White Paper

Trimble SX12 Laser Pointer

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Geospatial.Trimble.com/Products-and-Solutions/Trimble-SX12

Trimble SX12 – Every Day, Everywhere, Every Job

Laser Pointer Overview

The Trimble SX12 builds upon the SX10 platform that combines a powerful robotic total station with a high-speed 3D scanner. The SX12 is the next generation of this platform that includes new internal cameras and an eye-safe, green laser pointer. In order for a laser pointer to be as useful as possible, it needs to be highly visible and have a small diameter. The Trimble SX12 innovates on these requirements and makes aiming and marking far easier than with other total stations. The Trimble SX12 laser pointer is also focusable, utilizing the same focusing lens as the telecamera.

The following white paper describes some of the key aspects of the Trimble SX12 laser pointer system. We know it could sound complex, which is why we want to share this information so that you can become familiar and confident in the system.

The key points to remember are:

- 2mm positioning accuracy with the laser pointer
- 3mm diameter laser pointer spot up to 50m away
- A very visible and auto-focused, green laser pointer that is dependable and accurate
- For high-accuracy applications, use EDM Standard mode, or the “Mark Point” function in Trimble Access Stakeout

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Background

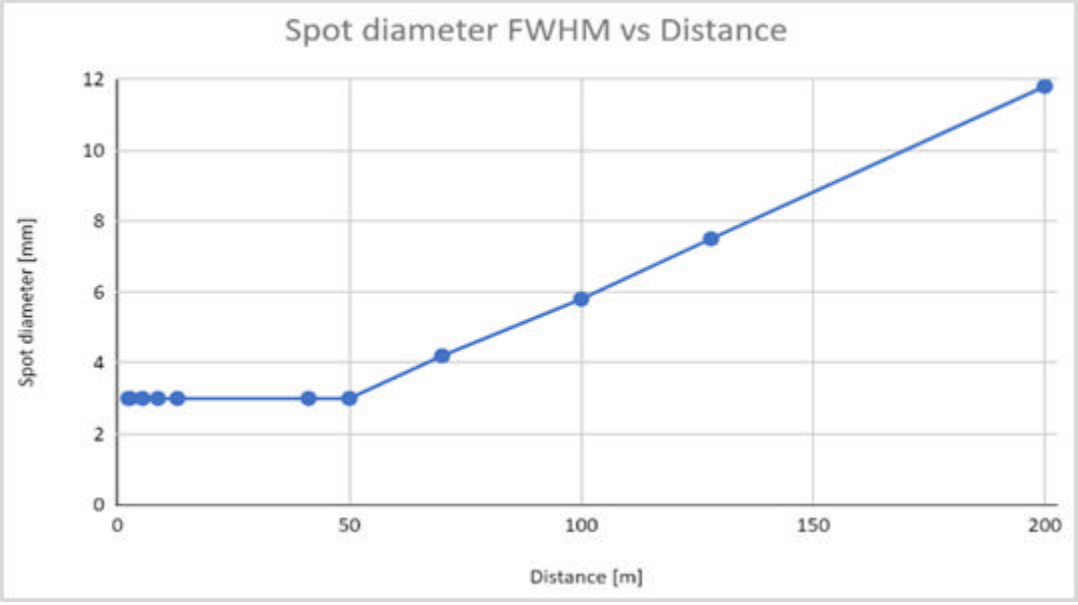
The Trimble SX12 EDM is optimized for high precision and speed, the same qualities that enable the SX12 to be a true high-speed scanner. For many other total stations on the market, the EDM doubles as the laser pointer, however this is not possible for the Trimble SX12 given that the EDM operates at 1550 nm wavelength. 1550nm is in the infrared spectrum and invisible to the human eye, so is not suitable as a laser pointer. Instead, the Trimble SX12 EDM and laser pointer are two separate laser sources.

The Trimble SX12 laser pointer is coaxial with the EDM, however, as with all alignments of different sensors, there are collimation errors that need to be compensated for.

The laser pointer's small size, color, and power all contribute to its exceptional visibility. The small laser spot is achieved using focusing lenses. The color is green, which is more visible to the average human eye than red. The power, though always Laser Class 1, can be set to three different modes to suit the environment and maximize visibility.

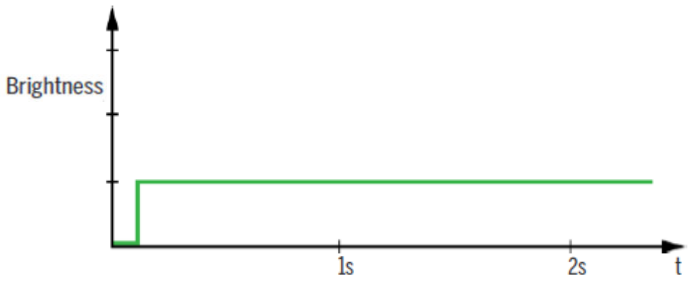
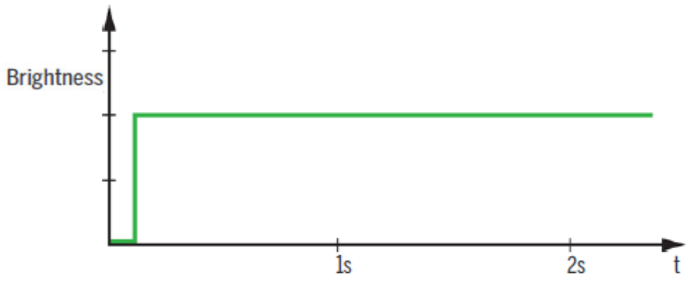
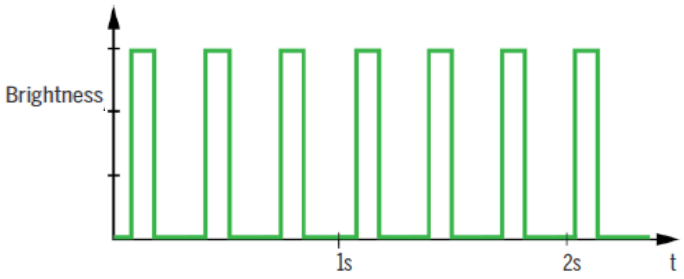
Autofocus Implementation

As with the telecamera, the laser pointer is focused based on the distance being received from the EDM. EDM Distances are being continually measured to ensure the laser spot is continually being focused for the distance you are working at. The laser pointer spot diameter is 3mm from 1.3m to 50m range, then an additional 3mm for every 50m beyond.



Laser Pointer Modes to Maximize Visibility in Different Conditions

To adapt to different lighting conditions, target type, and working range, there are three different modes available for the laser pointer. Tap and hold on the laser pointer icon in the instrument functions screen of Trimble Access to change the laser pointer mode.

Laser Pointer Mode	Brightness and Corresponding Solid/Flash Pattern
Low-light mode • Meant for use in low-light conditions, such as tunnels • The laser is always on, but the intensity is lowered to make it easy to pick the center of the point	
Standard mode • Meant for use in most lighting conditions • The laser is always on, and the laser intensity is maximized within the Laser Class 1 categorization of the laser. • This mode is useful for most lighting conditions and surface types	
Extended Range Flashing mode • Meant for use in bright conditions, on dark surfaces or when working at an extended range. • The increased peak intensity helps you see the laser at longer ranges. There is a constant blink pattern to maintain the Laser Class 1, eye safe classification.	

Separate Collimation Correction for EDM and Laser Spot

For the SX12 to achieve the unique properties of a green focusable laser spot, with a market leading EDM spot size, and a scan rate of 26.6 kHz, the EDM and laser spot come from different sources.

During the production process, the two lasers are calibrated to exit the total station on the same axis (co-axial). The complexity with this system is that temperature changes inside of the instrument result in very small movements in the mechanical structure and optics inside of the instrument, meaning temperature and measurement distance can affect where the EDM and laser pointer are positioned relative to one another.

To handle this, each instrument is individually calibrated during the production process. This individualized calibration is combined with tailored workflows in Trimble Access to ensure confidence in your measurements and stake locations.

When operating in EDM Standard mode, the temperature calibration is taken into account and the measurement accuracy when using the laser pointer for positioning is 2mm +/- 0.5mm. When operating around 10°C ambient temperature, there is little deviation between the laser and EDM. Likewise, when operating at close ranges, in typical working temperature, the deviation is extremely small or insignificant.

Accurate and Dependable Results

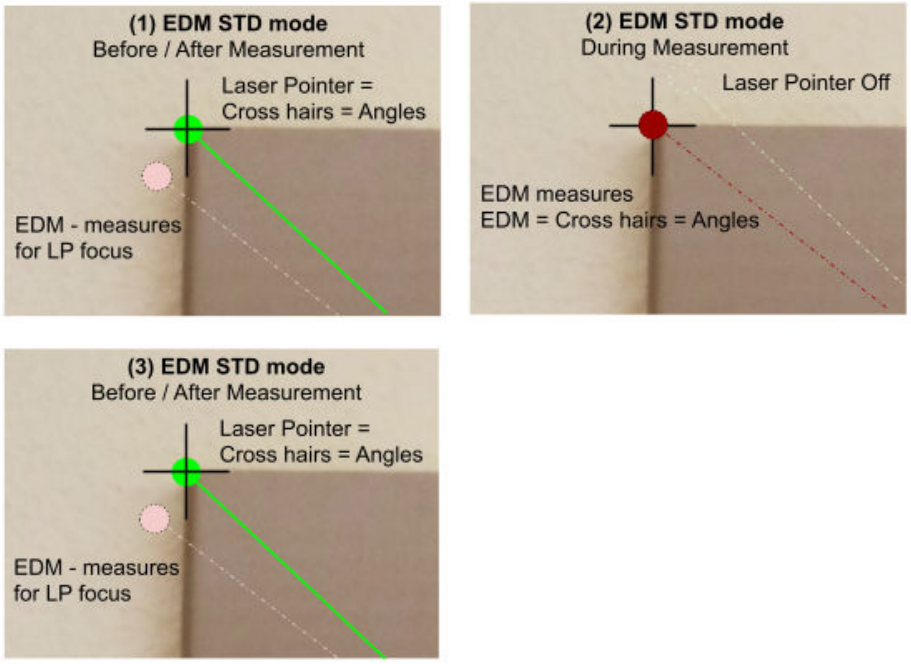
The instrument and field software behaviour is tailored to ensure accurate and dependable results, with a key consideration being whether the instrument is in Standard or Tracking mode.

The key points to remember are:

- The cross hairs in the video display in Trimble Access will always indicate where the measurement is being taken to
- If you use the laser pointer with EDM in standard mode, then the measurement will always be taken where the laser spot is positioned.

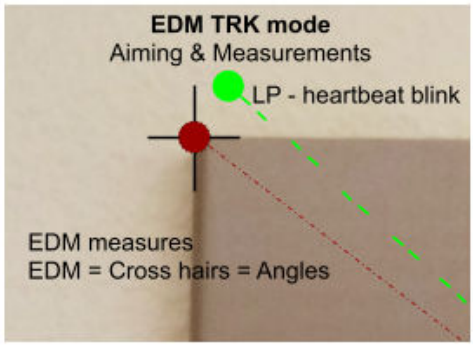
Laser / EDM Workflow in Standard Mode for Measure Topo

When the laser is positioned on the desired object of interest and the user initiates a measurement (1), the instrument will turn off the LP and re-aim so that EDM lands where LP was and then measure the distance (2), then the instrument returns to the original position with the laser pointer turned back on (3).

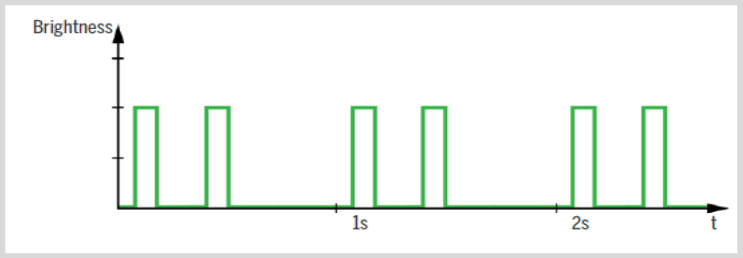


Laser / EDM Workflow in Tracking Mode for Measure Topo

Tracking mode is intended for fast, constant measurements in applications where potential degradation in accuracy is acceptable in order to achieve the faster measurement speed. To achieve this faster measurement, no positioning adjustment is done by the instrument, so any misalignment between the laser pointer and the EDM beam will be incurred in the measurement.



To avoid the unintentional high accuracy use of a laser pointer with tracking mode, the laser pointer has a unique “heartbeat flash pattern” when the EDM is in tracking mode. This flash pattern is consistent across all modes of the laser pointer (standard, low-light, extended range flashing), though the intensity will vary between the modes.

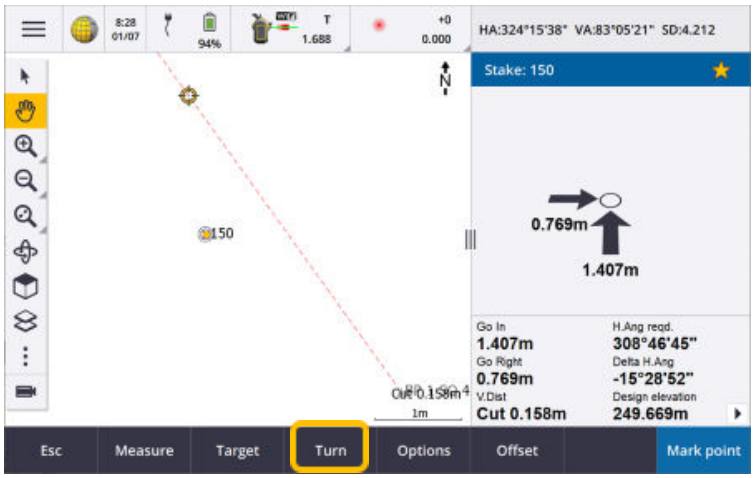
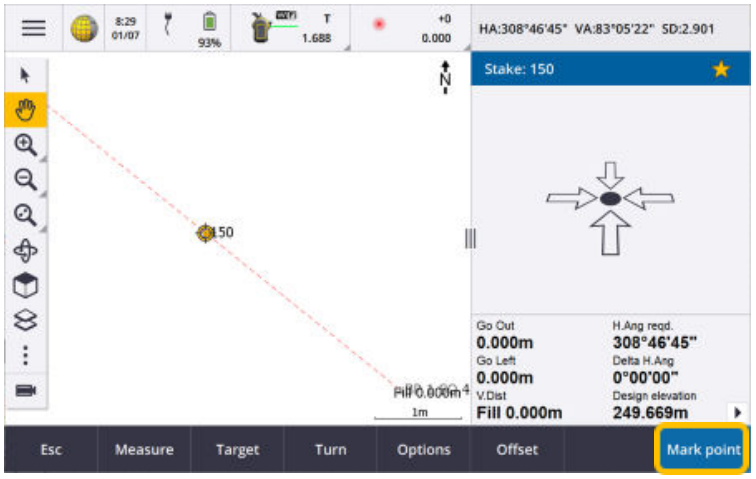
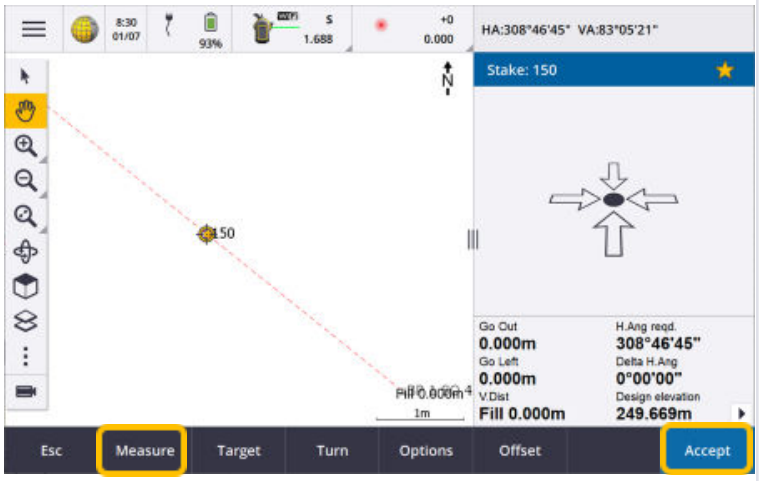


Laser / EDM Workflow for Stakeout

Typically in order to efficiently stakeout points, the instrument is placed in tracking mode so that the instrument is continually getting measurement values and the software can provide delta information for the current location in relation to the point to be staked.

As described above, when using the SX12 with the laser pointer, standard mode is required to ensure the highest accuracy. This holds true when doing stakeout also, so Trimble Access has a tailored workflow to remain both efficient and accurate when staking out points using the laser pointer in the SX12.

There is a new “Mark Point” step that will position the laser pointer on the true stake position by automating a switch to standard mode. The laser pointer will also change from the tracking flash pattern to the solid standard mode. Step-by-step instructions can be found on the next page.

Step		Trimble Access Screenshot
1	The initial stakeout screen has a “Mark Point” button where you would previously have “Accept” You can use the joystick or video forms to navigate the instrument to the stake point, or to shortcut all of this, tap the “Turn” soft key to have the instrument position itself at the required Horizontal and Vertical angle. During this step, the laser pointer will heartbeat flash	
2	After navigating to the point and with deltas you are happy with, tap the “Mark point” button.	
3	This will put the instrument into standard mode and put the laser pointer on the EDM measuring location. At this point, the laser pointer is on solid If the deltas are unacceptable, readjust, then tap “Measure” to get an updated deltas. Tap “Accept” when happy to store the point	

Support

For more information see Geospatial.Trimble.com/SX12, or contact your local Trimble Representative.

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