument height:

- True Height mark **1**

  The top mark that corresponds to the center of the telescope unit. Referred to as the **True Height** measurement method in Trimble Access.

- Bottom Notch mark **2**

  Sits at the bottom of the instrument, allowing for easier measure-up. Referred to as the **Bottom Notch** measurement method in Trimble Access.

2
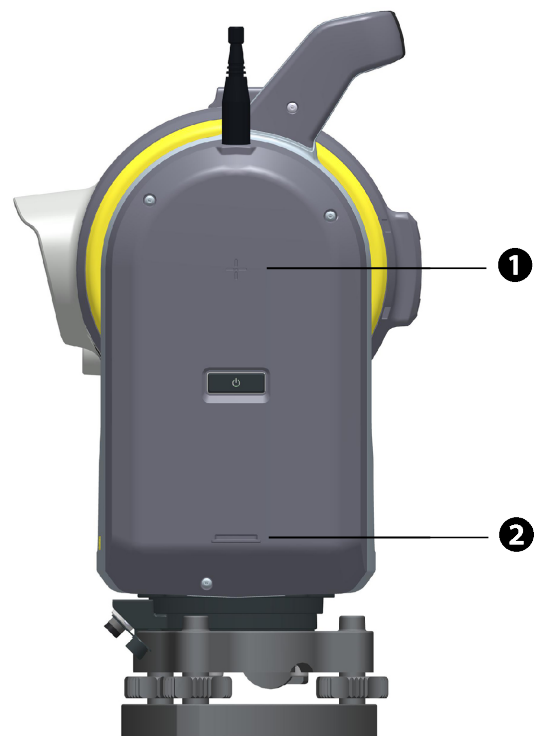
Working with the SX12

Creating a project

The **Projects** screen is the first screen that appears when you start the Trimble Access software. A project groups jobs and the files used by those jobs. You must create a project before you can create a job.

To create a project:

1. Tap **New**.

2. Enter the **Name** of the project.

3. If required, enter **Description**, **Reference**, and **Location** details.

   This information will appear with the project name in the **Projects** screen.

4. If required, select an image for the project. To select a file on the controller or your network, tap 📁 .

   The selected image will appear next to the project name in the **Projects** screen.

5. Tap **Create**.

   The project folder is created on the controller and the **New job** screen appears.

Creating a job

A job organizes and stores the data collected during a survey. It may contain data from several different surveys. You must create a job before you can measure any points or make any calculations.

When you create a new project, the **New Job** screen appears automatically.

1. Select the **Create from template** option.

2. In the **Job name** field, enter the job name. For example: **SX12 Demo**.

   The job name can be a maximum of 32 characters and can include upper or lower case letters and numbers.

3. In the **Template** field, select **Default** to create the job from the default template provided with the software.

   All the job properties from the selected template are copied into the job.

4. To change the coordinate system used for data in the job, tap the **Coord. sys** button. By default, the selected coordinate system is **Scale: 1.0000000000**.

   Because this is an optical survey, this job will use the default template and coordinate system.

5. If you have files to link to the job, for example a CSV file containing control point coordinates, tap the **Linked files** button. Select the files to link. Tap **Accept**. The software returns to the **New job** screen.

   The number of linked files is shown in the **Linked files** field.

6. If required, tap the **Feature library** button and then select the feature library to use for the job. For this job, select **GlobalFeatures**. Tap **Accept**.

   The software returns to the **New job** screen.

7. Tap **Accept**.

The new job **SX12 Demo** is created and opened.

Connecting to the SX12

1. Insert the battery so that the battery status indicator on the battery is facing upward.

2. To turn on the instrument, press the **Power** button.

   The LED on the Power button indicates the current instrument mode.

   - If the LED is ON for ½ second and then OFF for 1 second (*a short flash*), the instrument is searching for a Wi-Fi connection.

   - If the LED is ON for 2 seconds and then OFF for ½ second (*a long flash*), the instrument is searching for a Long Range Radio (LRR) connection.

3. Once you have configured the connection settings, the Trimble Access software automatically connects to the SX12 when you power on the SX12. When connected, the flashing instrument icon changes to a steady SX12 icon.

Configuring Wi-Fi connection settings

> **NOTE –** Any controller running Trimble Access can connect to an SX12 using Wi-Fi™. To connect to an SX12 using Wi-Fi Halow™, Trimble Access must be running on a Trimble controller that has an EMPOWER EM130 Wi-Fi HaLow module. Wi-Fi HaLow uses a different frequency band to standard Wi-Fi and is available only in the United States, Canada, Australia, and New Zealand.

1. If the instrument is in LRR mode (the LED shows a long flash), then press the **Power** button until the LED blinks rapidly and then release the button to change the instrument to Wi-Fi mode (the LED shows a short flash).

2. To select the instrument to connect to:

a. In Trimble Access, tap ☰ and select **Settings / Connections**.

b. Select the **Wi-Fi** tab.

c. Select the **Wi-Fi network** that matches the serial number of the SX12 you are using. For example, Trimble-SX12-30710008 and then tap **Accept**.
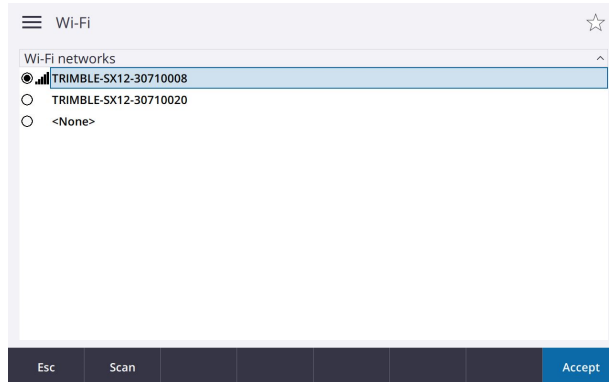
If the required instrument is not listed:

- If you are using an Android controller, wait for the list of **Wi-Fi networks** to automatically refresh.

- If you are using a Windows controller, tap **Scan**. The controller scans for Wi-Fi devices and adds them to the list of **Wi-Fi networks**.

> **TIP –** In congested Wi-Fi environments it can be useful to set the Wi-Fi channel used by the instrument in the **Instrument settings** screen. To do this tap ☰ and select **Instrument / Instrument settings**, and then tap **Wi-Fi** and select the required Wi-Fi channel. If you are using an SX12 with a controller that has an EMPOWER EM130 Wi-Fi HaLow™ module, you can select the Wi-Fi HaLow channel or auto-scan to find the best channel. For more information, see **Instrument settings** in the *Trimble Access Help Portal*.

d. Tap **Accept** to close the **Connections** screen.

3. When connecting the controller to an SX12 that is running firmware S2.8.x or later for the first time, Trimble Access prompts you to enter the instrument password. When the software connects to the instrument, the password you entered is stored on the controller.

   If the instrument is using the factory default password (for example, when the instrument is being used for the first time, the password has been reset, or if the instrument has returned from service), the software prompts you to change the password. Enter a password at least 8 characters long, with a minimum of one numeric character and one symbol. When the software connects to the instrument, the password you entered is stored in the instrument and on the controller.

> **TIP –** If a password for the selected instrument has previously been saved on the controller, then the software connects to the instrument without prompting you to enter the password.

4. Once the software connects to the instrument, the Wi-Fi signal strength is shown in the status bar alongside the instrument icon.

> **NOTE –** If the saved password on the controller does not match the password saved in the instrument, then the software cannot connect.
>
> - If you know the password stored in the instrument, in Trimble Access select the instrument in the **Wi-Fi** tab and then tap **Forget** to forget the password saved on the controller. Reconnect to the instrument using Wi-Fi, where the software will prompt you to enter the correct password.
> - If you do not know the password stored in the instrument, press the **Power** button rapidly on the instrument 5 times to reset the password in the instrument to the factory default password. Restart the instrument and reconnect to the instrument using Wi-Fi, where the software will prompt you to change the password. When the software connects to the instrument the new password you entered is stored in the instrument and on the controller.
>
> For more information on managing instrument passwords, see **Instrument password** in the *Trimble Access Help Portal*.

Configuring LRR connection settings

1. If the instrument is in Wi-Fi mode (the LED shows a short flash), then press the **Power** button until the LED blinks rapidly and then release the button to change the instrument to LRR mode (the LED shows a long flash).

2. To switch between Wi-Fi and LRR, press the **Power** button until the LED blinks rapidly and then release the button.

3. In Trimble Access, tap the flashing instrument icon in the status bar above the map to open the **Auto-connect options** screen.

4. To configure the settings for the instrument to use if the instrument is switched to long range radio mode:

   a. In the **Auto-connect options** screen, tap **Radio**.

   b. Enter the radio channel and network ID you have set in the instrument. For example:

      - In the **Radio channel** field enter **5** and press **Enter**.
      - In the **Network ID** field enter **10** and press **Enter**.
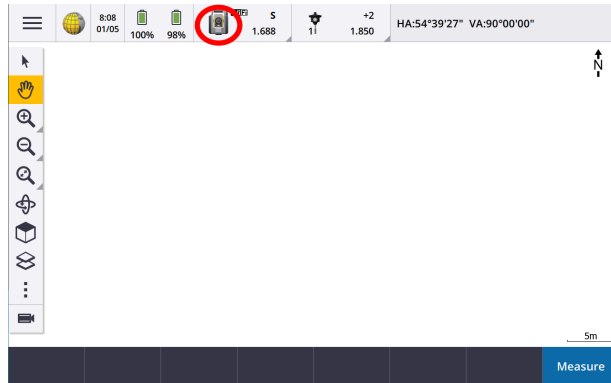
   c. Tap **Accept**.

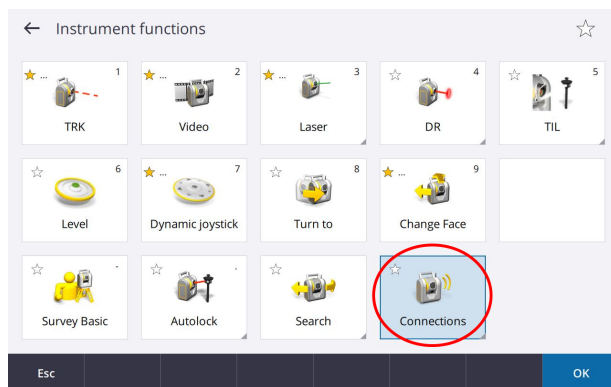The software returns to the **Auto-connect options** screen.

5. Tap **Accept** to close the **Auto-connect options** screen.
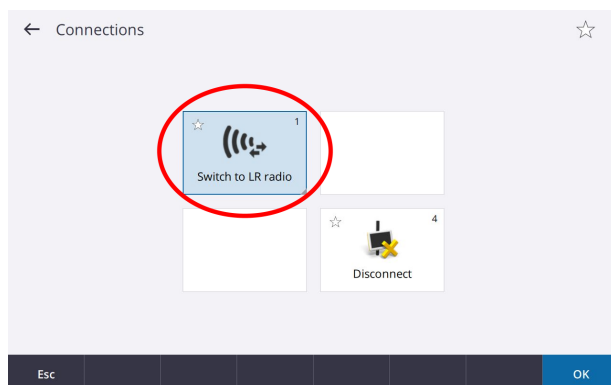
Switching between connection modes

1. To switch from Wi-Fi to LRR connection mode when Trimble Access is connected to the instrument:

   a. Tap the SX12 icon in the status bar.

   b. Tap **Connections**.

   c. Tap **Switch to LR radio**.

   The radio settings are sent to the SX12 using the existing Wi-Fi connection and then applied when the controller connects to the instrument. The instrument will then change to LRR mode.

> **NOTE –** A long range radio connection provides additional working range for the user, but provides a slower wireless data transfer rate.

Starting a survey

> **NOTE –** For this example, we are using the default SX12 survey style. If your job has specific requirements you may need to make appropriate changes to the survey style. To do this, from the main Trimble Access menu, tap **Settings / Survey styles**. For more information, refer to the Trimble Access Help.

1. From the map, tap **Measure**.
2. Select the survey style to use. For this exercise, select **SX10 and SX12**.
3. Tap **Station setup**.
4. Position the instrument over a known point:
   a. Use the optical plummet in the instrument tribrach to orient and initially level the SX12 over a known point.

b. Use the video plummet display to accurately set up and level the SX12 over the known point.
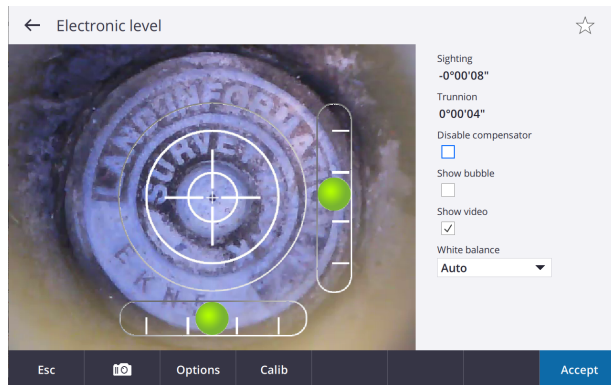
> **NOTE –** To see movements in the instrument position reflected as expected in the video plummet display, orient the instrument so the handle is closest to the operator and the instrument is in the Face 1 position. The figures below show how the instrument orientation is reflected in the plummet screen. Moving the plummet forward moves the plummet toward the top of the screen.
>
>
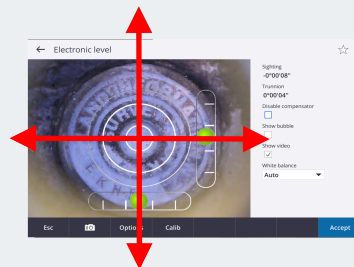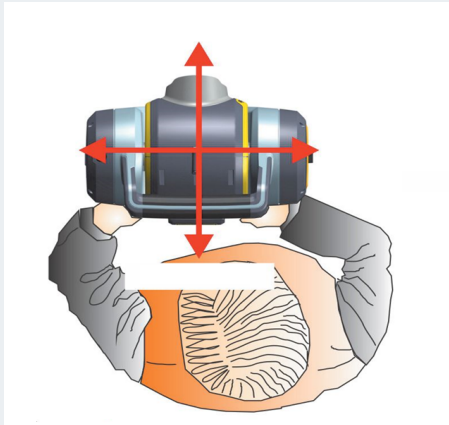
c. Ensure the instrument is level and accurately positioned over the point.

d. Tap **Accept**.

5. Enter correction information so that the software can calculate and apply corrections to the measurements.

 a. In the **Temperature** field, enter the current temperature.

 b. Tap **Accept**.

The instrument pressure is calculated inside the SX12, so you do not need to enter a value in the **Pressure** field. The **PPM** and **Refraction constant** values are automatically calculated using the pressure and temperature values.

> **TIP –** If the job is set up to use Celsius as the temperature unit but you enter a temperature of 70F, the software converts the temperature to Celsius (21.1C) as well as computing the PPM.

6. Select or key in the point at which the instrument is set up:

 a. In the **Instrument point name** field, enter the name of the point over which you have set up the instrument.

 b. Measure the instrument height. Enter the value in the **Instrument height** field. To select the height measurement method (either true height or bottom of notch), tap ▶ .

 c. Tap **Accept**.

7. Measure the backsight point:
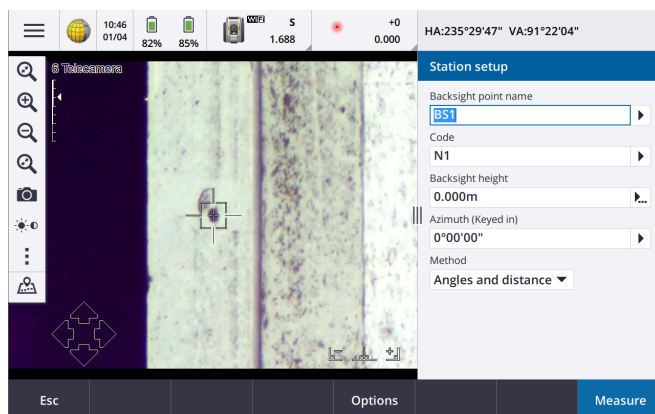
a. In the **Backsight point name** field, select the point over which you have set up the target.

b. In the **Backsight height** field, enter the height of the backsight.

c. In the **Method** field, select the method you are using to measure to the backsight. In this example, we selected **Angles and distance**.

d. Make sure the **Target** icon in the status bar is set for DR measurements. If it is not, tap the **Target** icon and then select **Target DR**.

e. To make sure the instrument is correctly oriented, increase the zoom of the video display so that the target intersection is clearly visible.

f. To fine-tune the aim of the instrument, use the keys in the video display or on the controller.

g. When the instrument is successfully pointed at the backsight target, tap **Measure**.

8. The residuals are displayed at the bottom right of the screen. If they are within tolerance, tap **Store**.

If an out of tolerance screen appears, check your settings and pointing and then re-do the station setup.
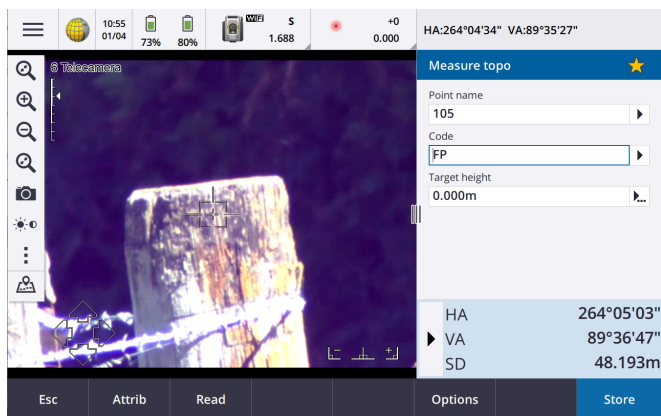
Station setup is complete.

Measuring points using the Video screen

Once the station setup is complete, Trimble Access shows the **Map** screen.

1. To open the **Measure topo** screen, tap ≡ and select **Measure / Measure topo**.

2. Move the target from the backsight point to the point you want to measure.

3. To re-aim the SX12 at the target, do one of the following:

    • Tap the video display at the desired location.

    • Drag a single finger across the video display in the direction you want the image to move.

To zoom in or out, place two fingers on the video display and 'stretch out' to zoom in or 'pinch in' to zoom out from the center of the video display.

4. Once the instrument is successfully aimed at the target, enter the point details:

   a. Enter the point name.

   b. If required, enter a feature code that describes the point.

   c. Select the measurement method. In this example, we selected **Angles and distance**.

   d. Measure the target height and enter it.

5. Tap **Measure**.

6. The measurement details are displayed at the bottom right of the screen. Tap **Store**.

Measuring points using the laser pointer

Once the station setup is complete, Trimble Access shows the **Map** screen.

1. Tap the Instrument icon in the status bar to open the **Instrument functions** screen.

2. In the **Instrument functions** screen, tap **Laser pointer** to enable the laser pointer.

3. In the **Instrument functions** screen, tap **Dynamic joystick** to open the **Dynamic joystick** screen.

> **TIP –** If the screen does not show the **Dynamic joystick** button, tap **Joystick** and then tap the **Dynamic joystick** softkey. The **Instrument functions** screen shows the icon for the last used joystick.

The center of the **Dynamic joystick** screen is a touchpad, where the instrument will follow the movements of your finger on the touchpad. For coarse movements, a vertical slider appears to the left, and a horizontal slider appears below the touchpad.
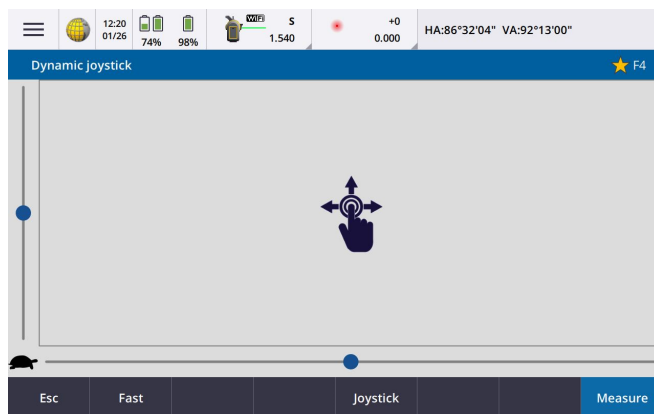
4. Use the **Dynamic joystick** to direct the laser pointer to the location of the point to be measured:

   - To coarsely position the laser pointer, use the horizontal or vertical slider:
     - Tap and hold the blue cursor on the horizontal axis and drag to the left or right. The laser pointer moves accordingly. Release the cursor to stop moving the laser pointer. When released, the blue cursor returns to the center of the horizontal axis.
     - Tap and hold the blue cursor on the vertical axis and drag up or down. The laser pointer moves accordingly. Release the cursor to stop moving the laser pointer. When released, the blue cursor returns to the center of the vertical axis.
   - To move the laser pointer in any direction, tap the touchpad in the center of the screen and drag around to the required location.
   - To fine-tune the position of the laser pointer:
     - Tap once on the touchpad to move the laser pointer 0.5 mm in that direction.
     - Press once on an arrow key in the directional pad on the controller to move the laser pointer 0.5 mm in that direction.
     - Press and hold an arrow key in the directional pad on the controller to keep moving the laser pointer at a constant speed of 20 mm per second in that direction.

   To change the speed of the dynamic joystick, toggle the **Slow / Fast** softkey. **Fast** speed is indicated by the hare icon 🐇 in the lower left corner. **Slow** speed is indicated by the tortoise icon 🐢 and is four times slower than **Fast** speed.

5. When the laser pointer is at the required location, tap **Measure** to measure the point. Enter the point details:

   a. Enter the point name.
   b. If required, enter a feature code that describes the point.
   c. Select the measurement method.
   d. Measure the target height and enter it.

6. The measurement details are displayed at the bottom right of the screen. Tap **Store**.

7. When the point is stored, the software returns to the **Dynamic joystick** screen, ready for you to move the laser pointer to the next location.

Staking points using the laser pointer

When staking out points using the laser pointer, Trimble Access adds a **Mark point** step to the workflow which automates a temporary switch to STD mode for the highest accuracy. This positions the laser pointer at the EDM location, which is the true stakeout position.

To stake out points:

1. Make sure the **Target height** is correct.

    To change the target height, tap the target icon in the status bar and edit the height of the target. Tap **Accept**.

2. Tap the SX12 icon in the status bar to open the **Instrument functions** screen.

    a. Tap the first button in the **Instrument functions** screen until it shows **TRK**.

    b. Tap the **Laser pointer** button to enable the laser pointer.

    c. Tap **OK**.

3. Tap the point you want to stake out in the map and then tap **Stakeout**.

4. Navigate to the point using the information on-screen.

    > **TIP –** Tap the **Turn** softkey to have the instrument automatically turn to the required horizontal and vertical angle.

5. Tap **Mark point** to put the instrument into **STD** mode. The laser pointer stops flashing and moves to position itself at the EDM location.

6. If required, tap **Measure** to update the deltas using the laser pointer location.

7. Tap **Accept** to store the point.

    The instrument automatically returns to **TRK** mode and the laser pointer resumes tracking.

    > **TIP –** To measure the stake position without repositioning the laser pointer on the EDM location, tap **Options** in the **Stakeout** screen and clear the **Mark point with laser pointer** check box. The stake position measurement is taken to the EDM location, so doing this can mean you have an offset between where the stake position is shown with the laser pointer, and where the stake measurement is taken to with the EDM. For more information, see EDM settings, page 28.

8. If you selected the **View before storage** option, the staked deltas you selected in the **Stakeout options** screen are shown. Tap **Store**.

Completing a scan

1. Tap ≡ and select **Measure / Scanning**.

2. Enter the **Scan name**.

3. Define a rectangular or polygon scan frame around the area of interest.

    For more information, see Defining the scan parameters, page 20.
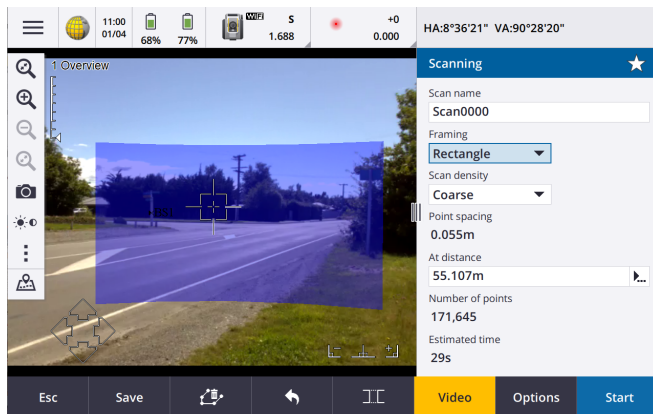
4. In the **Scan density** field, select **Coarse**.

5. To capture panorama images during the scan, scroll down the form and select the **Panorama** check box. Additional settings appear below the **Panorama** check box. See Panorama options, page 23.

6. Tap **Start**.

   The software shows the progress of the scan. When the scan is complete, the instrument returns to its original position.

Defining the scan parameters

This section describes how to set up your scan using the fields in the **Scanning** screen.

Selecting the region to scan

You can define the scan frame using one of the following framing methods:

- Rectangle
- Polygon
- Horizontal band
- Full dome

The most interactive part of scanning is defining the scan frame. Select each mode in turn and try setting different scan frames with each mode but do not start a scan.

Additional softkeys appear, depending on the framing method selected. Tap them to try them out.

When defining the frame area, tap **Undo** ⬅ to remove the last created frame point, or tap **Reset region** 🗑 to clear the framing region and start again.

Rectangle

To define a rectangular scan frame, tap in the video display at two opposite corners.

The order in which you tap the corners of the scan frame changes how the rectangle is drawn. Experiment with different ways to create the rectangle (for example, tap the left side then the right side, or the right side and then the left side.)
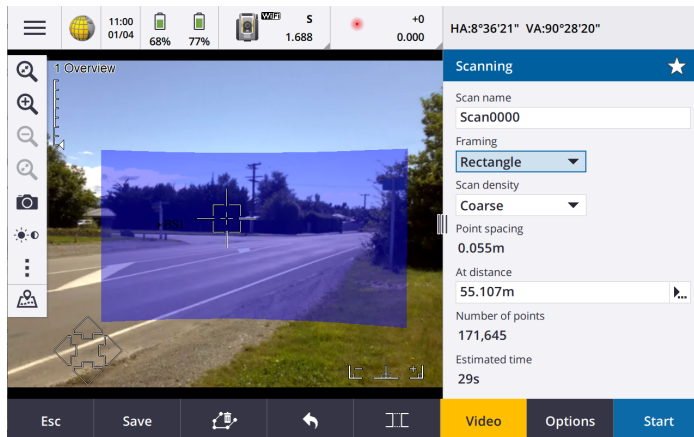
Polygon

To define a polygon scan frame, tap each vertex of the polygon in the video display.
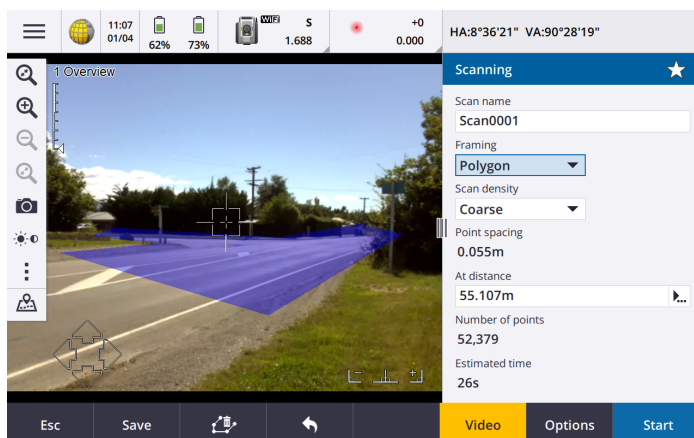
Horizontal band

A horizontal band scan frame scans a full 360 degrees within the selected horizontal band.

To scan everything:

- below the defined vertical angle, tap once above the horizon in the video display.
- above the defined vertical angle, tap once below the horizon in the video display.

To select a narrower horizontal band, tap again in the video display to limit the upper or lower vertical edge of the horizontal band you have defined. In general, it is better to select the top of the band first.
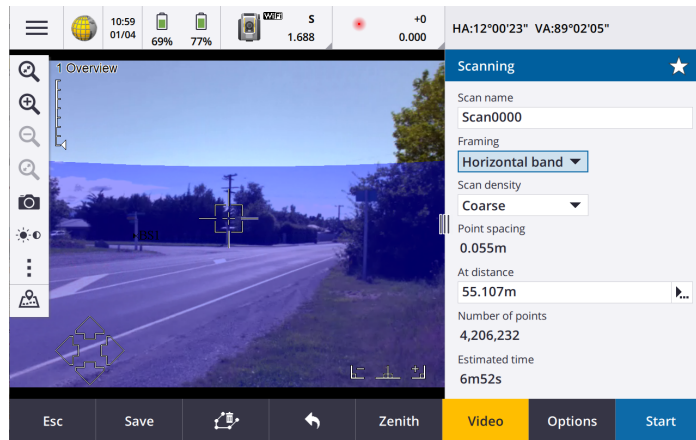
Full dome

When you select the full dome framing method, the scan area is always 360° horizontally and vertically down to 148°.
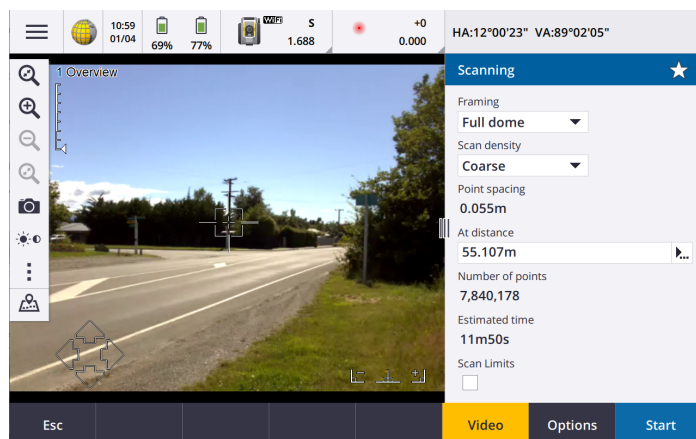
Configuring the density of scan points

In the **Scan density** field, select the required scan density. To check the point spacing for the selected scan density, enter the distance to the target in the **At distance** field. The value shown in the **Point spacing** field shows the point spacing at the specified distance.

> **TIP –** If required, you can make a DR measurement to the scan object instead of entering the distance in the **At distance** field. To do this, tap ▶ in the **At distance** field. Tap **Measure**. Measure a single measurement to the mid-point of the scan area.

Once you have selected the scan frame and scan density, the software estimates the number of points and estimated time required to complete the scan.

> **NOTE –** The **At Distance** value is also used in the projection of the scan frame on the video. If you are tightly framing the boundary of your object of interest, then ensure the **At Distance** is appropriate so you capture the entire object.

Setting scan limits

To limit the scan range, select the **Scan limits** check box and then enter the **Minimum distance** and **Maximum distance** values for acceptable scan points. To measure the distance to a target or object, tap ▶ and select **Measure**.

> **NOTE –** Points outside the specified range will not be stored.

Panorama options

To view panorama options, select the **Panorama** check box in the **Scanning** screen. Additional settings appear below the **Panorama** check box.
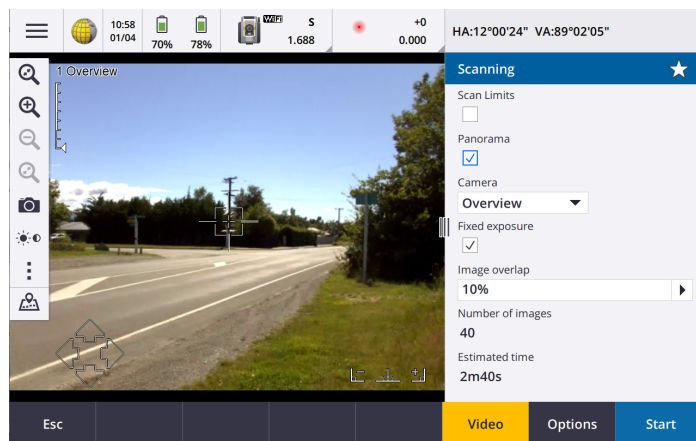
To change the camera used to capture the panorama, select it in the **Camera** field. The Overview and Primary cameras are available with any **Framing** method.

> **NOTE –** The Telecamera is available only when the **Framing** method is set to **Rectangle** or **Polygon**. Telecamera panorama images are fixed focus. For best results, the contents of the framed area should all be at a similar distance. Panoramas captured using the Telecamera are limited to a maximum of 1000 images.

If you are using the SX10/SX12 Telecamera, focus the Telecamera to the scanning area. To do this, aim the instrument at the object of interest and make sure the zoom level indicator in the top left of the Video feed shows **Telecamera**.

If the Telecamera cannot focus automatically on the object of interest, tap ☀◑ in the **Video** toolbar to view the instrument camera options. Select the **Manual focus** check box and then tap the arrows to adjust the camera focus.

To fix the exposure to the settings in use at the time you start the scan, point the instrument toward the location that defines the camera exposure you want to use for all panoramic images and select the **Fixed exposure** check box.

The software uses the defined frame area to calculate the **Number of images** and **Estimated time** required to complete the panorama.

Repeating scans

If you are using an SX12 to scan the same area multiple times, you can quickly and easily repeat scans by loading a previous scan in the same job or a linked job. For example, you can scan a floor once to find the high or low areas that need leveling, and after performing remedial work you can repeat the scan to confirm the floor is within the required tolerances.

To load a scan:

- The instrument must be set up on the same point as the scan you want to repeat.
- Make sure the **At distance** value is accurate so that the software can correctly recalculate the vertical angles and account for differences in instrument height between the scans.

To load a previous scan

1. If you are not already in the **Scanning** screen, tap ≡ and select **Measure / Scanning**.
2. Tap **Load**.

   The software shows a list of all of the scans in the current job and linked jobs that have been taken at the same point as the current station.
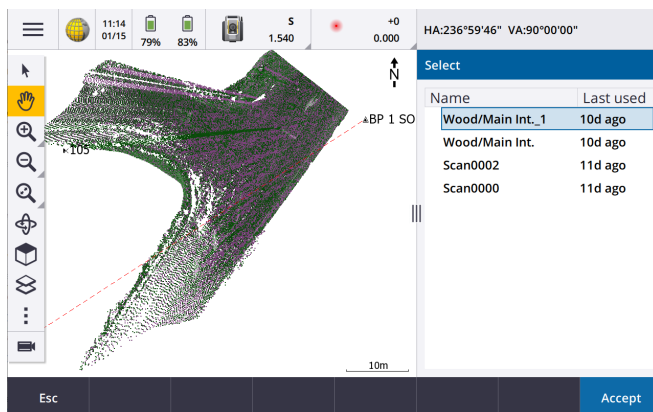
3. Select the scan to load.

   The **Scanning** screen shows the scan parameters of the selected scan, including the scan frame. The **Scan name** is automatically based on the name of the loaded scan.
4. If required, edit the scan parameters.
5. Tap **Start**.

To save scan parameters without scanning

You can define scan parameters and save them to load later, without having to complete the scan.

1. In the **Scanning** screen, enter the **Scan name**.
2. Define the scan parameters, including the frame. Alternatively, load a previous scan and modify it.
3. Tap ⟩ or swipe right to left (or left to right) along the row of softkeys and tap **Save**.

A scan record containing zero points is written to the job. Note that there is no associated .rwcx file for an empty scan.

> **TIP –** If you create an empty scan and then later do not want it to appear in the list of scans to load, you can delete it in the **Review job** screen.

Surface inspection

Use **Surface inspection** to compare an as-built surface, such as a horizontal floor, inclined or vertical wall, or cylinder, with a reference surface. The **Surface inspection** Cogo function calculates the distance to the reference surface for each point in the selected scan(s) and creates an inspection point cloud.

Points in the inspection point cloud are color-coded to provide immediate visual feedback between the point cloud and the reference surface. When inspecting a horizontal floor, for example, you will be able to see immediately any parts of the floor that are lower than they should be, and any parts of the floor that are higher than they should be.
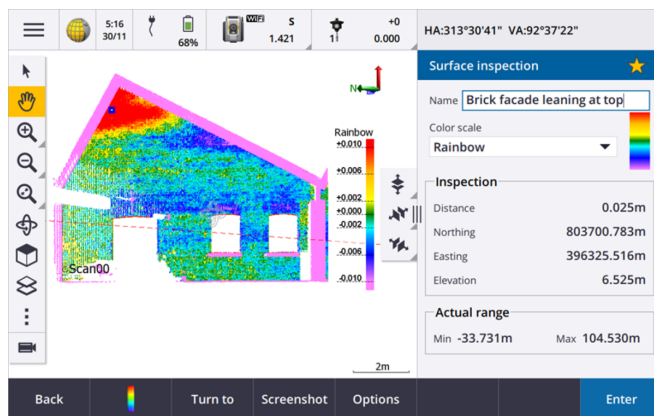
To inspect a surface

1. Tap ☰ and select **Cogo / Surface inspection**.

2. Tap ⋮ in the map toolbar and select **Scans**. Select the **Scans** tab and then select the scan or scans to include in the inspection. A check mark ✔ indicates the scan is visible in the map. To return to the **Surface inspection** screen, tap **Accept**.

3. To include only a section of the selected scan file(s) in the inspection, select the scan points to include in the map.

4. Enter a **Name** for the surface inspection.

5. Select the **Method**.

6. In the **Reference surface** group, enter the parameters to define the surface to compare the as-built scan against.

   - To define a **Horizontal plane**, enter or select a point or enter an elevation.

   - To define a **Vertical plane**, enter or select two points.

   - To define an **Inclined plane**, enter or select three points.

   - To define a **Cylinder**, enter or select two points that define the axis of the cylinder and enter the radius of the cylinder.

7. In the **Color scale** field, select the color scale to use for the inspection results. To modify the color scale parameters, tap the color scale softkey in the **Surface inspection** screen.

8. Tap **Calc**.

   The software compares the visible scans or selected scan points to the defined **Reference surface**.

   The **Actual** range group shows the minimum and maximum distances between the scan and the reference surface.

To inspect the surface further:

- Tap any scan point to view the coordinates of the point and the distance from that scan point to the reference surface.

- To turn the connected instrument to the selected point, tap **Turn to**. Turn on the laser pointer to highlight where any remedial work may be required.

- To create a screen capture of the current software view, including the map and **Surface Inspection** form, tap **Snapshot**. If required, annotate the snapshot using the **Draw** tools and tap **Store**. To save the screen capture to the job, tap **Store**.

9. Tap **Store**. The inspection parameters are saved to the job.

    You can view the saved inspection in the map at any time.

    The surface inspection is immediately hidden from the map and the **Surface Inspection** form is ready for a new inspection.

Copying the job

Use the **Copy job files to** function to copy the job to a different location. This could be a removable external drive such as a USB drive or, if the controller is connected to your office network, it could be a folder that you have access to on the network.

1. Tap ☰ and select **Job**, and then tap **Copy**

2. In the **Copy** screen, select **Copy job files to**.
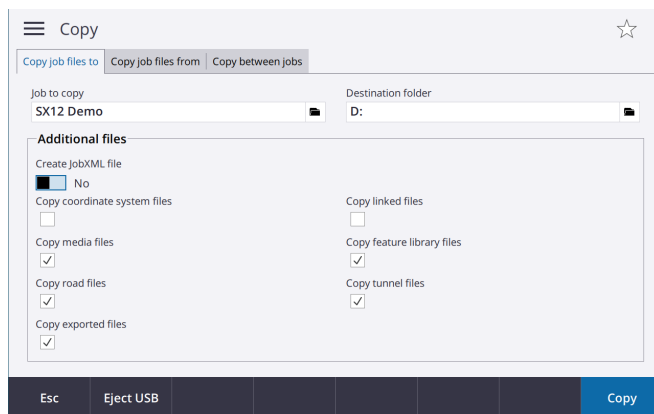
3. Browse to and select the **Job to copy**.

4. Tap 🗀 to select the **Destination folder** for the copied job.

   You can select a folder on any available drive, such as a network drive or a USB drive.

5. Select the folder for the copied job from the **Select folder** screen. Tap **Accept**.

6. To copy project files associated with the job, select the appropriate check boxes.

7. Tap **Accept**.

3

Advanced configuration of the SX12

EDM settings

To configure settings for the electronic distance meter in the instrument, tap ≡ and select **Instrument** ⁄ **EDM settings**.

Direct Reflex

Select the **Direct Reflex** check box to enable DR mode.

You can also enable DR mode from the **Instrument functions** screen, or by changing the target to **Target DR**.

Laser pointer

Select the **Laser pointer** check box to enable the laser pointer. You can also enable or disable the laser from the **Instrument functions** screen.

> **TIP –** To streamline the process of locating a prism in dark environments, enable the **LaserLock** check box in the **Target controls** screen and enable the laser pointer in the **EDM settings** screen. If the **LaserLock** check box in the **Target controls** screen is not enabled then you must select the **Direct Reflex** check box to enable DR mode and make the **Laser pointer** check box available in the **EDM settings** screen.

When the EDM is in **standard mode**:

- The laser pointer is steady when the **Laser power** is set to **Low-light** or **Standard**.

- The laser pointer flashes a regular on-off flash pattern when the **Laser power** is set to **Extended range flashing**.

- In standard mode the camera crosshair is aligned with the laser pointer. The EDM alignment may differ from the laser pointer, depending on instrument and ambient temperature and range (up to 20 mm @ 50 m). The measurement will, however, be made at the position where the laser pointer and crosshair is aimed.

When the EDM is in **tracking mode**:

- The laser pointer flashes an on-on-off flash pattern to indicate the laser pointer may not be exactly aligned with the camera crosshair and EDM.

- In tracking mode the camera crosshair is aligned with the EDM. The laser pointer alignment may differ from the EDM, depending on instrument and ambient temperature and range (up to 20 mm @ 50 m).

- During stakeout, if the laser pointer is enabled, the **Stakeout** screen shows the **Mark point** softkey instead of the **Measure** softkey. When you tap **Mark point**, the instrument changes to **STD** mode and the laser pointer changes to solid and moves to position itself at the EDM location. When the point is stored the instrument automatically returns to **TRK** mode and the laser pointer resumes flashing.

Laser power

Use the **Laser power** field to set the brightness of the laser spot reflection. Select:

- **Low-light**: When working indoors, in low ambient light conditions, when pointing at highly reflective surfaces, or at close range.
- **Standard**: When working in normal conditions.
- **Extended range flashing**: To find the laser spot when working in difficult conditions, including outdoors, in high ambient light conditions, when pointing at low to non-reflective surfaces, or at long range.

Blink laser

To blink the laser and the target illumination light (TIL) when storing a point measured with DR mode, select the number of times the laser will blink in the **Blink laser** field.

The **Blink laser** field is not available when the **Laser power** field is set to **Extended range flashing**.

Prism standard deviation / DR standard deviation

To define the acceptable accuracy of a measurement, enter a **Prism standard deviation** or **DR standard deviation** value, depending on the mode the instrument is in. When measuring to diffuse targets the standard deviation is displayed on the status line until the standard deviation satisfies the defined value. Once the standard deviation is satisfied, the measurement is accepted. To accept the measurement before the standard deviation is satisfied, tap **Enter** while the standard deviation is displayed on the status line.

Target illumination

When working in a dark environment, use target illumination to more easily locate and see targets. Target illumination works best when using the Primary camera.

> **NOTE –** When storing a point measured with DR mode, the target illumination light and the laser blink for the number of times set in the **Blink laser** field of the **EDM settings** screen.

To turn on or turn off target illumination at any time, tap the instrument icon in the status bar and then tap **TIL**.
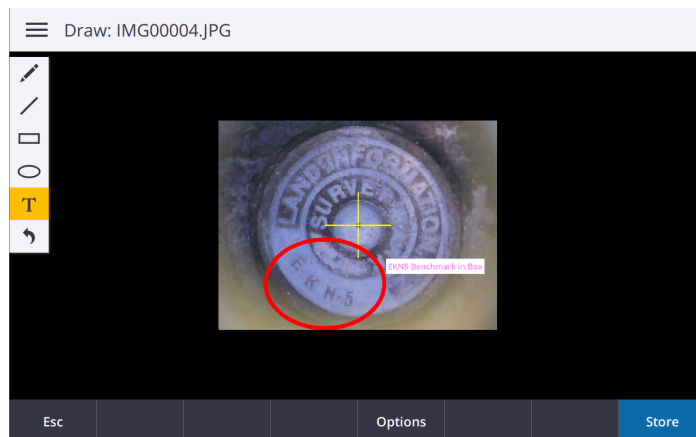
Electronic level options
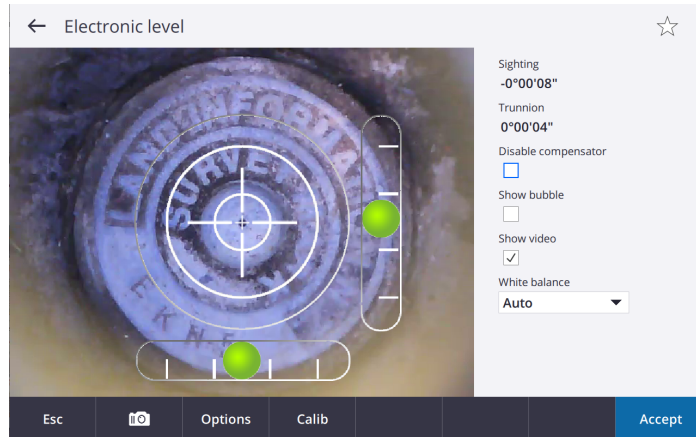
You can control the following items in the **Electronic level** screen:

- **Disable compensator** – controls whether the compensator is enabled. If the compensator is enabled, the software corrects the horizontal and vertical angles if the instrument is leveled when it is not completely vertical.

- **Show bubble** – controls whether the tilt bubble is shown.

- **Show video** – controls whether the view through the plummet camera is shown.

- **White balance** – controls the light levels in the view/image from the plummet camera.

To capture a snapshot using the plummet camera, tap [📷]. By default, the image is displayed with the **Draw** toolbar so you can draw lines, shapes or add text to the image. For example:

To configure options for capturing snapshots using the plummet camera, tap **Options**.

- **Auto capture snapshot** – automatically captures a snapshot using the plummet camera when you tap **Accept** to complete the Electronic level setup. This option is useful if photo records of marks are required.

- **Autostore snapshot** – automatically stores the snapshot without displaying the **Draw** toolbar. Select this option if you *do not* want to draw on the image.
- **Annotate snapshot** – a crosshair is overlaid onto the captured snapshot and the leveling information is stored as a footnote. Select the color of the crosshair in the **Crosshair color** field.
- **Save original image** – the original image as well as the annotated image are saved.

The example below shows a snapshot with annotations:

Time: 11:22:48 AM	Date: 1/4/2021	
Sighting: -0°00'08"	Trunnion: 0°00'04"	Compensator: On
Station: BP 1 SO 454045	Code: EKN5	
Height (SX bottom notch): 1.688m		
Temperature: 22.0°C	Pressure: 989.40mbar	PPM: 8
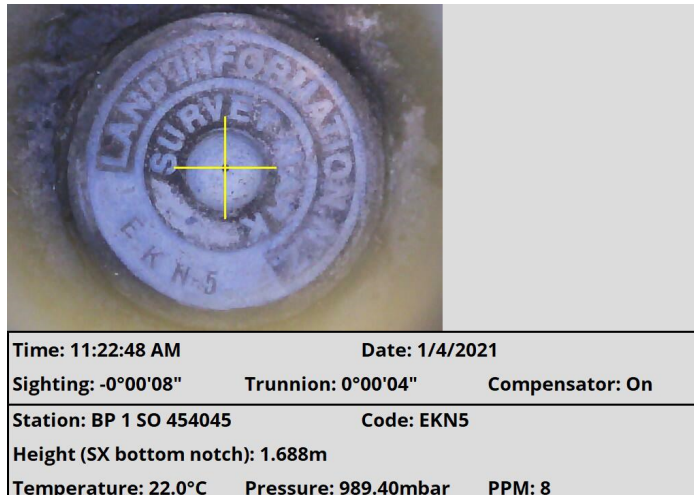
# On-screen video display controls

To view the **Video** feed from the instrument, tap 🎥 in the map toolbar or tap the Instrument icon in the status bar to open the **Instrument functions** screen and then tap **Video**.

The video display in the Trimble Access software provides the following controls for fast operation and configuration of the SX12.

Button	Function
‖‖	Change size of video display relative to form appearing alongside.
1 Overview	Current zoom level and camera mode in use
	Visual zoom level indicator

Button	Function
On-screen joystick arrows	On-screen joystick: • Tap for small movements • Tap and hold for larger movements
Turn hot keys	Hot keys to turn 90° left, turn 180°, or turn 90° right
Zoom magnifier icons	Tap 🔍 or 🔍 to zoom in/out to the maximum optical zoom level/full extents. For very precise aim, tap 🔍 and then tap 🔍 to use digital zoom or use the on screen **Zoom indicator**.
Zoom +/– icons	Tap 🔍 or 🔍 to zoom in/out one zoom level at a time. Alternatively, place two fingers on the screen and stretch out to zoom in on the center of the video or pinch in to zoom out. Drag one finger across the screen to pan.
Camera icon	Tap 📷 to capture an image.
Image settings icon	Tap ☀ to define image settings.
Menu icon	Tap ⋮ and then select the items to display in the video screen and to configure photo properties. Select **Settings** or **Filter**.
Map icon	Return to the map.

Camera options

To manually adjust the camera settings for the SX12, tap ☀ in the **Video** toolbar.
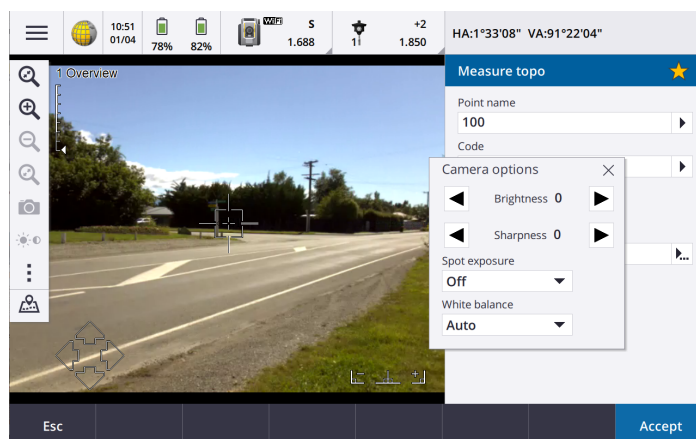
The following settings affect the image shown in the video display as well as images or scans captured using the instrument.

- **Brightness** – controls the brightness of the image.
- **Image sharpness** – controls how clearly defined the edges of objects are.
- **Spot exposure** – when enabled, you can select a small region of the image in the video display that the software uses to determine the exposure values for the entire image.
- **White balance** – controls the light levels in the image.

Video display and image storage options

Changing the items that appear in the video display

To change the items that appear in the video display, tap ⋮ and then select **Settings**.

Display

The *Display* group controls whether items are displayed in the video or map screen. Select:

- **Points** to display points
- **Names** to display name labels next to points.
- **Codes** to display code labels next to points.
- **Elevations** to display elevations.
- **Label color** to change the color used for labels.

Point cloud

To configure the display of point clouds:

- Select the **Scan point size**.
- Select the **Color mode** for the point cloud.

Select...	To...
Scan color	Indicate the scan the points belong to
Station color	Indicate the station used to measure the points
Gray scaled intensity	Indicate the reflective intensity of points using a gray scale
Color coded intensity	Indicate the reflective intensity of points using a color
Color by elevation	Indicate the elevation of points using a color.
Cloud color	Show all points the same color

If you select **Color by elevation** as the **Color mode** for the point cloud, enter the **Minimum elevation** and **Maximum elevation** values.

BIM model options

Enable **Overlay on video** to show data from IFC files in the video screen.

> **NOTE –** Enabling this switch overlays data from all IFC files currently shown in the map. To show or hide individual IFC files, or individual layers within an IFC file, tap ⛰ in the video toolbar to return to the map and then tap ❧ in the map toolbar and select the **Map files** tab.

By default objects in IFC files are displayed as solid objects with 100% opacity. To make the object more transparent, select an **Opacity** value less than 100%.

Alternatively, in the **Display** field, select **Wireframe** to view the edges of the object. White lines in the IFC file are shown in black when the **Wireframe** option is selected.

On screen display

Select or clear the check boxes to control whether items are in the **Video on screen controls**.

Crosshair

You can select or clear the check boxes to change the appearance of the crosshairs in the **Video** screen:

- Enable the **Black and white** switch to show the crosshairs in black and white. To show the crosshairs in a different color, set the **Black and white** switch to **No** and then select the required color.
- Select **Extend crosshair** and/or **Enlarge center cross** to increase the size of the crosshair elements.

Controlling how images are stored

To change the image capture options in the video display, tap ⋮ and then select **Settings**.

Snapshot options

Enable **Autostore snapshot** to automatically store captured images.

If **Autostore snapshot** is not selected, the image is displayed before storing, enabling you to draw on the image.

Enable **Snapshot on measure** to automatically capture a snapshot after a measurement is taken from the video screen.

Annotate options

Select the items to include on the annotated image.

Photo properties

Set the **File name**.

File names are automatically incremented from the start file name. The image captured is always the same size as the video display on screen.

Controlling the points that appear in the video display or map

By default, the video display and the map show all the points scanned in the current job. To prevent some points from appearing you can:

- Enable or disable specific scans
- Select points using a filter

Displaying points by scan

1. In the video display, tap ⋮ and then select **Scans**.

2. To disable specific scans, clear the check mark next to the scan by tapping it. To disable all scans, tap **None**.

Scan	Station	Points	Start time	Duration
Scan0000	BP 1 SO 454045	45k	1/4/2021 11:05:29 AM	0m13s
Scan0002	BP 1 SO 454045	52k	1/4/2021 11:07:39 AM	0m27s
Wood/M...	BP 1 SO 454045	307k	1/4/2021 11:15:25 AM	0m58s
Wood/M...	BP 1 SO 454045	307k	1/4/2021 11:28:32 AM	0m58s

3. Tap **Accept**.

Displaying points by filter

1. In the video display, tap ⋮ and then select **Filter**.

2. To disable some point types from appearing, clear the check mark next to the point type by tapping it. To disable all point types, tap **None** and then select the point types to display.

Select filters
- Topo points (GNSS)
- F1 Topo points (Conv.)
- F2 Topo points (Conv.)
- Mean turned angle
- As-staked points
- Keyed in points (normal)
- Keyed in points (control)
- Calibration points
- Cogo points (computed)
- Construction points
- Observed control points
- FastStatic points
- Base points
- Check points

3. Tap **Accept**.

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