TRIMBLE SX10
SCANNING TOTAL STATION

FIELD GUIDE

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®Trimble.

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Introducing the SX10

- ▶ Key features
- ▶ Physical features

Key features

The key features of the Trimble® SX10 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 SX10 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 SX10 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 SX10 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 SX10, it uses several technologies that were developed for Trimble S Series instruments. These features provide improved instrument quality and productivity gains for instrument users.

- MagDrive

  The SX10 incorporates Trimble MagDrive™ servo technology, which provides for exceptional speed and accuracy with smooth, silent operation.
- SurePoint

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

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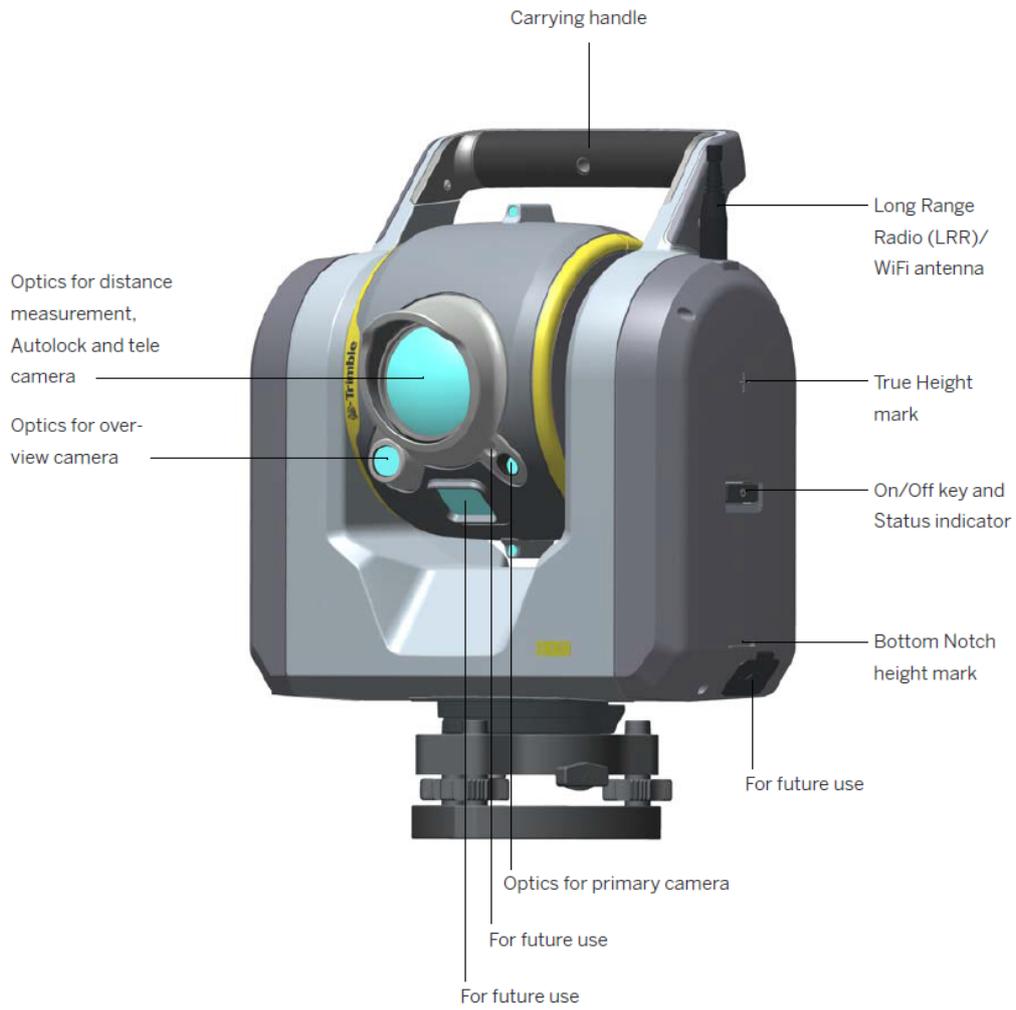
Physical features

The main physical features of the SX10 scanning total station are described below.

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°

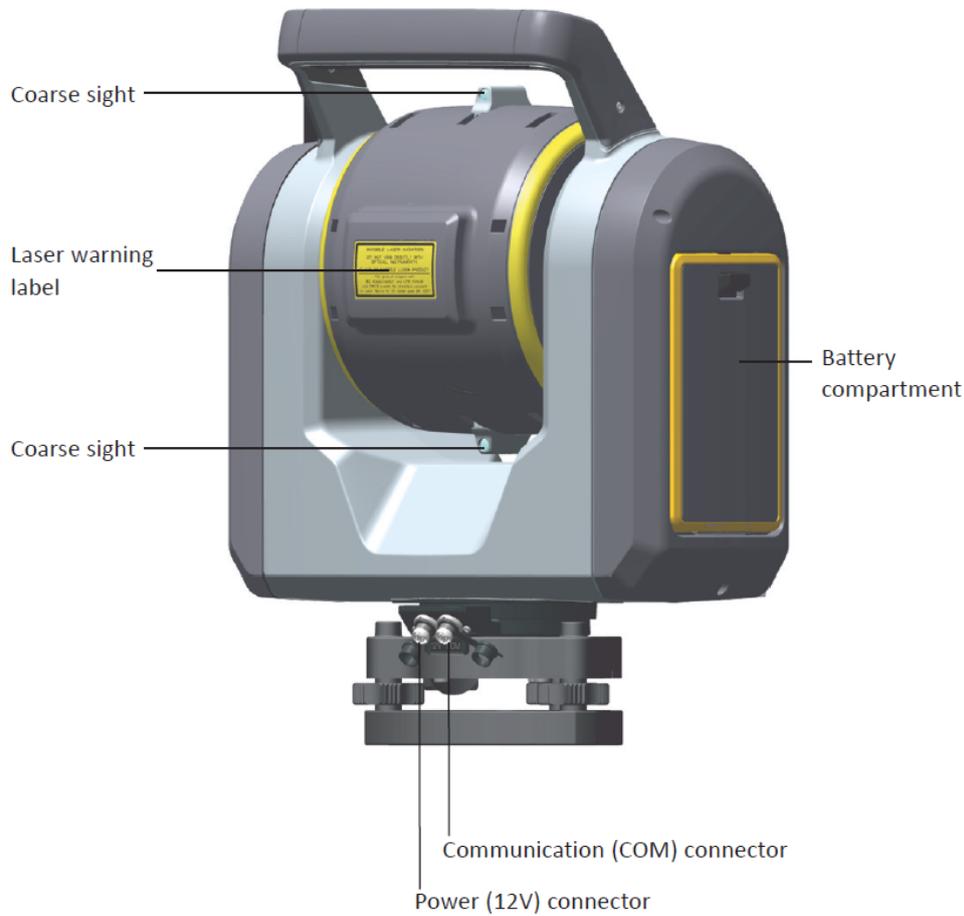*NOTE –* *For more information, refer to the Trimble SX10 Scanning Total Station datasheet.*

Features of the SX10, shown in the Face 2 position:

Carrying handle

Long Range
Radio (LRR)/
WiFi antenna

Optics for distance
measurement,
Autolock and tele
camera

True Height
mark

Optics for over-
view camera

On/Off key and
Status indicator

Bottom Notch
height mark

For future use

Optics for primary camera

For future use

For future use

Features of the SX10, shown in the Face 1 position:

Physical features of the SX10 include:

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

Connections

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

Instrument operation

Because the SX10 is designed specifically to maximize productivity during a robotic workflow, the SX10 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 SX10, 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

  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

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

2
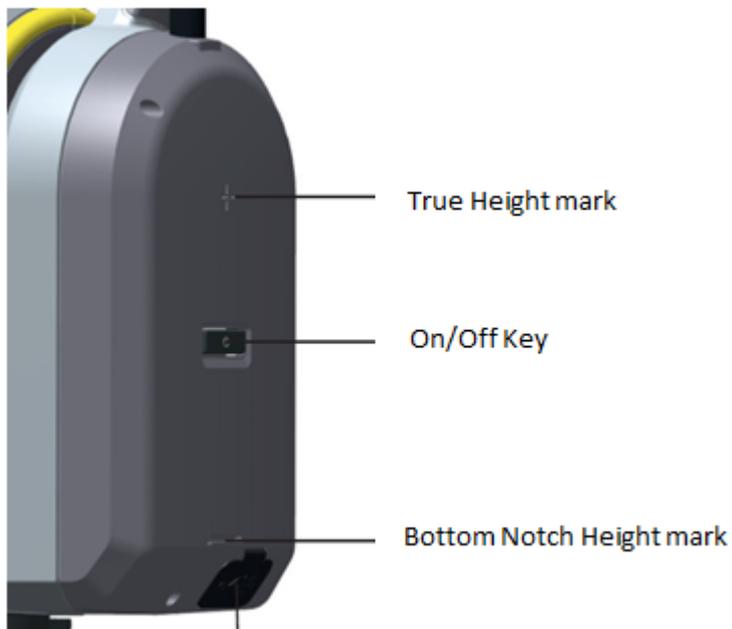
Working with the SX10

- ▶ Configuring connection settings
- ▶ Connecting to the SX10
- ▶ Creating a job
- ▶ Starting a survey
- ▶ Measuring points
- ▶ Completing a scan
- ▶ Copying the job

Configuring connection settings

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, the instrument is searching for a Wi-Fi connection.

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

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

   NOTE – The instrument must be in Wi-Fi mode the first time you attempt to connect to a controller. You must connect to the instrument and configure radio settings using the controller before you can switch to long range radio mode.

4. On the controller, start the Trimble Access software.

5. From the main Trimble Access menu, tap **Settings**.

6. Tap **Connect**. The **Connect** screen appears.

7. Tap **Wi-Fi**.

   a. Select the **Wi-Fi network** that matches the serial number of the SX10 you are using. For example, Trimble-SX10-30599951.
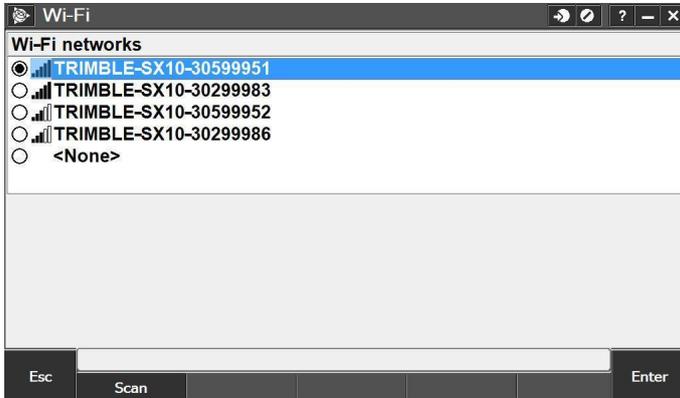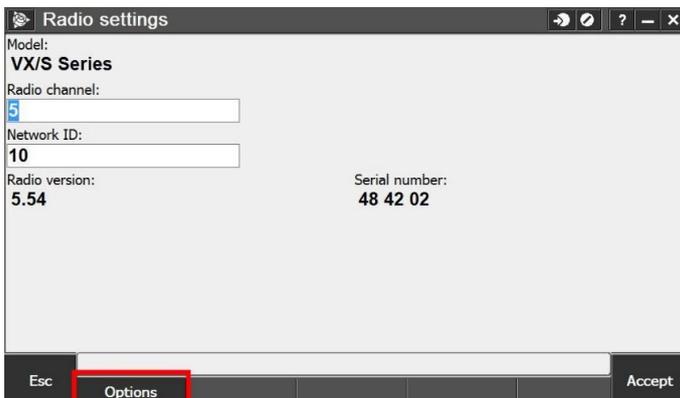

   b. Tap **Enter**.

   The software returns to the **Settings** screen.

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

   a. Tap **Connect**.

   b. Tap **Radio settings**.

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

   - In the **Radio channel** field enter **5**.
   - In the **Network ID** field enter **10**.

   d. Tap **Accept**.

9. Tap **Back** to return to the **Settings** screen.

10. Tap **x** to close the Trimble Access **Settings** app.

Connecting to the SX10

1. From the main Trimble Access menu, tap **General Survey**.

   The message **Connecting to SX10** appears.

   By default, the Trimble Access software automatically connects to the SX10 when you start a survey application, such as General Survey.

2. To change the auto connection settings, from the main Trimble Access menu, tap **Settings** and then select **Connect** / **Auto connect**. Alternatively, tap the flashing auto connect icon in the status bar.

3. To switch between Wi-Fi and LRR connection modes:

   a. Tap the SX10 icon in the status bar.

   b. Tap **Connections**.

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

The radio settings are sent to the SX10 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.*

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.

1. From the main General Survey menu, tap **Jobs**.

2. Tap **New job**.

    a. In the **Job name** field, enter the job name. For example: **SX10 Demo**.Tap ▣ to select the project folder to store the job.

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

    b. To change the coordinate system used for data in the job, select **Coord. sys**. 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.

    c. If you have files to link to the job, for example a CSV file containing control point coordinates, select **Linked files**. 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.

    d. If required, select **Feature library** 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.

e. Tap **Accept**.
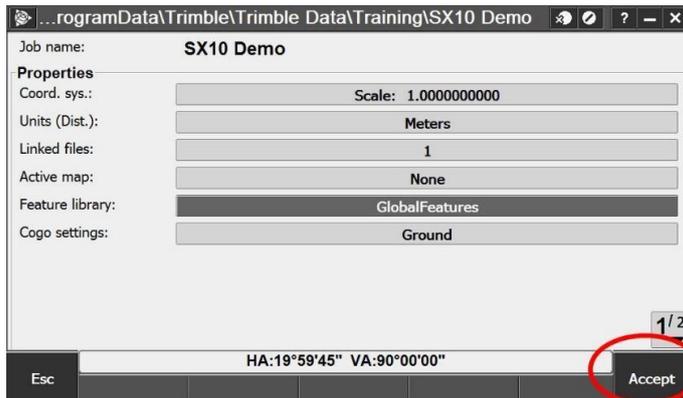
The new job **SX10 Demo** is created and opened.

Starting a survey

1. From the main General Survey menu, tap **Measure**.

2. Select the survey style to use. For this exercise, select **SX10**. Tap **Next**.

    NOTE – For this workflow example, we are using the default SX10 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.*

3. Tap **Station setup**. Tap **Next**.

4. Position the instrument over a known point:

    a. Use the optical plummet in the instrument tribrach to orient and initially level the SX10 over a known point.

b. Use the video plummet display to accuately set up and level the SX10 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.*
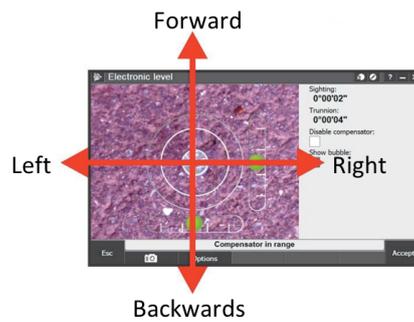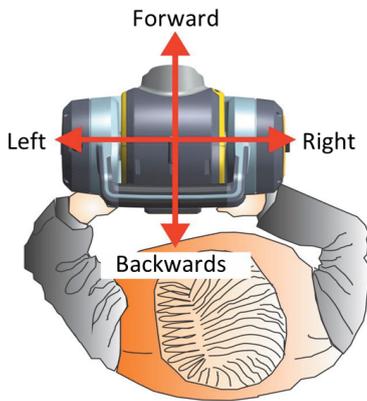
c. Ensure the instrument is level and accurately positioned over the point.

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.
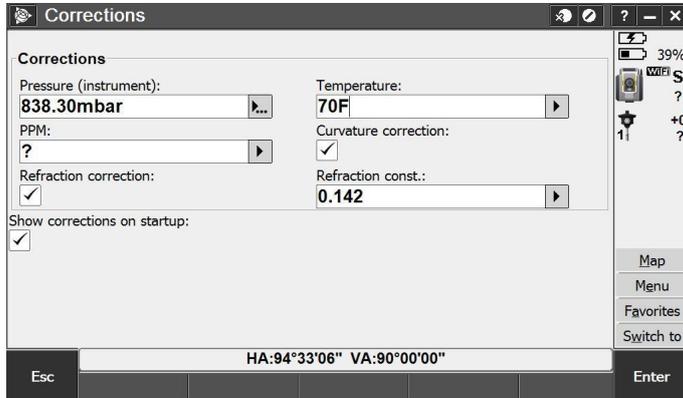
b. Tap **Accept**.

The instrument pressure is calculated inside the SX10, 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:
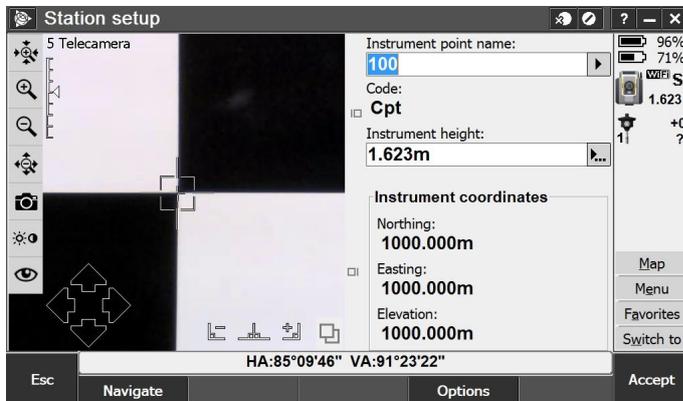
a. In the **Instrument point name** field, enter the name of the point over which you have set up the instrument.

b. Measure the instrument height. Enter the value in the **Instrument height** field. To change the height measurement method, tap 🔽.

c. Tap **Accept**.

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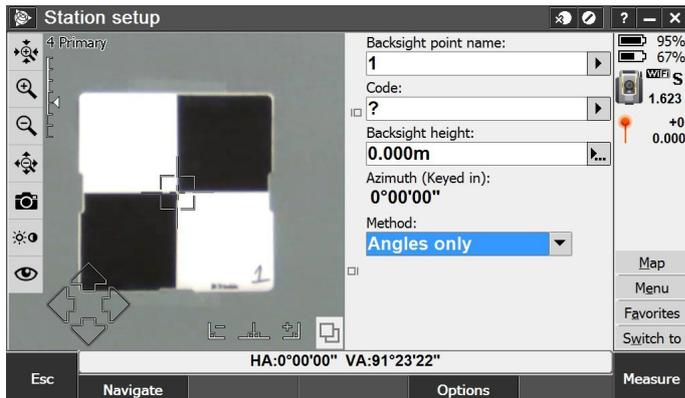
a. In the **Backsight point name** field, select the point over which you have set up the target.

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 only**.

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 then re-do the station setup.

Station setup is complete.

Measuring points

1. From the main General Survey menu, tap **Measure**.

2. Tap **Measure topo**.

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

4. To re-aim the SX10 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.

5. 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.

6. Tap **Measure**.

7. The measurement details are displayed at the bottom right of the screen. Tap **Store**.
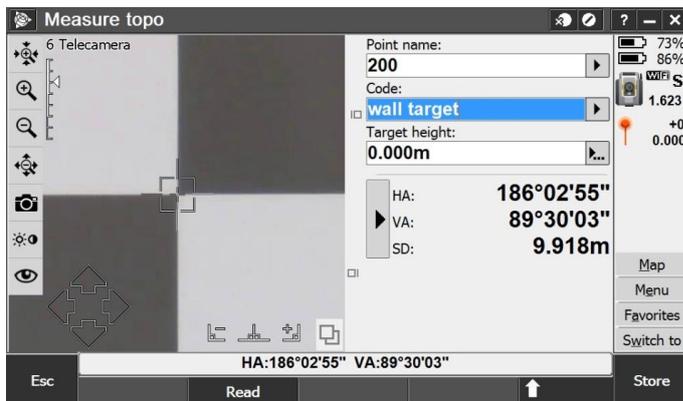
Completing a scan

1. From the main General Survey menu, tap **Measure**.

2. Tap **Scanning**.

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

   For more information, see Defining the scan parameters, page 18.

4. In the **Scan density** field, select **Coarse**.

5. To capture panorama images during the scan, select the **Panorama** check box. Additional settings appear on page 2 of the **Scanning** screen. See Panorama options, page 21.

6. Tap **Start**.

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.

TIP –

- Tap [icon] to delete the current scan frame.
- Tap [icon] to remove the most recent vertices.
- Other icons appear, depending on the framing method selected. Tap them to try them out.

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.

Panorama options

To view panorama options, select the **Panorama** check box in the **Scanning** screen. Additional options appear on page 2 of the the **Scanning** screen.

To change the camera used to capture the panorama, select it in the **Camera** field.

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.

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. From the main General Survey menu, tap **Jobs**.
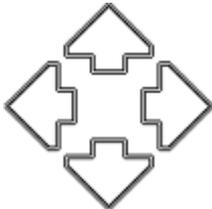2. Tap **Copy job files to**.
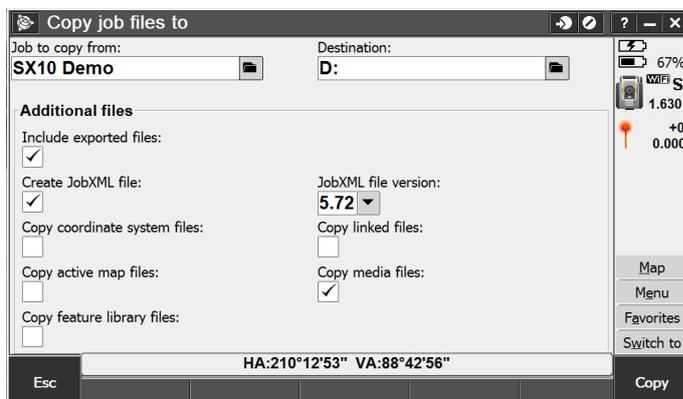
3. To select the appropriate destination folder, tap ▣.

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

5. Tap **Copy**.

   A message confirms the number of files copied.

3

Advanced configuration of the SX10

- ▶ On-screen video display controls
- ▶ Camera options
- ▶ Video display and image storage options
- ▶ Electronic level options

On-screen video display controls

The video display in the Trimble Access software provides the following controls for fast operation and configuration of the SX10.

Button	Function
▯▢	Hide video display/maximize form
▢▯	Hide form/maximize video
▱	Toggle between video display and map
1 Overview	Current zoom level and camera mode in use
	Visual zoom level indicator
	On-screen joystick: • Tap for small movements • Tap and hold for larger movements

Button	Function
	Hot keys to turn 90° left, turn 180°, or turn 90° right
	Quick jump to maximum or minimum zoom
	Zoom in/out one zoom level at a time
	Capture snapshot
	Go to camera settings
	Go to video display and image settings

Camera options

To manually adjust the camera settings for the SX10, tap ☀● in the video display.

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

The **Point cloud** group appears only when the controller is connected to an SX10.

Select from the options for scan point color and scan point size to differentiate between different scan points.

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
Cloud color	Show all points the same color

On screen display

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

Controlling how images are stored

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

Snapshot

Enable **Autostore snapshot** to automatically store captured images. You cannot annotate or draw on an image before it is automatically stored.

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

Enable **Annotate snapshot** to add an information panel and crosshair for the measured position to the image.

Annotate options

Select the items to include on the annotated image.

Photo properties

Set the file name, image size, and compression.

NOTE – *File names are automatically incremented from the start file name. The image captured is always the same size as the video display on screen. Not all image sizes are available at all zoom levels. The higher the quality of the image, the larger the file size of the captured image.*
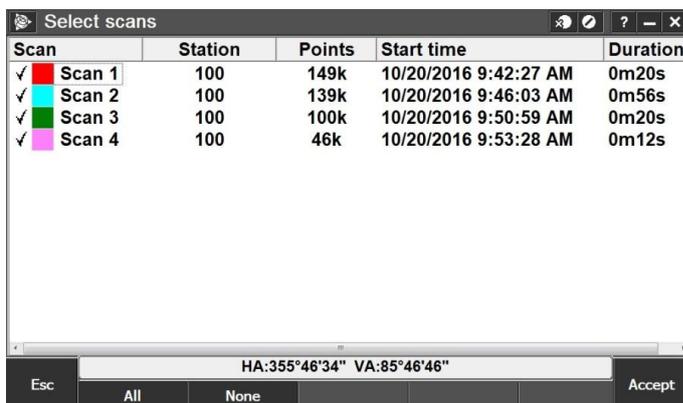
Controlling the points that appear in the video display or map

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
✓ Scan 1	100	149k	10/20/2016 9:42:27 AM	0m20s
✓ Scan 2	100	139k	10/20/2016 9:46:03 AM	0m56s
✓ Scan 3	100	100k	10/20/2016 9:50:59 AM	0m20s
✓ Scan 4	100	46k	10/20/2016 9:53:28 AM	0m12s

HA:355°46'34" VA:85°46'46"

Esc   All   None   Accept

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.
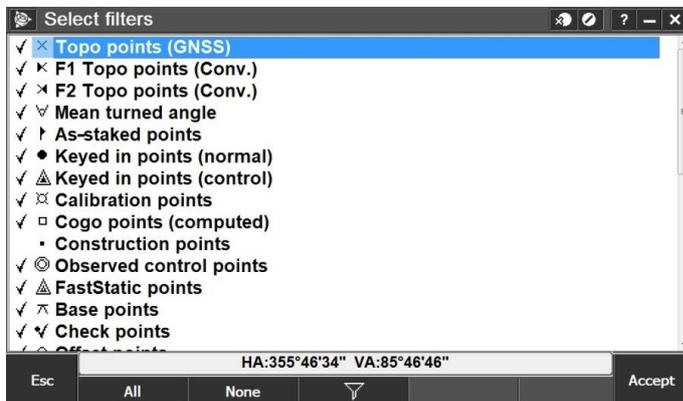
3. Tap **Accept**.

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 levelled 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 levelling information is stored as a footnote.
- **Save original image** – the original image as well as the annotated image are saved.

The example below shows a snapshot with annotations:
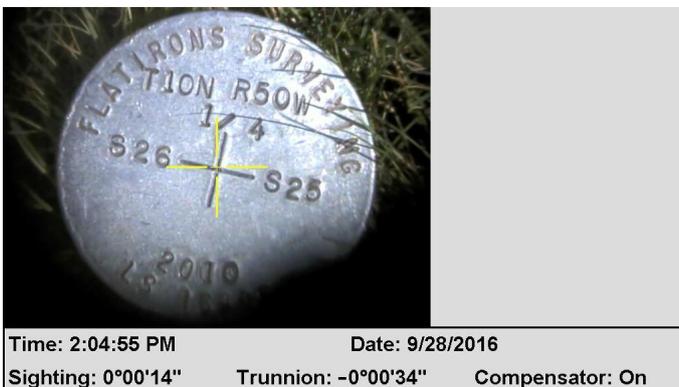
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