



USER GUIDE

X9

3D LASER SCANNER

Revision B
April 2023



Legal Notices

Geospatial business area

Trimble Inc.
10368 Westmoor Drive,
Westminster, CO 80021
USA
800-538-7800 (toll free in USA)
+1-937-245-5600 Phone
+1-937-233-9004 Fax
www.trimble.com/support/

Trimble Inc.
4450 Gibson Dr
Tipp City, OH 45371
USA

Trimble Europe BV
Industrieweg 187A
5683 CC, Best
Netherlands

Legal Notices

© 2023, Trimble Inc. All rights reserved.

Trimble and the Globe & Triangle logo are trademarks of Trimble Inc., registered in the United States and in other countries. All other trademarks are the property of their respective owners.

Release Notice

This is the April 2023 (Revision B) release of the *Trimble X9 3D Laser Scanner User Guide*.

Regulatory Information

For applicable regulatory information, please see the *Trimble X9 Regulatory Information Document* included with this Trimble product, or consult your Trimble dealer.

Product Limited Warranty Information

For applicable product Limited Warranty information, please refer to the *Limited Warranty Card* and *Extended Warranty Card* included with this Trimble product, or consult your local Trimble authorized dealer.

Safety Information

Before you use your Trimble product, make sure that you have read the user manual and understood all safety requirements. Failure to follow the instructions, warnings and precautions may lead to device damage, and/or user injury.

WARNING – This alert warns of a potential hazard which, if not avoided, could result in severe injury or even death.

CAUTION – This alert warns of a potential hazard or unsafe practice that could result in minor injury or property damage or irretrievable data loss.

NOTE – An absence of specific alerts does not mean that there are no safety risks involved.

Use and care

This product is designed to withstand the rough treatment and tough environment that typically occurs in construction applications. However, the scanner is a high-precision electronic instrument and should be treated with reasonable care.

Also see, [Care and maintenance, page 17](#).

CAUTION – Operating or storing the instrument outside the specified temperature range can damage it.

CAUTION – Please read carefully the manual before using the instrument. Failure to follow the instructions, warnings and precautions that are in the manual may lead to device damage, and/or user injury.

Laser safety

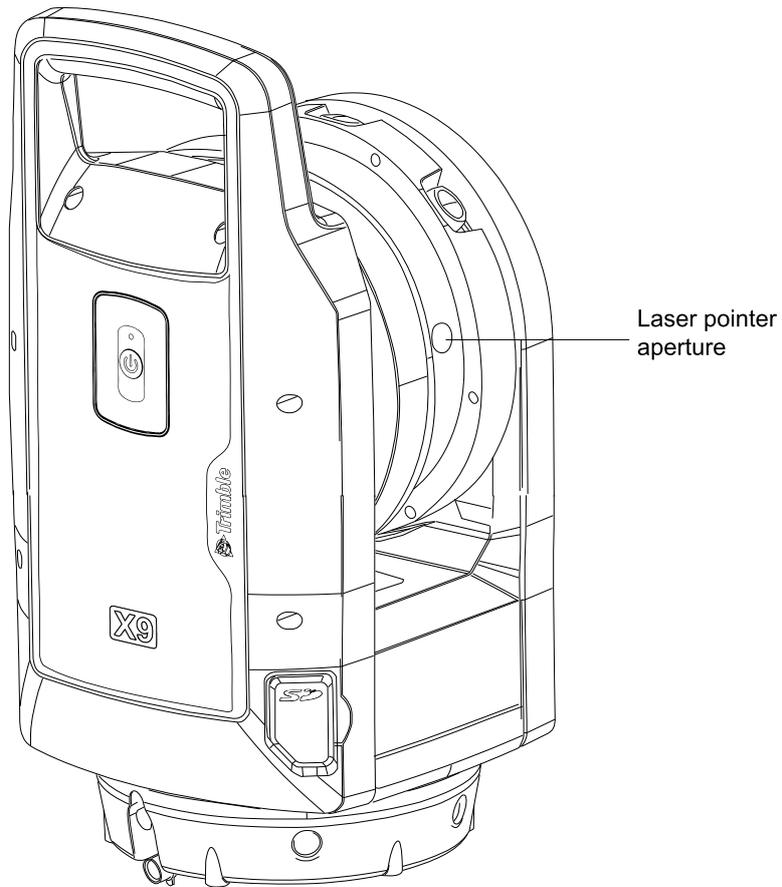
Before you use the instrument, make sure that you understand this user guide, as well as all equipment, job site safety requirements and regulations.

This equipment has been tested and found to comply with IEC 60825-1 2007, IEC 60825-1 2014, and 21 CFR 1040.10, and 1040.11 except for deviations pursuant to Laser Notice No. 50, dated June 24, 2007.

WARNING – Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous LED or laser radiation exposure. As with any bright light source, such as the sun, electric welding arcs or arc lamps, common sense applies. DO NOT look into the laser aperture when the laser is on. For further information regarding safe use of lasers, refer to the IEC 60825-1 2007, and IEC 60825-1 2014.

Apertures

The following figure shows the position of the Trimble® X9 3D laser scanner aperture.



Class 2 Laser Product

The Trimble X9 3D laser scanner is a CLASS 2 LASER PRODUCT.

WARNING – Viewing the laser and/or LED output with telescopic optical instruments (for example, telescopes and binoculars) may pose an eye hazard.

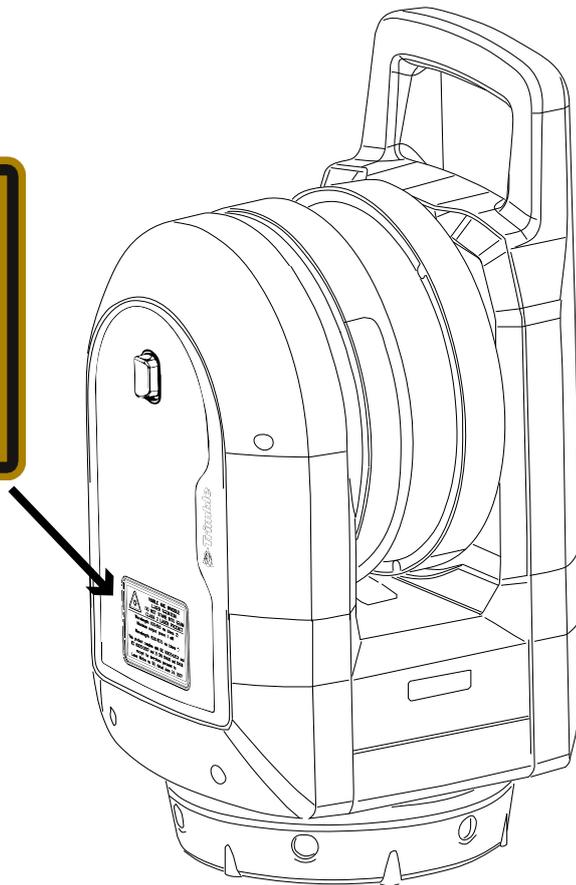
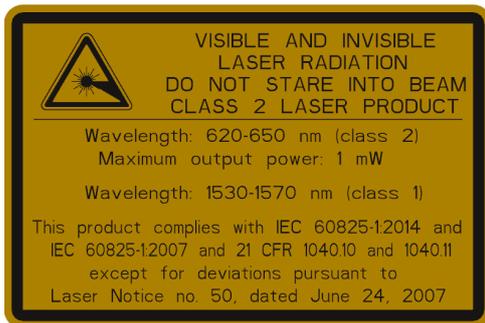
The instrument contains visible and invisible laser sources.

A class 2 laser with a wavelength of 620–650 nm for laser pointer function when enabled by the field software.

- Beam divergence of $0,25 \times 0,35$ mrad
- Maximum output power of 1mW

A class 1 laser with a wavelength of 1530–1570 nm for scanning measurements:

- Beam divergence of 0.8 mrad
- Output power of < 50 mW in scanning mode (rotational frequency > 20 Hz)
- Pulse duration 0.5 ns
- Pulse repetition rate 0.1 MHz – 1 MHz



Battery safety

WARNING – Do not damage the rechargeable Lithium-ion battery. A damaged battery can cause an explosion or fire, and can result in personal injury and/or property damage. To prevent injury or damage:

- Do not use or charge the battery if it appears to be damaged. Signs of damage include, but are not limited to, discoloration, warping, and leaking battery fluid.
- Do not expose the battery to fire, high temperature, or direct sunlight.
- Do not immerse the battery in water.
- Do not use or store the battery inside a vehicle during hot weather.
- Do not drop or puncture the battery.
- Do not open the battery or short-circuit its contacts.

WARNING – Avoid contact with the rechargeable Lithium-ion battery if it appears to be leaking. Battery fluid is corrosive, and contact with it can result in personal injury and/or property damage. To prevent injury or damage:

- If the battery leaks, avoid contact with the battery fluid.
- If battery fluid gets into your eyes, immediately rinse your eyes with clean water and seek medical attention. Do not rub your eyes!
- If battery fluid gets onto your skin or clothing, immediately use clean water to wash off the battery fluid.

WARNING – Charge and use the rechargeable Lithium-ion battery only in strict accordance with the instructions. Charging or using the battery in unauthorized equipment can cause an explosion or fire, and can result in personal injury and/or equipment damage. To prevent injury or damage:

- Do not charge or use the battery if it appears to be damaged or leaking.
- Charge the battery only in a Trimble product that is specified to charge it.
- Be sure to follow all instructions that are provided with the battery charger.
- Discontinue charging a battery that gives off extreme heat or a burning odor.
- Use the battery only in Trimble equipment that is specified to use it.
- Use the battery only for its intended use and according to the instructions in the product documentation.
- Cover battery terminals with proper insulating tape before disposal to avoid heat generation by an inadvertent short-circuit.

Contents

Legal Notices	2
Safety Information	3
Class 2 Laser Product	5
Battery safety	6
Contents	7
Introduction	9
About the Trimble X9 3D laser scanner	10
Technical support	10
Related information	10
Instrument Description	11
Inspecting the shipping container	11
Features	14
Care and maintenance	17
Transporting the instrument	18
Servicing the instrument	19
Battery and Chargers	20
Batteries	21
Battery safety information	22
Charging the batteries	22
Conditioning the battery	23
LED status indicators	24
Setup	25
Setting up the tripod and instrument	26
Inserting the battery	27
Inserting a memory card	28
Connecting the USB communication or power supply cable	29
Powering the instrument on and off	30
Connecting the instrument to a controller	32
Scan settings	37
Choosing an image mode	38
HDR mode	38
White Balance Correction mode	38
Self-leveling	38
Automatic calibration	39
Applying an atmospheric correction	39
Acquiring data	42
Moving between stations	44
Updating the firmware	45
Accessories	50
Power supply	51
SD card and memory card reader	53

Trimble backpack	54
Gitzo Series 3 tripod	55
Quick release	56
Triple mag mount	57

Introduction

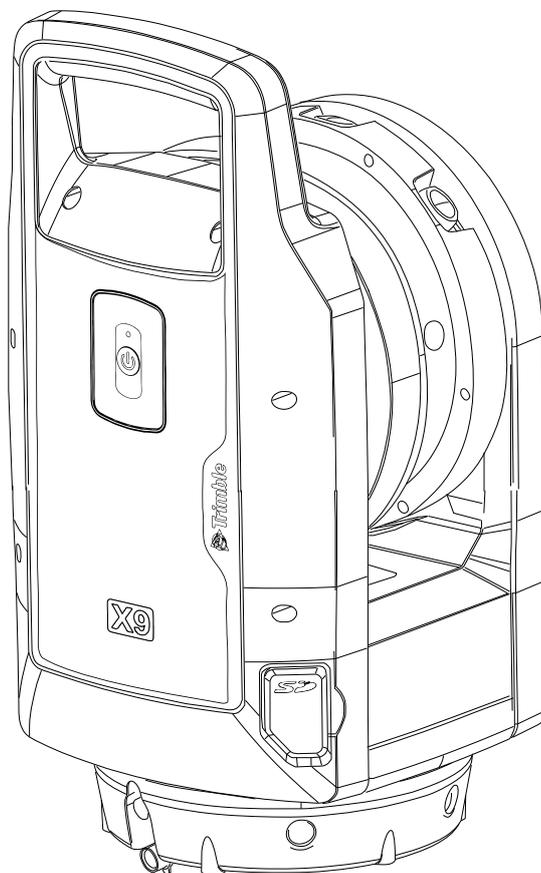
- [About the Trimble X9 3D laser scanner](#)
- [Technical support](#)
- [Related information](#)

This manual describes how to set up and use the Trimble® X9 3D laser scanner. Even if you have used other 3D laser scanner products before, Trimble recommends that you spend some time reading this manual to learn about the special features of this product.

Throughout this user guide, the X9 3D laser scanner will be referred to as the instrument.

About the Trimble X9 3D laser scanner

The X9 is an easy-to-use high-speed 3D laser scanning system with exceptional speed, range and accuracy to increase efficiency. Proven innovations like automatic calibration and in-field registration ensure data quality, simplify adoption and provide confidence in the field



Technical support

If you have a problem and cannot find the information you need in the product documentation, contact your local dealer. Alternatively, go to the **Support & Downloads** area of the X9 Scanner webpage (geospatial.trimble.com/X9). Product updates, documentation, and any support issues are available for download.

Related information

For more information about this product, please go to geospatial.trimble.com/X9.

Instrument Description

- [Inspecting the shipping container](#)
- [Features](#)
- [Care and maintenance](#)
- [Transporting the instrument](#)
- [Servicing the instrument](#)

This section describes the features of the instrument, the labels on the instrument, and the instrument field of view.

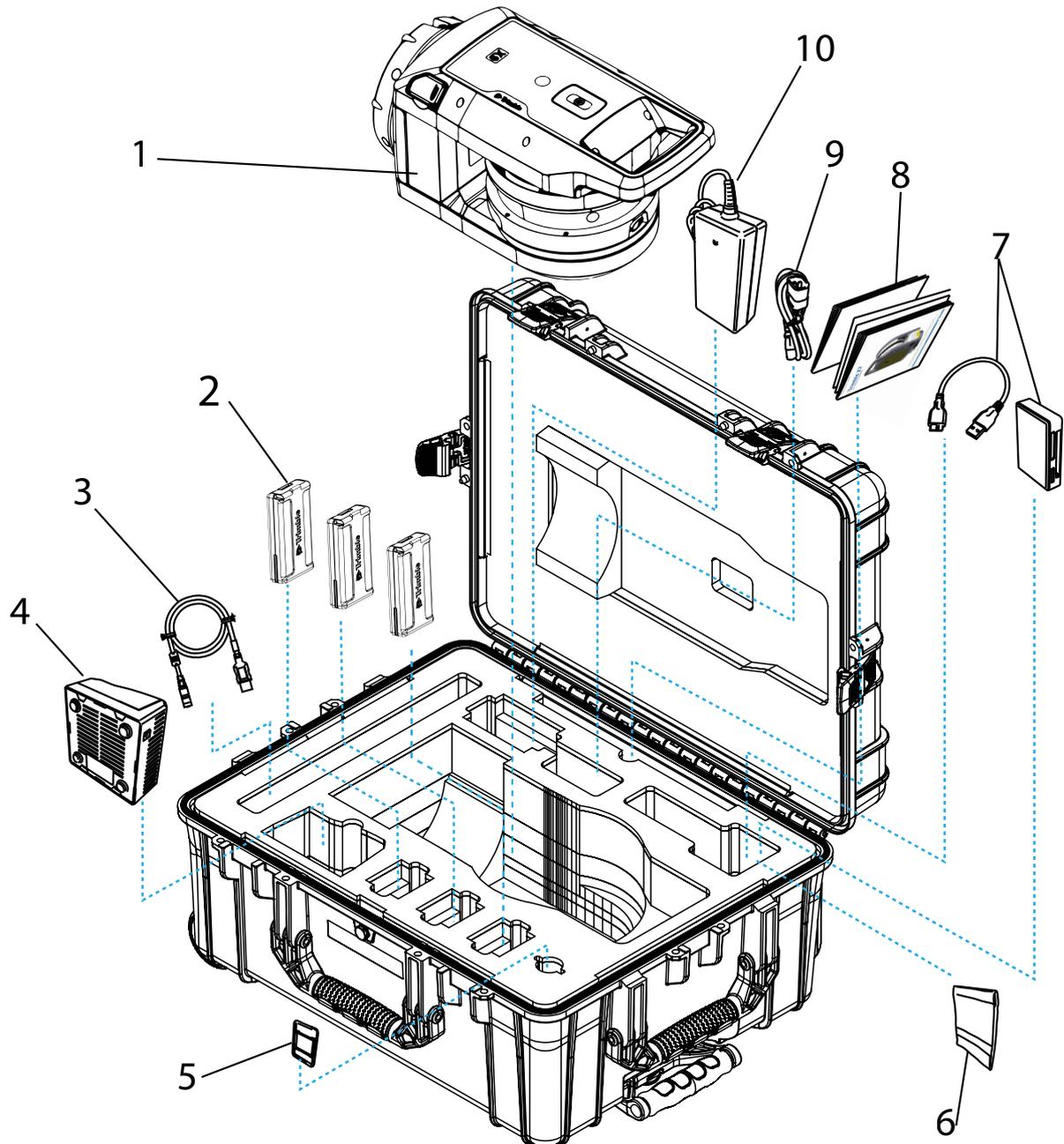
Inspecting the shipping container

The X9 3D laser scanner is packed inside an instrument case and transported inside a cardboard shipping box with two foam inserts around the case.

Inspect the shipping container. If the shipping container arrives in poor condition, examine the equipment for visible damage. If damage is found, immediately notify the carrier and your Trimble sales representative. Keep the shipping container and the packing material for the carrier to inspect.

Trimble recommends that you keep the shipping box and foam inserts in case you need to transport the instrument. The shipping box and foam inserts provide additional protection for the instrument. See [Transporting the instrument, page 18](#).

When you unpack the instrument, check that all ordered items are received. Below is an example of the items in the instrument case:



Item	Description
1	X9 3D laser scanner
2	Battery (×3)*
3	USB communication cable
4	Dual-battery charger**
5	SD card
6	Cleaning cloths
7	SD card reader
8	Documents: Quick start guide, warranty activation card, instrument test certificate, regulatory information document

Item	Description
9	Power supply cable for charger**
10	Power supply for charger**

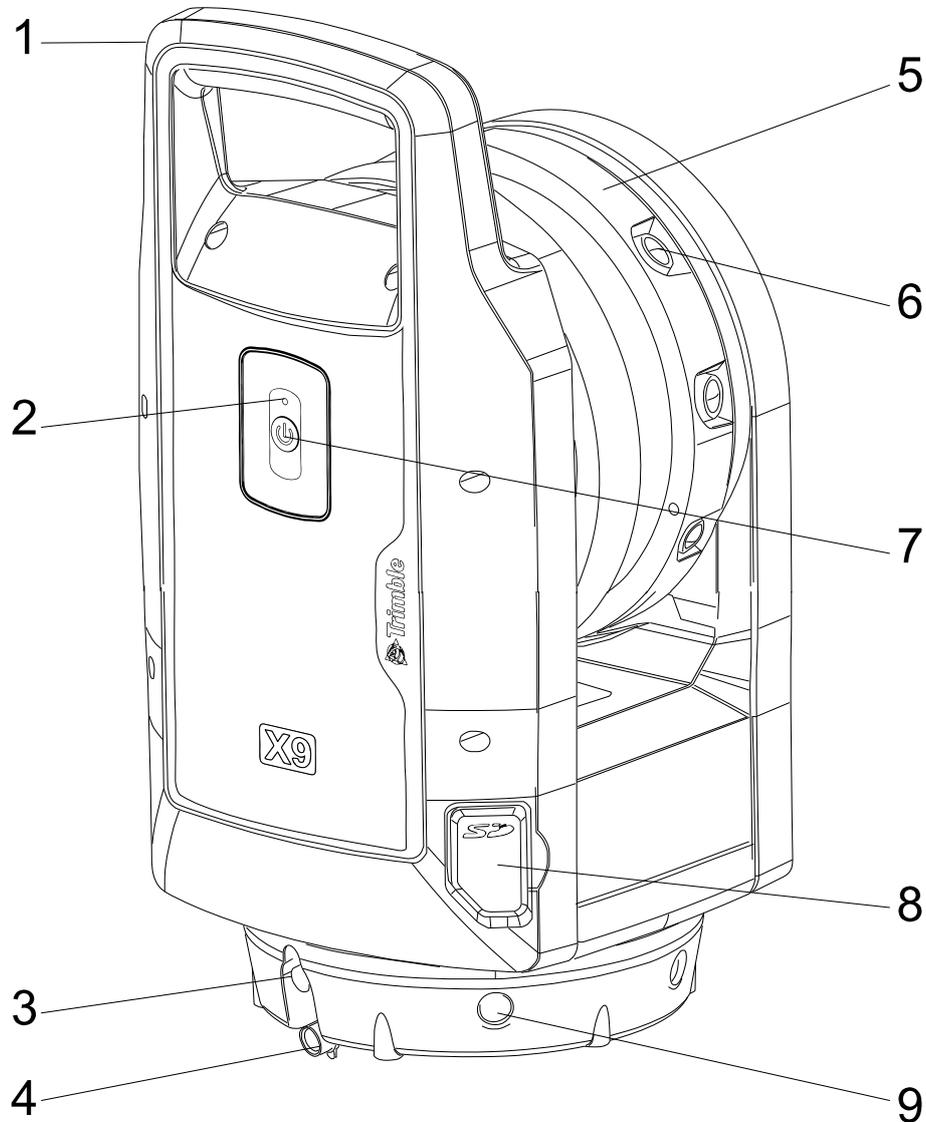
* Shipping regulations only allow two batteries to be packed separately and one battery to be inserted in the instrument. Before use, remove the tape over the contact of the battery in the instrument.

** Regional parts (P/N 101070-00-##) ordered and shipped separately.

Features

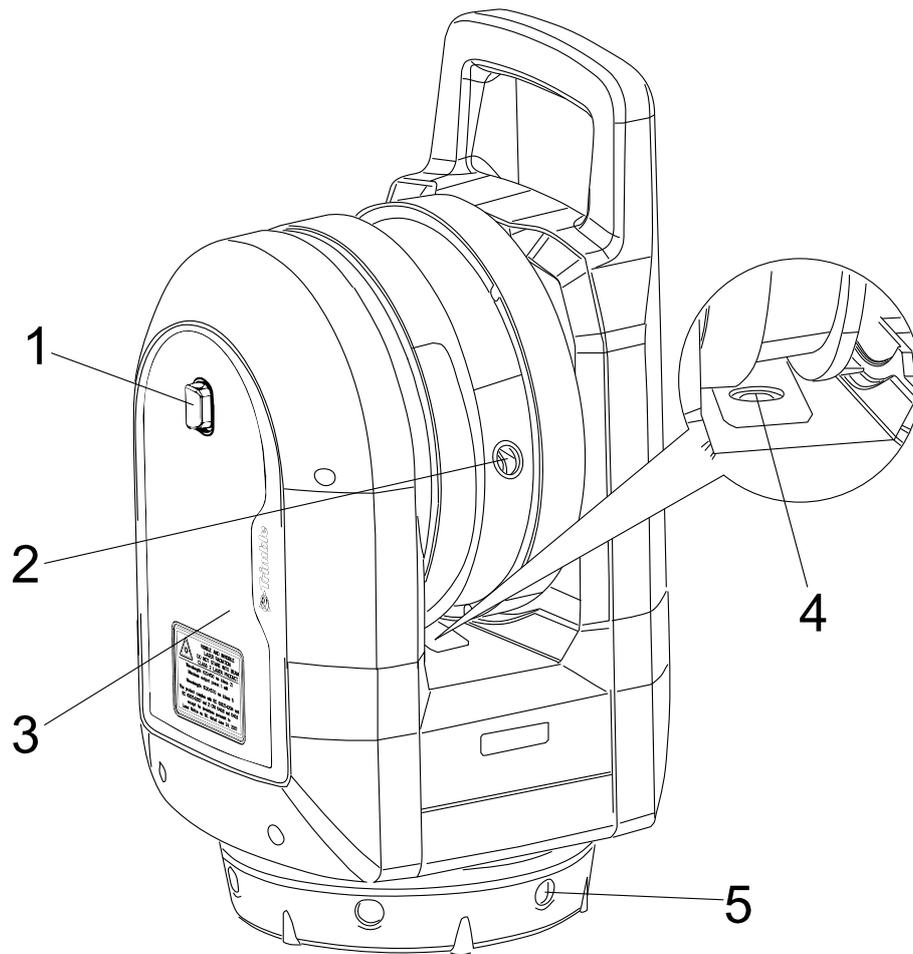
Learn the names and the locations of the instrument features.

Front of instrument



Item	Description
1	Carrying handle
2	On/Off status indicator
3	Communication and power connector
4	10 MP camera (×3)
5	Camera unit assembly
6	On/Off key and scan button
7	SD card slot cover
8	Multi-color LED (×5)

Back of instrument



Item	Description
1	laser pointer aperture
2	Auto-calibration system
3	Battery compartment cover lock
4	Battery compartment cover
5	Multi-color LED (×5)

Labels

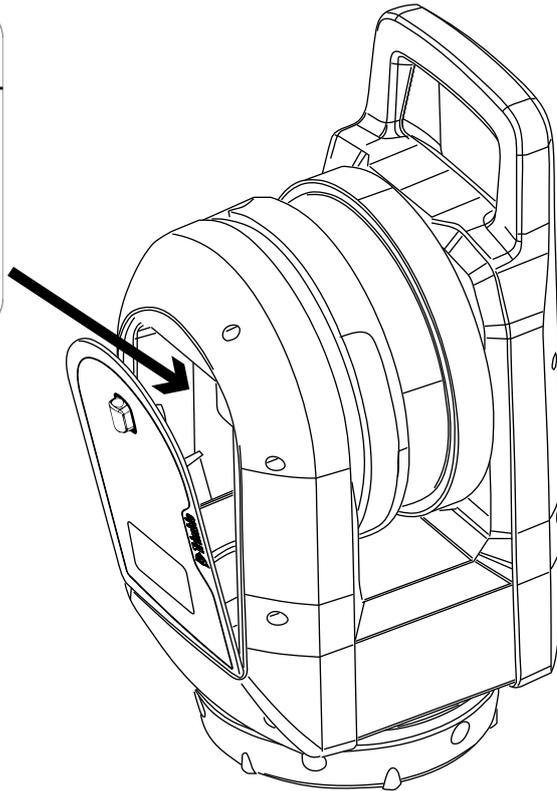
The instrument has two labels:

- Laser warning label

The laser warning label states the name and date of the standard applied and information about the laser class. See [Class 2 Laser Product, page 5](#).

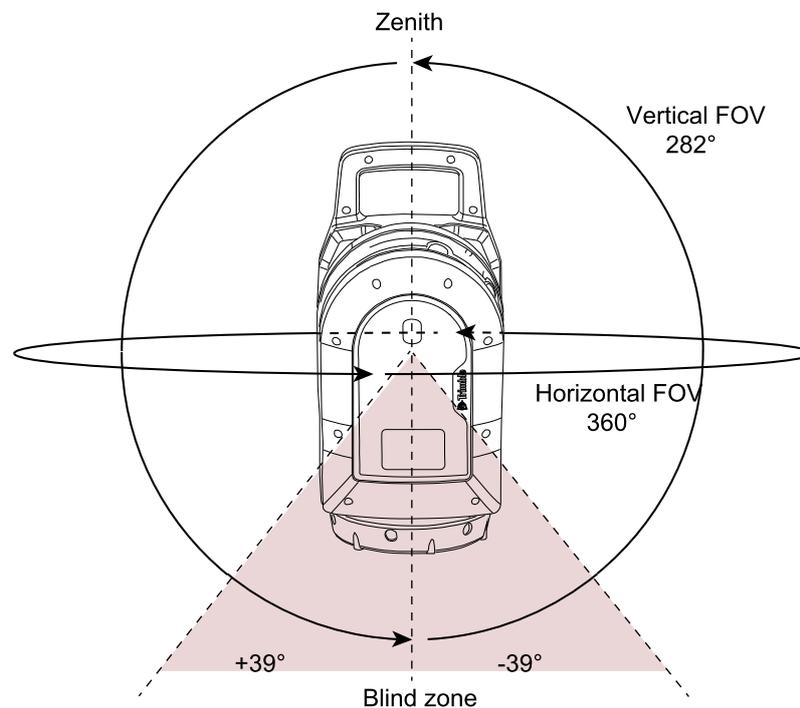
- Identification label

The identification label contains the address of manufacturer, serial number, instrument type, manufacture date, etc.



Instrument field of view

The Field Of View (FOV) of the instrument is the range of horizontal and vertical angles through which the instrument can capture data.



Care and maintenance

WARNING – DO NOT remove any covers from the instrument. This instrument is designed to withstand normal electromagnetic disturbance from the environment but it contains circuits that are sensitive to static electricity.

If an unauthorized person opens the instrument cover, the function of the instrument is not guaranteed and the warranty will be invalidated.

The instrument is designed and tested to withstand field conditions, but like all precision instruments, it requires care and maintenance. To get the best results from the instrument, take the following steps:

- Do not subject the equipment to rough jolts or careless treatment.
- Keep the rotating mirror lens clean. Use only lens paper or other material that is designed for cleaning optical equipment.
- Keep the instrument protected and in an upright position, preferably in the instrument case.
- Do not carry the instrument while the instrument is mounted on a tripod. Doing so can damage the tribrach screws.
- Whenever manually rotating the instrument, use a slow and steady movement.
- Do not carry the instrument by the rotating mirror. Use the handle.

- When you need extremely precise measurements, make sure that the instrument has adapted to the surrounding temperature. Significant variations in instrument temperature can affect precision.
- If the instrument is moved from (extreme) cold to warm temperature, leave the instrument in the closed instrument case for at least 15 minutes in order to avoid condensation. Then open and leave the instrument case open until all moisture has dried.

Cleaning the instrument

CAUTION – Strong chemicals can damage the instrument. DO NOT use strong detergents such as benzene or thinners on the instrument or the instrument case.

Except for the lenses, use a cloth damp with water to clean the instrument.

Cleaning the lens

Be careful when cleaning the lenses.

If there is sand or dust on the lenses, soak the sand and dust with water from a spray bottle.

Remove the sand and dust carefully with a soft cloth. **Do not** rub.

With the cleaning cloths supplied with the instrument, gently clean the lenses in a circular motion from the middle and out towards the edge of the lens. **Do not** rub.

Removing moisture

If the instrument has been in damp weather, take the instrument indoors and remove the instrument from the instrument case. Leave the instrument to dry naturally. If condensation forms on the mirror lens, allow the moisture to evaporate naturally. Leave the instrument case open until all moisture has evaporated.

Storing the instrument

Storage temperature range is from -40 °C to +70 °C (-40 °F to 158 °F) in a dry environment.

Remove the battery from the instrument before storage.

Transporting the instrument

Always transport the instrument in a locked instrument case. When shipping the instrument, the instrument case should be packed in the original shipping box with foam inserts. Ensure that you save the shipping box and inserts for this purpose.

Always remove the internal battery during transport.

When transporting batteries, make sure to follow national and international rules and regulations. Contact your transport company before shipping.

An optional backpack is available for easy transport at the job site. The backpack can also be used for airline carry-on. Check with the airline to confirm carry-on size restrictions for specific aircraft. See [Trimble backpack, page 54](#).

Servicing the instrument

NOTE – There are no user-serviceable parts on the instrument.

When you send the instrument to a service center, clearly write the name of the sender and the receiver on the instrument case. If repairs are required, enclose a note in the instrument case. The note should clearly describe any default or symptoms, and indicate that service is required.

Battery and Chargers

- Batteries
- Battery safety information
- Charging the batteries
- Conditioning the battery
- LED status indicators

Batteries

Three rechargeable lithium-ion batteries are provided with the instrument. Charge the battery completely before first use.

NOTES –

- Remove the tape over the contact of the battery stored in the instrument before charging or using it with the instrument.
- Trimble recommends only using batteries that have P/N 99511-30.
- The performance of the battery will be lower at temperatures below 0 °C (32 °F). The performance of a cold battery might not be enough to start the instrument.
- For best battery performance, keep the battery at a temperature as close to 20 °C (68 °F) as possible before it is put to use in the instrument.

The battery has an integrated power gauge that displays the condition of the battery. Press the button on the battery to activate the power gauge.



Item	Description
1	LEDs
2	Power button

When you press the button, four LEDs on the instrument battery show the power level. Each LED corresponds to a power level of 25% so that when the power level is at 100%, all four LEDs are lit with a solid green light. If the battery is completely discharged, all LEDs are off.

If all the LEDs flash when the button is pressed, the battery needs to be reconditioned in the battery charger. See [Conditioning the battery, page 23](#).

When the battery capacity is between 0 and 100%, one LED will flash. A battery with less than 10% capacity might not be able to start an instrument.

Disposal

- Before disposal, discharge the battery.
- Cover battery terminals with proper insulating tape before disposal to avoid heat generation by an inadvertent short-circuit.
- Dispose of the used battery in an environmentally sensitive manner, following local and international regulations.

Battery safety information

Before charging or using a battery it is important that you read and understand the safety information. See [Safety Information, page 3](#).

Charging the batteries

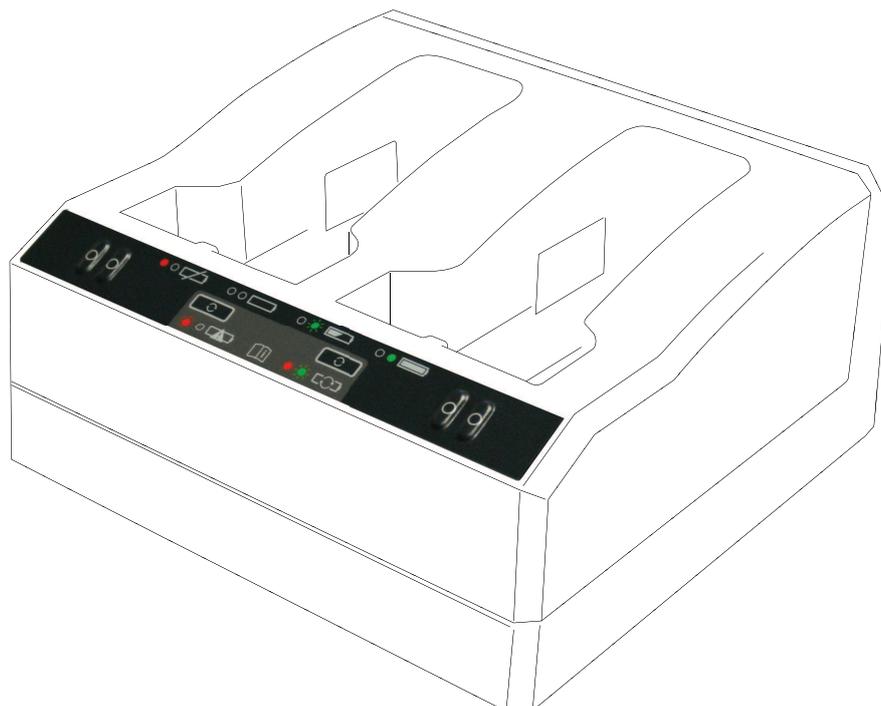
A regional dual-slot battery charger must be purchased separately with the instrument using P/N 101070-00-##.

NOTE – If the battery temperature is colder than 0 °C (32 °F), Trimble recommends allowing the battery to reach room temperature before charging it.

Dual-slot charger

The charger operates between 0 °C and 40 °C (32 °F and 104 °F). Charging a battery at temperatures in the range of 0 °C to 5 °C (32 °F and 41 °F) will take longer than charging at room temperature.

CAUTION – The bottom of the charger is hot when in use. Do not touch the bottom plate. Ensure that nothing blocks the vent holes in the back of the charger. The charger should be placed on a fire-retardant surface and ensure there is a clear area at least 50 cm around the charger during use.



To charge the battery:

1. Ensure that nothing blocks the vent holes in the back of the charger.
2. Place the charger on a hard, flat and level surface to ensure that there is airflow under the charger.
3. To apply power to the charger, use the AC to DC converter or 12 V cigarette plug. The charger scans the slots for a battery.
4. Place the battery in any of the slots. The red light turns off (can take up to five seconds). For an explanation of the LED display, see [LED status indicators, page 24](#).
5. Charging takes approximately three hours per battery at room temperature. If two batteries are placed in the charger, the batteries will be charged one at a time.

Leave a deeply discharged or shorted battery overnight in the charger to attempt to revive the battery. A shorted battery is typically revived as soon as the slot is scanned. If the red LED turns off, the battery is revived. If the red LED stays on, the battery is no longer functional and needs to be replaced.

Conditioning the battery

CAUTION – The bottom of the charger is hot when in use. Do not touch the bottom plate. Ensure that nothing blocks the vent holes in the back of the charger. The charger should be placed on a fire-retardant surface and ensure there is a clear area at least 50 cm around the charger during use.

After a number of incomplete charge/discharge cycles, the power gauge in the smart battery becomes inaccurate. The battery is still safe to use, but the power gauge may no longer be accurate which may decrease the battery run time in the field. Then a conditioning is required. This is a cycle of:

- Charge battery completely.
- Discharge the battery until the voltage is below the low-end conditioning threshold. Charge battery again.

The need for conditioning is read out from the battery by the charger and indicated by a flashing red LED. Press the conditioning button to start conditioning the battery. There is one button for each slot. Only batteries that require a conditioning can be conditioned.

To condition the battery:

1. Press the conditioning button under the battery. The red LED becomes solid and then green LED starts to flash. Release the conditioning button.
2. If you remove the battery while conditioning is in progress, conditioning stops. To succeed, a conditioning cycle must be uninterrupted.

Conditioning a single battery can take up to 24 hours. Trimble recommends that you condition the batteries over a weekend.

LED status indicators

Beside each slot are two LED indicators (red and green) to display the battery status. The LED indicators can have the following conditions: off, on, and flashing.



1 – Red button, 2 – Green button, 3 – Conditioning button

Status	Red LED	Green LED
No battery detected (means no battery present or battery defect)	ON	OFF
Battery detected (charging not started yet)		
• Conditioning not required	OFF	OFF
• Conditioning required	FLASHING	OFF
Charging in progress		
• Conditioning not required	OFF	FLASHING
• Conditioning required	FLASHING	FLASHING
• Over/under-temperature (charge is inhibited)	One flash every 2 seconds	FLASHING
Conditioning in progress	ON	FLASHING
Conditioning done (battery fully charged)	ON	ON
Battery fully charged		
• Conditioning not required	OFF	ON
• Conditioning required	FLASHING	ON
Power supply over/under-voltage	OFF	One flash every 2 seconds

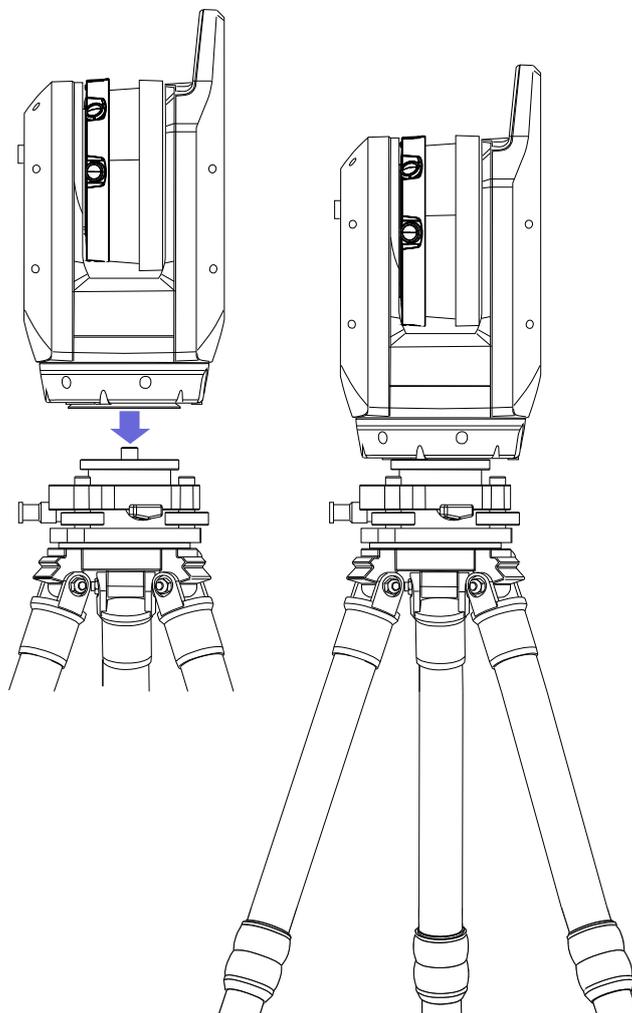
For more information regarding the dual-slot charger, please refer to the documentation delivered with the charger.

Setup

- Setting up the tripod and instrument
- Inserting the battery
- Inserting a memory card
- Connecting the USB communication or power supply cable
- Powering the instrument on and off
- Connecting the instrument to a controller
- Scan settings
- Choosing an image mode
- HDR mode
- White Balance Correction mode
- Self-leveling
- Automatic calibration
- Applying an atmospheric correction
- Acquiring data
- Moving between stations
- Updating the firmware

Setting up the tripod and instrument

A stable setup is critical for high-precision measurements. Ensure that you use a high-quality tripod with a head made of steel, aluminum, or equivalent material. Avoid the use of tripod heads made of fiberglass or other composite materials. To securely mount the instrument, Trimble recommends the Gitzo Series 3 tripod with a custom head and 5/8" bell connector (P/N 90573-TR).



Setting up the tripod

1. Adjust the legs on the tripod to the required height. Turn the locks on the tripod legs just enough so they can be extended equally and then tighten the locks so they are secure.
2. Spread the tripod legs wide apart so they lock out for increased stability.
3. Set up on a level, stable surface when possible.
4. Ensure the tripod head is visibly level and if necessary, adjust the leg heights.

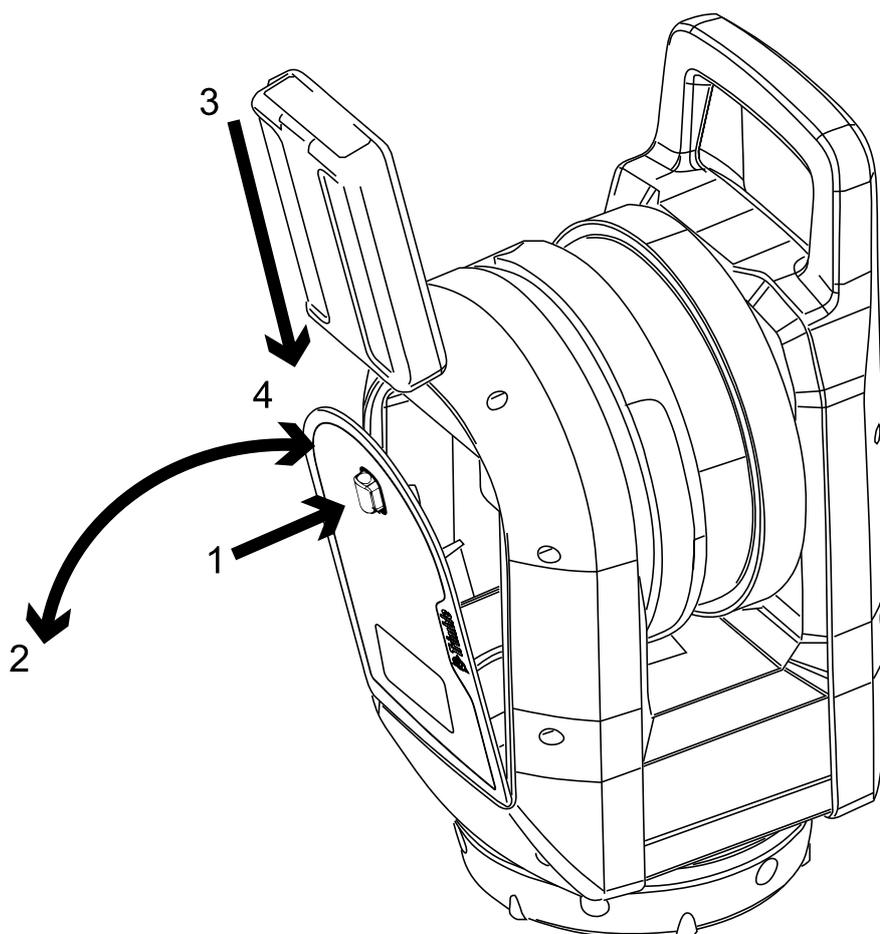
Setting up the instrument

1. Ensure the tripod is stable and the head is visibly level before connecting the instrument.
2. Place the instrument on the tripod head with one hand on the handle and one hand on the base.
3. Carefully center the instrument on the tripod head.
4. With one hand still on the handle, secure the instrument by screwing the tripods bell connector into the 5/8" threaded connection at the base of the instrument.
5. Ensure the bell connector is threaded in completely, but do not over-tighten. The instrument is now ready for operation.

Inserting the battery

The instrument battery fits into the battery compartment on the side of the instrument. This battery can easily be removed and replaced. To insert the battery:

1. Press the battery compartment lock downward to unlock.
2. Open the battery compartment.
3. Slide the battery into the battery compartment, with the battery connectors positioned towards the bottom of the instrument, and facing inward.
4. Close the battery compartment.



Inserting a memory card

The instrument comes with a SDHC (Secure Digital High Capacity) 32 GB memory card (see [page 53](#)).

Before inserting or removing a memory card, ensure that the instrument is off.

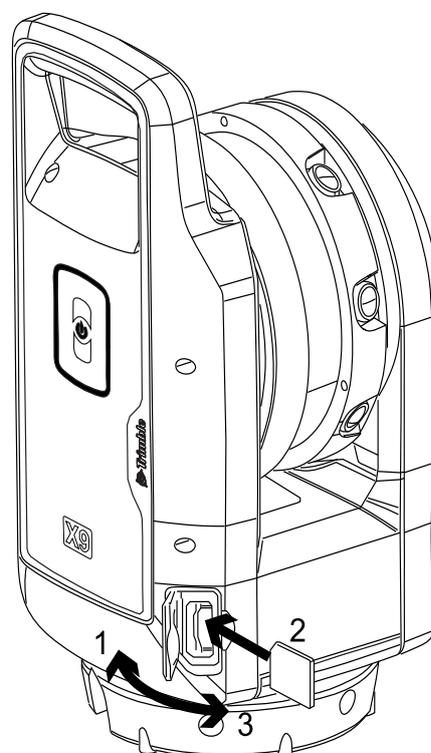
NOTE – Recording is not possible on a memory card with the write protect switch on the locked position. Ensure that you first slide the switch to the unlocked position.

CAUTION – Do not insert the memory card upside down or back to front. Inserting the memory card incorrectly could damage the instrument and/or the memory card.

NOTE – Trimble recommends using SDHC memory cards (by default, they are formatted in the FAT32 file system) with a minimum size of 32 GB, a class 10 speed and a temperature ranging from -20 °C to 85 °C. If you choose to use an extended capacity SDXC memory card, it must meet the specifications given above and must be formatted in the FAT32 file system. Use the SD Card Management features on the field software application to ensure that the SDXC memory card is formatted in the FAT32 file system. For more information, refer to the field software user guide.

1. Open the memory card slot cover.
2. Slide the memory card into the card slot until it clicks into the locked position.
3. Close the memory card slot cover.

To remove the memory card from the card slot, gently push the memory card to unlock it.

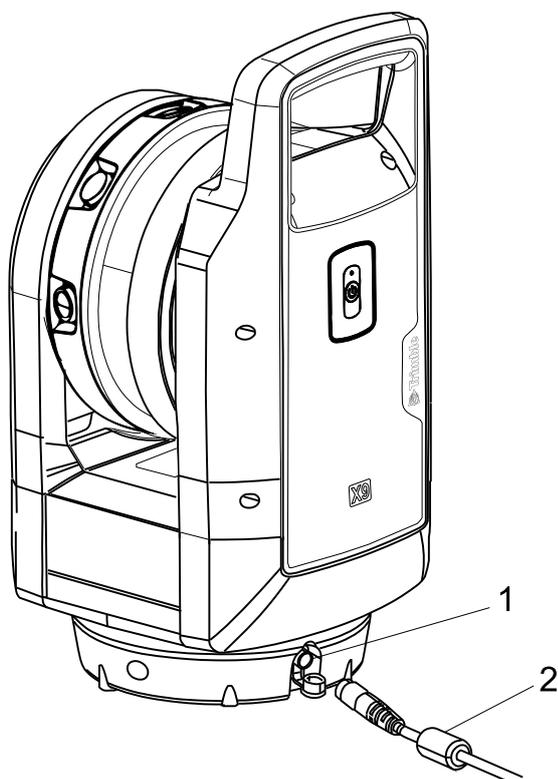


Connecting the USB communication or power supply cable

The instrument has an external connector in the base of the instrument to connect the delivered USB communication cable (P/N 53099032) or an optional power supply (P/N 58027007-00), see [Power supply, page 51](#). The USB communication cable can be used when the Wi-Fi communication is not possible.

The power supply can be used indoors if you are out of battery power.

1. Remove the rubber cap from the COM/12 V power connector on the front side of the instrument.
2. Align the red dot on the LEMO connector of the USB communication (or power supply) cable with the red mark on the COM/12 V power supply connector.
3. Firmly insert the LEMO connector of the USB communication (or power supply) cable.
4. Do one of the following:
 - a. Connect the USB communication cable to the USB port of the controller.
 - b. Connect the power supply cable to the external power supply and then plug the power supply into a power source.



- 1 COM/12 V power connector
- 2 To USB controller or power supply

NOTE – If there is a charged battery in the instrument, the instrument automatically turns on after connecting the USB cable.

Powering the instrument on and off

Turn the instrument on and off with the On/Off key.

Powering on the instrument

With a battery inserted, power on the instrument with a short press of the On/Off key.

NOTE – With the external power supply connected to the power connector, the instrument automatically powers on.

Powering off the instrument

To power off the instrument, press and hold down the On/Off key within one second and five seconds until you hear one beep followed by descending beeps and the On/Off key LED starts to flash with a high frequency. The LED continues to flash with a high frequency until the instrument powers off.

On/Off Key LED

The On/Off LED indicates different instrument modes, see the table below.

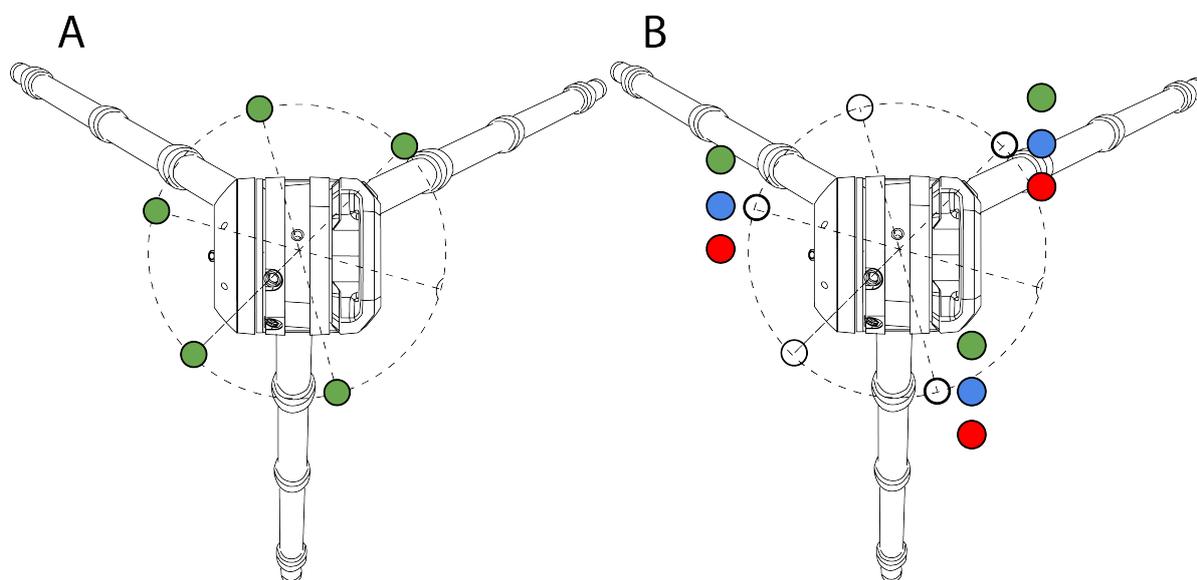
On/Off key LED	The instrument is ...
Off	off.
Yellow, flashing	starting up or shutting down.
Yellow, flashing slow	ready, but not connected to a controller.
Yellow, solid	ready and connected to a controller.
Yellow, flashing fast	updating the firmware.

Multi-color LEDs

The five LEDs indicate different states of the instrument, see the table below.

All LEDs	The instrument is ...
Off	off.
Orange, flashing	starting, shutting down, updating firmware, or running a diagnostic or field calibration report.
Green, solid	ready to scan with controller or scan button operation.
Blue, flashing	initializing, calibrating, leveling, and scanning.
White, flashing	acquiring images.
Red, solid	encountering an issue with the battery, the SD card, leveling, auto-calibration, acquiring data, or there is a hardware failure.

Leveling LEDs	The instrument is ...
All five LEDs are green solid (see A)	leveled.
Three LEDs are flashing (see B)	not leveled.
<ul style="list-style-type: none"> • Green, flashing • Blue, flashing • Red, flashing 	<p>Tripod leg near the LED does not need adjusting.</p> <p>Tripod leg near the LED is too low.</p> <p>Tripod leg near the LED is too high.</p>



NOTE – All LEDs and LED leveling guides can be turned on/off. Refer to the field software documentation.

Sound notifications

Sound	The instrument ...
Ascending beeps	is starting.
One beep	is starting a scan or having the memory card removed.
One long beep	is completing a scan or a diagnostic or field calibration report.
One short beep	has successfully created a precision point.
Two short beeps	has failed to create a precision point.
Three beeps	is resetting the Wi-Fi settings to 2.4 GHz Auto mode.
Four beeps	is encountering an issue, has moved during the operation, the battery is low, or there is not enough space left in the memory card.
One beep followed by descending beeps	is shutting down.
One beep, followed by three beeps (after ten seconds) and then five beeps (after ten more seconds)	is resetting the Wi-Fi password to the factory default value.

Connecting the instrument to a controller

To operate the instrument with the field software, it must be connected to a controller. The controller can be a Trimble T10x tablet or a comparable Windows 10 tablet running the field software. When the instrument is started, it is available for connection by the field software with Wi-Fi or through the USB 2.0 cable.

Use only the approved cable P/N 53099032 for cable communication between the instrument and the controller. This Hirose 6P-PC to USB 2.0 cable has been designed to high-speed data transfer.

1. Start the field software Trimble Perspective, Trimble Field Link, or Trimble Forensics Capture.

NOTE – These instructions are based on the Trimble Perspective software. The Field Link or Forensics Capture software has a slightly different appearance.

2. If there is no project available, tap **+** to create a new project:



The newly created project is loaded.

TIP – If several projects are available, the last loaded project is automatically loaded.

3. Tap  to open the **Connections** page.
4. Choose a connection type; either **Wi-Fi** or **USB**.
 - If you connect a controller to an out-of-box instrument, the Trimble Perspective software prompts you to set a new Wi-Fi password:

Set New Password

The default password must be changed to secure this device.
Changing the password will reset the connection

- ✘ At least 8 characters
- ✘ At least one number
- ✘ At least one special symbol

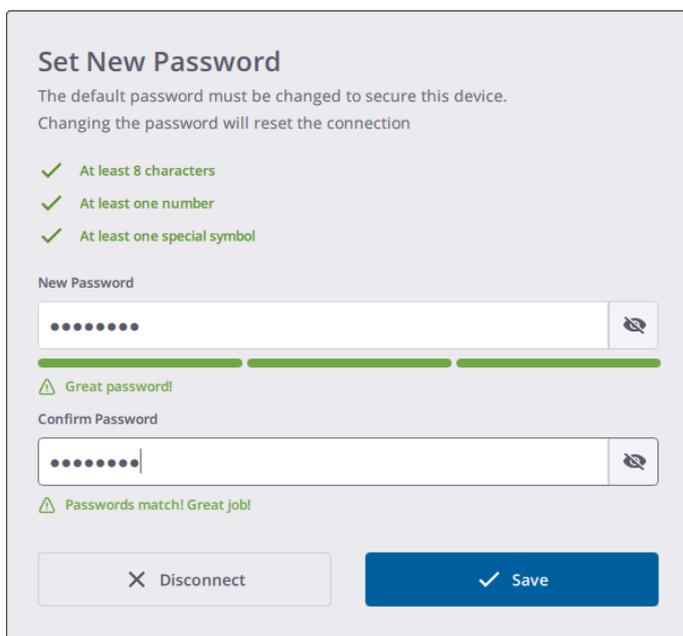
New Password

Confirm Password

✘ Disconnect

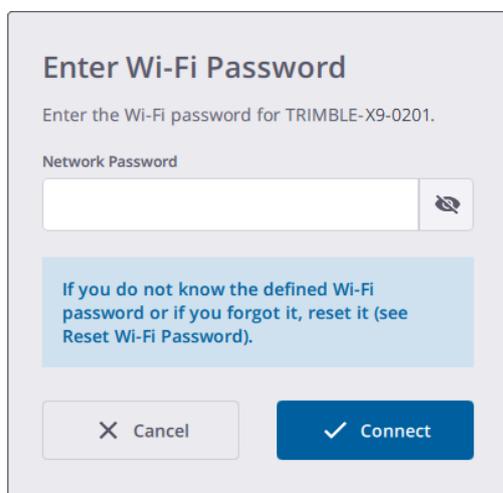
✓ Save

Your new Wi-Fi password should contain only ASCII characters. It must be at least eight characters long, and contain at least one number and one special symbol:



Tap **Save** to set the defined Wi-Fi password to the instrument. The next time you reconnect to the instrument with the same tablet, the connection is automatic and does not require a Wi-Fi password.

- If you connect to the instrument from a different tablet, the Perspective software prompts you to enter the Wi-Fi password that is saved to the instrument.
 - If you know the password, enter it and tap **Connect**:



- If you do not know the password that has been set to the instrument, reset it. See [Setting a New Wi-Fi Password](#), page 35.

5. Once the connection is established, tap **X**.

NOTE – To disconnect the instrument from the controller, tap **Disconnect**.

Connecting with Wi-Fi

With the **Connections** page opened, choose an instrument to connect. Instruments serial numbers in the range of the controller will display for connection:



Once the Wi-Fi connection is established, the **Instrument** and **Wireless Signal** icons turn green and the **Battery** icon shows the level of the battery in the instrument:



To change the communication to the USB cable, connect the USB cable from the controller to the instrument COM connector.

Connecting with USB cable

When the USB cable is connected to the instrument, the USB cable is automatically selected as the primary communication type and the connection to the instrument is automatically established. If the USB cable is disconnected from the instrument, the controller starts searching for an instrument in its vicinity using Wi-Fi.

When the instrument is connected to the controller with the USB cable, the instrument automatically turns on after the controller is turned on.

Once the USB connection is established, the **Instrument** and **USB Connection** icons turn green and the **Battery** icon shows the level of the battery in the instrument:



The **Instrument**, **Wireless Signal** (or **USB Connection**), or **Battery** icons let you check the information related to the instrument in use (Name and Reference Number), the level of the battery in use in the instrument, and the storage space left in the memory card.

Setting a New Wi-Fi Password

To reset the Wi-Fi password to the factory default value, press the On/Off key on the instrument for twenty seconds. You will hear a first beep, followed by three consecutive beeps after ten seconds, and then five consecutive beeps after ten more seconds. Release the On/Off key after hearing the five consecutive beeps to complete the reset.

The Perspective software prompts you to set a Wi-Fi password the next time you connect to the instrument. Your new Wi-Fi password should contain only ASCII characters. It must be at least eight characters long, and contain at least one number and one special symbol:

Set New Password

The default password must be changed to secure this device.

- ✗ At least 8 characters
- ✗ At least one number
- ✗ At least one special symbol

New Password

Confirm Password

NOTE – To reset the Wi-Fi password, you can be connected to the instrument with Wi-Fi or with a USB cable.

Wi-Fi settings

The instrument has the wireless 802.11n technology meaning the instrument supports the **2.4 GHz** and **5 GHz** frequency bands. The default factory values for the Wi-Fi settings are respectively **Auto (2.4 GHz)**, **Auto**, and **Empty** for the frequency band, the channel, and the region code for each newly shipped instrument.

At the first connection with a new instrument (or in case of an already connected instrument and if the region code of the instrument differs from the region of the controller), the field software applies the region of the controller to the instrument, and keeps the frequency band and the channel unchanged (Auto). During the update process, the instrument is automatically disconnected and reconnected to the controller. Based on the region code, the field software scans the Wi-Fi environment to select the best frequency and channel to use.

Wi-Fi Advanced Settings
Changing these settings will reset the connection

Current Configuration
2.4 GHz | Channel 11 | Region JP

Network Password Change

Frequency Range Auto

Channels Auto

Include Indoor Channels

Include DFS 60 Channels
An additional 60 seconds is required at start up to secure the channel

Cancel Apply

Out of the Auto mode, you can switch between **5 GHz** and **2.4 GHz**. The **5 GHz** frequency provides a faster data exchange rate at a shorter distance while the **2.4 GHz** frequency offers coverage for further distances, but may perform at a slower speed in the data exchange. Both frequencies can be used with a multitude of channels including indoor-use channels.

TIP – To reset the Wi-Fi settings to **2.4 GHz Auto** mode, press the On/Off button located on the right side of the instrument for at least 10 seconds until you hear three consecutive beeps. This process is useful to clear the frequency range, the channel, and the region code. It also resets the Wi-Fi password to the factory default value. This setting is legal in all countries and can be used to put the instrument in a legal state before shipping it internationally.

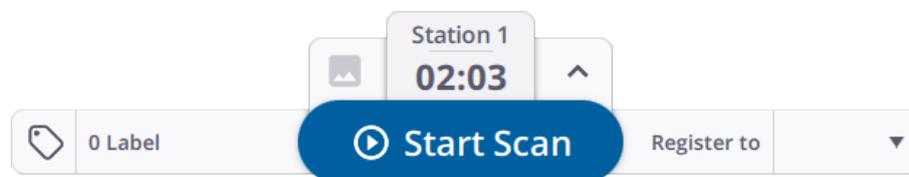
The **Wi-Fi advanced settings** are enabled only if a wireless connection between the instrument and the controller has been set.

TIP – To update the current Wi-Fi password, tap **Change** and set a new Wi-Fi password. See [Setting a New Wi-Fi Password, page 35](#).

Scan settings

These instructions are based on using the Trimble Perspective software.

Before scanning, you must define the settings for scan and image acquisitions. To open the scan settings, tap the pull-down arrow above the **Start Scan** button:



Scan duration defines the density and number of points for the three scan modes. You will first select a preset duration and the scan mode is either set automatically or you can choose between the four modes.

The three predefined modes, **Indoor**, **Standard**, and **High Speed** set the speed and quality of the scan:

- The **Indoor** mode reduces the calibration time and limits the range to 30 m for indoor applications.
- The **Standard** mode is (500 kHz) for full range higher sensitivity data acquisition up to 150 m.
- The **High Speed** mode is (1,000 kHz) for higher resolution data acquisition up to 120 m.

The following table shows the durations available for the scan modes, the point spacing at different distances and the maximum number of points you can expect from each scan.

Scan Duration ¹	Scan Mode	Spacing ² (mm) @ 10 m	Spacing ² (mm) @ 35 m	Spacing ² (mm) @ 50 m	Spacing ² (mm) @ 80 m	Number of points (Mpts)	Maximum file size (MB)
1 minute	Indoor	15				6.8	32
2 minutes	Standard	8	26	38	60	27.2	95
4 minutes	Standard	5	18	25	40	61.2	204
6 minutes	Standard	4	13	19	30	108.8	340
2 minutes	High Speed	8	26	38	60	27.2	175
4 minutes	High Speed	4	13	19	30	108.8	610
6 minutes	High Speed	3	9	14	20	244.8	1250

¹ Scan Durations are average scan times that include self-leveling and auto-calibration time. Durations can increase up to 30 seconds for full calibrations after startup or idle time until thermal stabilization.

² Spacing refers to the distance between two consecutive points.

For more information, refer to the field software user guide.

Choosing an image mode

You can choose to enable or disable the image acquisition function. To acquire images for each scan, set the **Images** mode to On and set the number of images to 15 or 30. Image acquisition time is one minute for 15 images and two minutes for 30 images. The acquired images can be used to create panoramic images and/or to colorize the scan data.

For more information, refer to the field software user guide.

HDR mode

Set the **HDR mode** to On to acquire images with more color and detail in bright and dark areas. After choosing a **Scan Duration** and a **Scan Mode**, and setting the **Images** and **HDR modes** to On, the exact duration in minutes and seconds is updated. The table below shows the exact times for all of the scan and images acquisition modes.

Scan mode	Images Off (min : sec)	15 images (min: sec)	15 images + HDR (min : sec)	30 images (min : sec)	30 images + HDR (min : sec)
Indoor	0:50	01:50	03:50	02:50	06:50
Standard (2 min)	02:03	03:03	05:03	04:03	08:03
Standard (4 min)	03:33	04:33	06:33	05:33	09:33
Standard (6 min)	05:36	06:36	08:36	07:36	11:36
High Speed (2 min)	01:27	02:27	04:27	03:27	07:27
High Speed (4 min)	03:15	04:15	06:15	05:15	09:15
High Speed (6 min)	06:08	07:08	09:08	08:08	12:08

White Balance Correction mode

Choose between an **Automatic White Balance** mode and a handful of white balance presets for either indoor or outdoor scenes like **Sunny**, **Cloudy**, **Fluorescent Cool White**, and **Incandescent**.

For more information, refer to the field software user guide.

Self-leveling

Self-leveling is a selectable On/Off option for automatic level compensation. By default, the **Self-leveling** option is set to On to support automatic registration. It consists of measuring the horizontality (or verticality) of the instrument by measuring the tilt:

- If the instrument is within a range of +10° and -10° from either side of its vertical axis, the acquired stations are flagged as "Leveled".
- If the instrument is within the following ranges, from +10° to +45° and from -10° to -45°, from either side of its vertical axis, the acquired stations are flagged as "Not leveled".
- If the instrument is out of the operating ranges, that is, greater than to +45° and -45° from either side of its vertical axis, an error notification appears and prevents data acquisition unless the instrument is upside down. Upside down scans are flagged as leveled if the tilt is within the range of ±10°.

Automatic calibration

Calibration is automatically performed, when required, after starting a scan. No targets or user interaction is required.

- The **Auto-Angular calibration** applies a correction to the collimation error, that is, the deviation of the Horizontal Axis (HA), or Vertical Axis (VA), or Sight Axis (SA).
- The **Auto-Distance calibration** applies a distance correction in the albedo measurement and the distance measurement.

Applying an atmospheric correction

The scanner uses the EDM (Electronic Distance Measurement) technology to collect points. Distance measurement is function of the velocity of light in the atmosphere and the velocity of light depends on the refractive index of air, temperature, pressure, and humidity. The Atmospheric Correction feature applies corrections to the distance measurement—expressed in PPM (Parts Per Million)—according to the atmospheric conditions. The default PPM value is zero.

Connect to a scanner. If the **Atmospheric Correction** option in the  **Settings > Scanner** panel is:

- **OFF**, all scans will be captured without any atmospheric correction being applied.
- **OFF**, and you turn the option **ON**.
 - The scanner has an atmospheric correction of zero, the **Configure Atmospheric Corrections** panel opens:

Configure Atmospheric Corrections

Enter the atmospheric pressure and temperature to calculate the correct Parts Per Million (PPM) value.

Pressure (500.00 - 3500.00)

mbar

Temperature (-20 - 50)

°C

Parts Per Million (-809 - 151)

↻

Current Instrument Value = 0 PPM

✕ Disable Corrections

✓ Save

- Define an atmospheric correction value:
 - a. Enter a pressure and a temperature and press **Enter**. The PPM value is automatically computed.
 - b. Or enter a PPM value and press **Enter**. As the pressure and the temperature cannot be deduced from the PPM, the Perspective software displays them as "---".
 - c. Optionally, use  to restore the previously saved PPM value.

NOTE – If the input value is out of range, the corresponding field is surrounded in red:

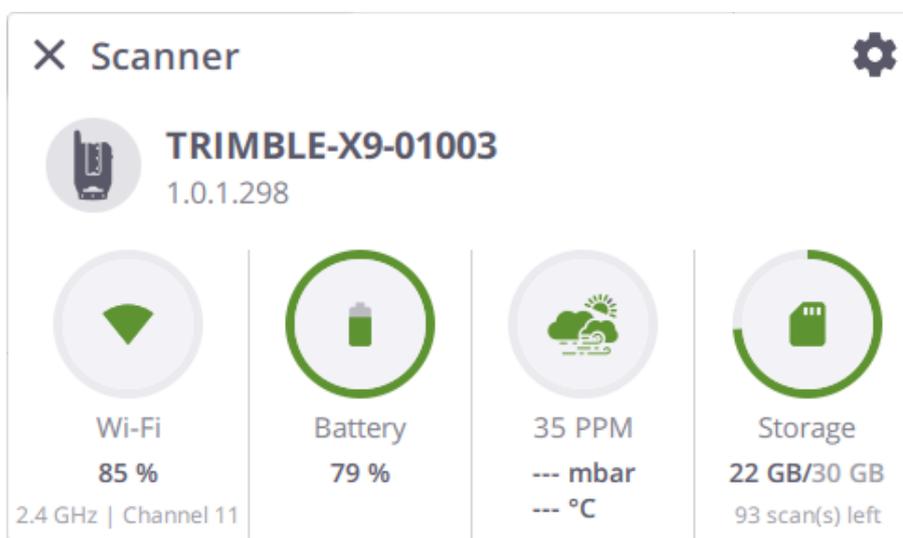
- Pressure: 500 mbar to 3500 mbar
- Temperature: -20 °C to 50 °C
- PPM: -809 to 151.

- d. Tap **Save**.
- Or disable the corrections. Tap  to turn the **Atmospheric Correction** option OFF in the  **Scanner > Settings** panel and to reset the PPM value of the scanner and in the Perspective software to zero.
- **ON**, and the scanner has an atmospheric correction set which:
 - Is equal to the value saved in the Perspective software, the atmospheric correction value will be applied to all scans.

- Tap  to open the **Scanner** panel:



- Tap  again to open the **Configure Atmospheric Corrections** panel:



- Define an atmospheric correction value as described above and optionally, use  to clear all the values. "---" will be displayed in all fields:

Configure Atmospheric Corrections

Enter the atmospheric pressure and temperature to calculate the correct Parts Per Million (PPM) value.

Pressure (50000.00 - 350000.00)

Pa

Temperature (-20 - 50)

°C

Parts Per Million (-809 - 151)

55

⊗

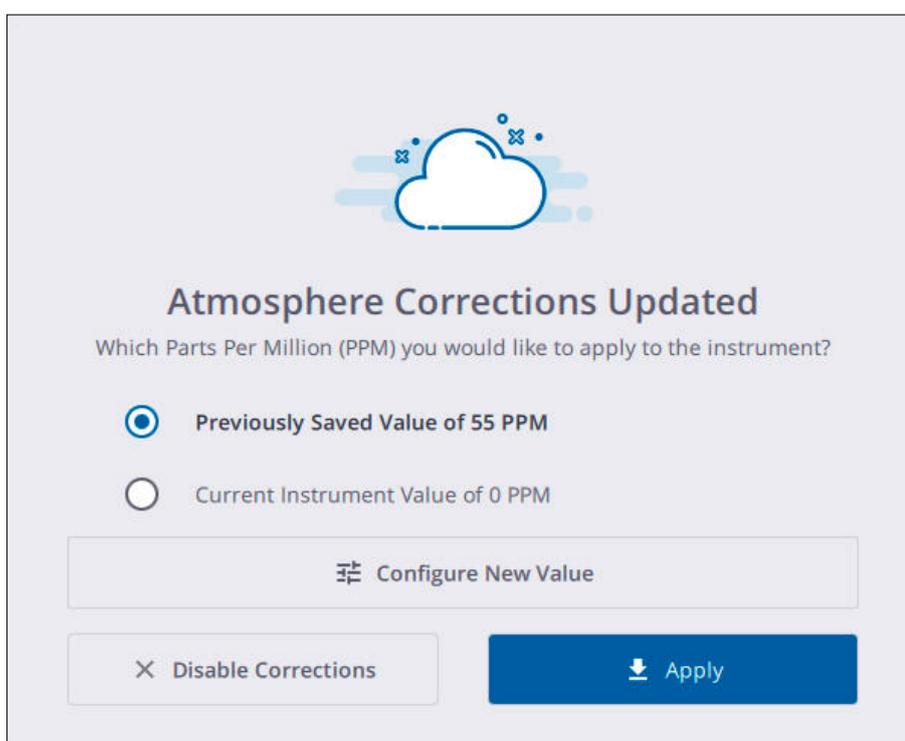
Current Instrument Value = 0 PPM

⊗ Cancel

✓ Save

NOTE – If you set zero to the atmospheric correction value, the PPM  icon is displayed.

- Is different from the value saved in the Perspective software, the **Atmospheric Corrections Updated** dialog opens:





Atmosphere Corrections Updated

Which Parts Per Million (PPM) you would like to apply to the instrument?

Previously Saved Value of 55 PPM

Current Instrument Value of 0 PPM

☰ Configure New Value

⊗ Disable Corrections

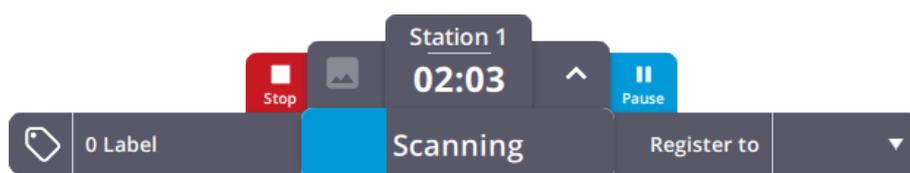
↓ Apply

- Do one of the following:
 - Choose to apply the previous value (saved in the Perspective software) or the current value of the instrument.
 - Configure a new value. Tap  to open the **Configure Atmospheric Corrections** dialog and define a new PPM value as described above.
 - Disable the corrections. Tap  to turn the **Atmospheric Corrections** option off in the **Scanner > Settings** pane and to reset the PPM value of the scanner and of the Perspective software to zero.

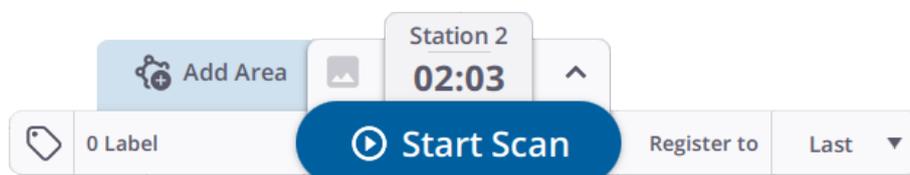
CAUTION – When you turn OFF the scanner, the PPM value of the scanner is reset to zero. The next time you reconnect to the scanner, if you apply the instrument value of 0 PPM, the Perspective software will display the PPM icon in GRAY .

Acquiring data

After connecting to an instrument, create a new project or load an existing one. New projects will start with **Station 1** and existing projects will display the next **Station** to acquire. A station is a scan position where you capture a 360° (**Full Dome**) scan. Once the required scan and image acquisition modes are set, tap **Start Scan**. A single beep indicates a scan has started. To stop or pause acquiring the data, tap **Stop** or **Pause**:



Once the station is complete you can **Add Area** scans or move to the next station to acquire the next full scan.



You can press and release the **On/Off** button located on the right side of the instrument for less than one second to acquire data without using the controller, in case you lose the Wi-Fi connection, or because the controller turns off due to the low battery level, or because you choose to use the push button operation.

The scan settings (**Scan mode**, **Images mode**, **Self-Leveling**, **Automatic Calibration**) are the last settings used or the default settings if using for the first time. The acquired data is stored on the SD card. The data will be downloaded to the controller once the connection between the instrument and the controller is re-established or you can place the SD card in the controller and use the **Import Scans** feature from the field software to import and automatically register the scans.

NOTE – When a scan is in progress, the atmospheric correction value cannot be changed. The **Atmospheric Correction** icon and the related option in the **Settings > Scanner** panel in the Perspective software are grayed-out:



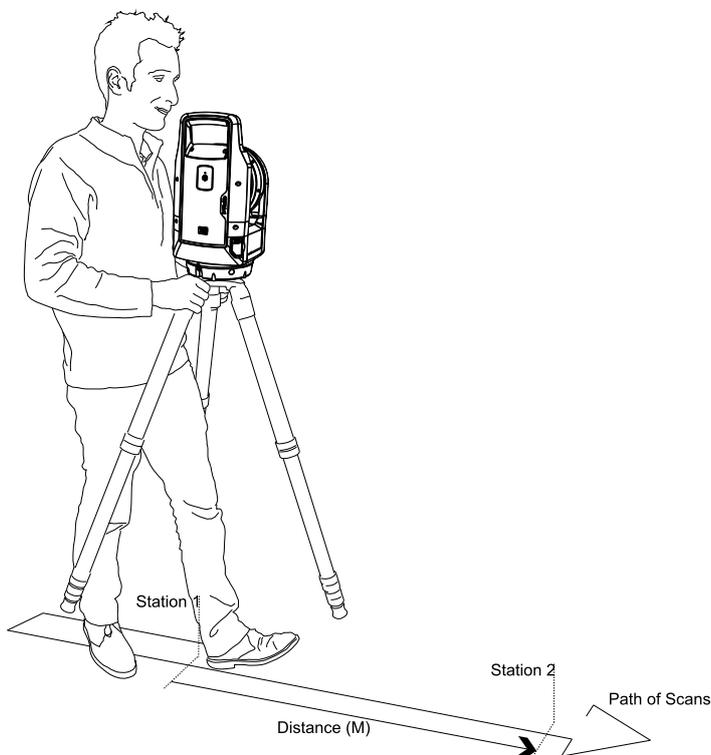
Once finished, for a:

- **Full dome scan**, the icon and the option become enabled again. You can change the value or disable or enable the option. Changing the PPM value will disable the **Area Scan** and **Laser Pointer** features.
- **Area scan**, the icon and the option remain grayed-out. The value still remains unchangeable, and you cannot disable or enable the option either.

For more information, refer to the Trimble Perspective, Trimble Field Link or Trimble Forensics Capture user guides.

Moving between stations

Follow the instructions below when moving the instrument from station to station to ensure a good scan registration.



Move the tripod and the instrument from one station to the next:

1. Grab the tripod by two legs with your hands near the head of the tripod.
2. Lift the tripod and the instrument together.
3. Move to the next station while:
 - Ensuring there is enough overlapping areas with the previous station.
 - Keeping the distance between two consecutive stations less than 10 m.

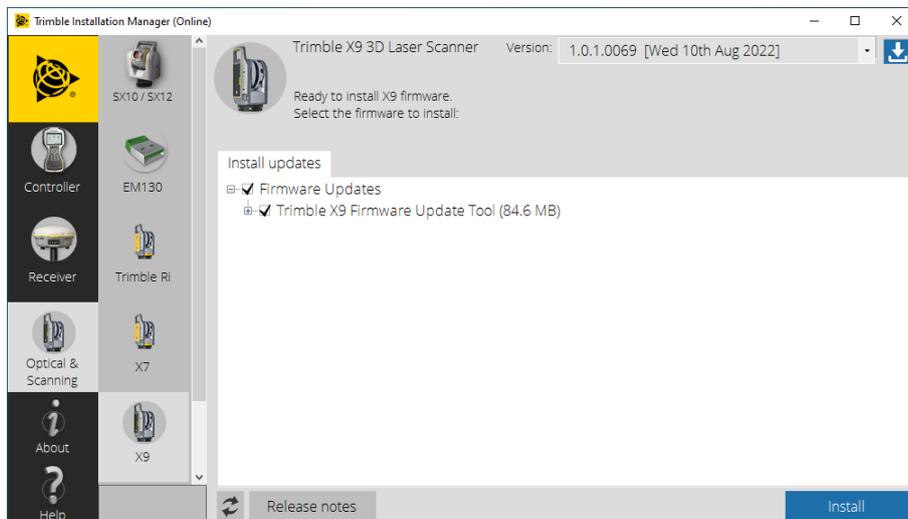
Having enough overlapping areas and limiting the distance between stations helps ensure good scan registration.

4. Lower the tripod and the instrument to the new scanning position.

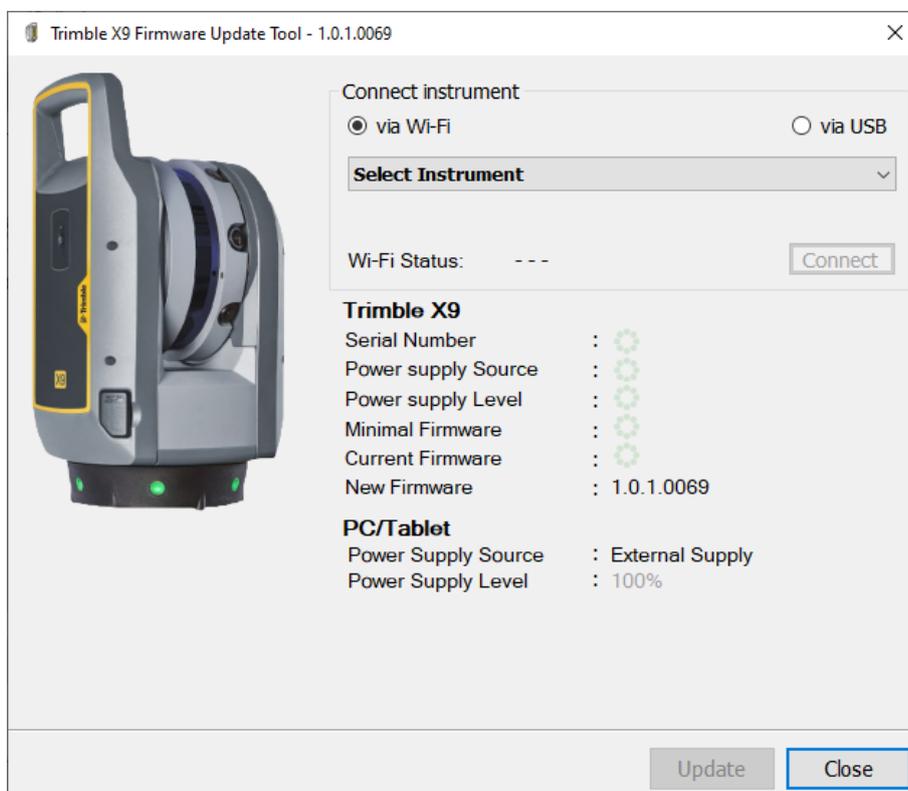
If the registration fails between two stations, consider capturing another station between them to improve overlap and/or decrease the distance between scans.

Updating the firmware

1. Download and install the Trimble Installation Manager.



2. Ensure that you have a fully charged battery in the instrument.
3. Turn on the instrument by pressing the **On/Off** button on the side of the instrument.
4. Start the Trimble Installation Manager.
5. In the Trimble Installation Manager screen, ensure that the **Trimble X9 Firmware Upgrade Tool** option is selected.
6. Click the **Version** pull-down arrow and choose the last version of the firmware.
7. Click **Install**. The **Trimble X9 Firmware Upgrade Tool** dialog appears:

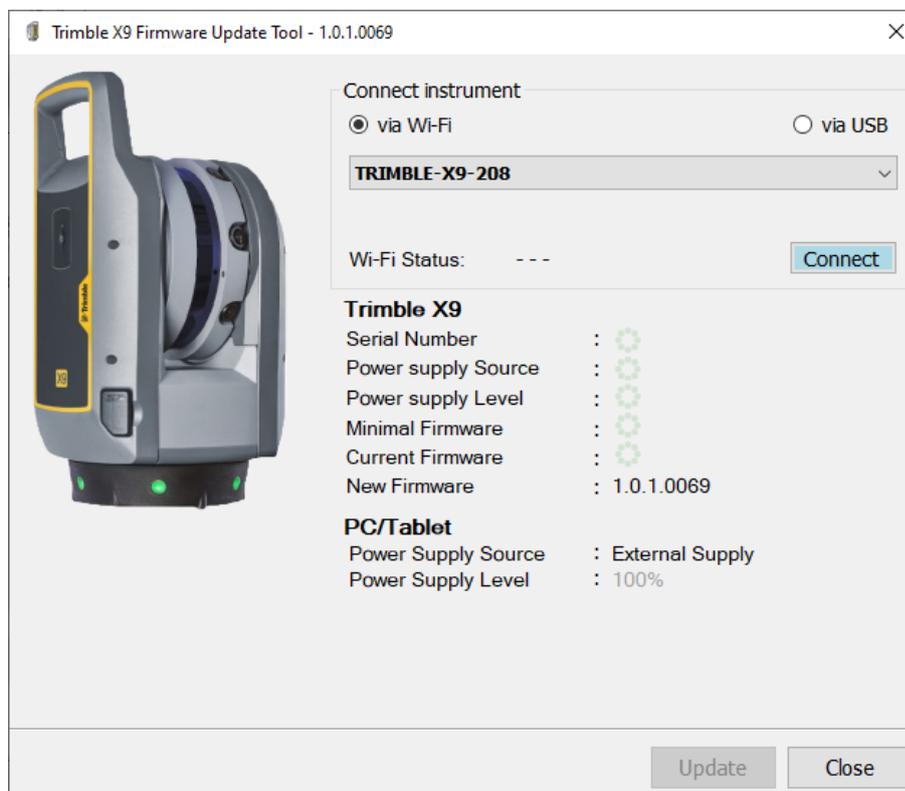


If you are:

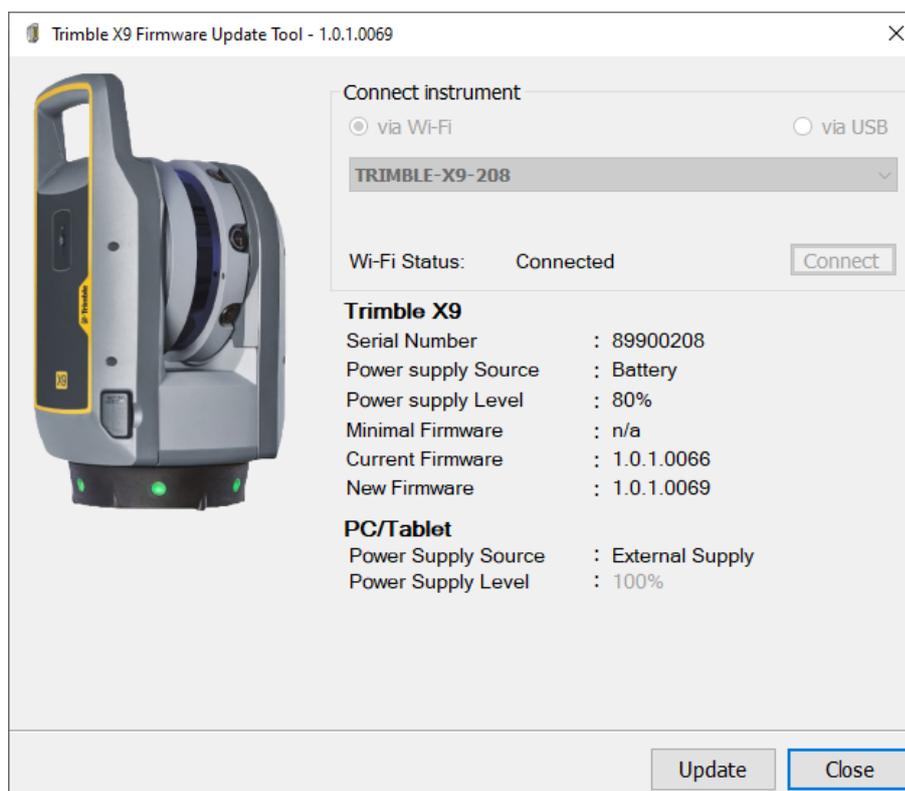
- Not connected to an instrument, go to [Step 8](#).
- Connected to an instrument (via the Perspective software), the serial number of the instrument, the level of the battery, and the version numbers of the firmware (minimal, current, and new) are listed. Go to [Step 9](#).

8. Choose a connection option; either **via Wi-Fi** or **via USB**.

- If you select the **via Wi-Fi** option, select an instrument to connect to and click **Connect**:

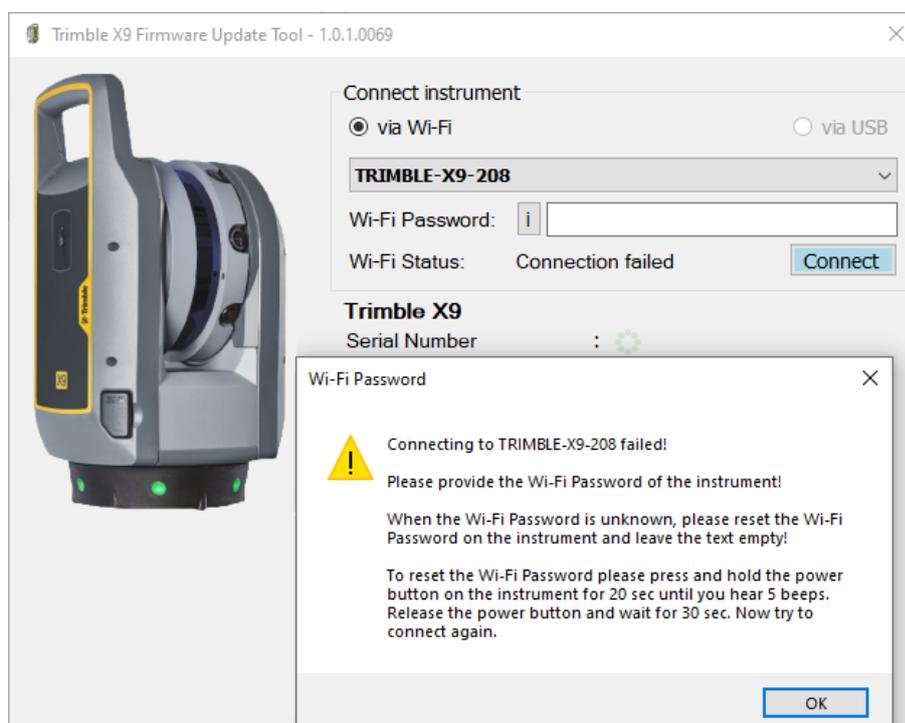


The connection to the instrument succeeds if you have previously connected to it with a Wi-Fi password.

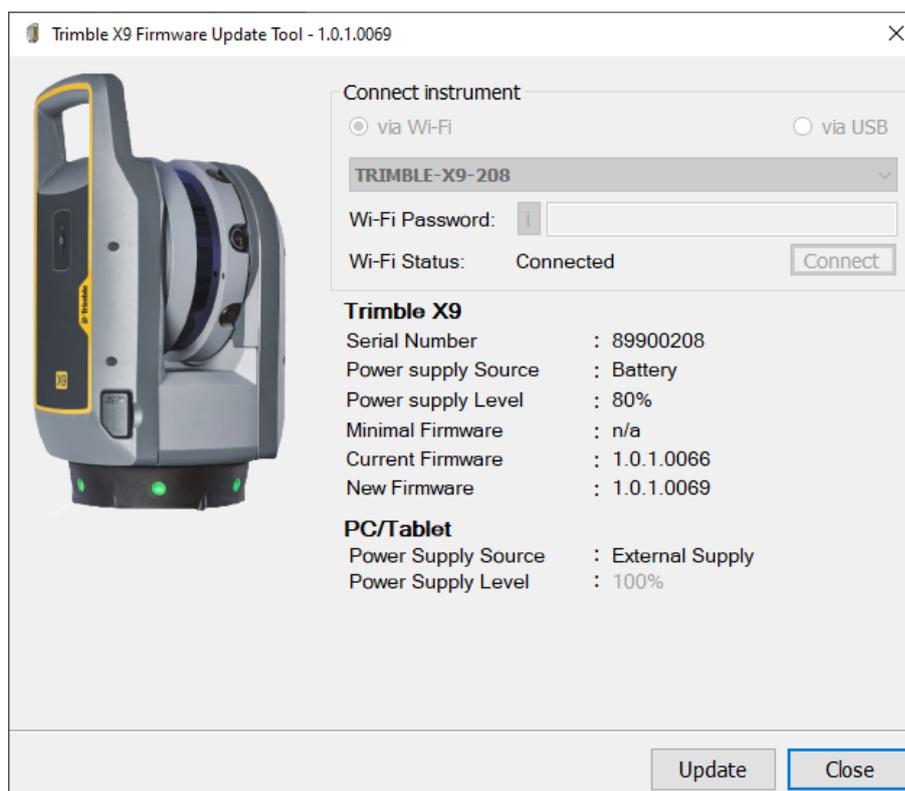


The connection to the instrument fails if you never connect to it with a Wi-Fi password. A dialog displays and prompts you to enter the Wi-Fi password or to reset it.

If you know the Wi-Fi password, enter it in the **Wi-Fi Password** field and click **Connect**:



If you don't know the Wi-Fi password, leave the **Wi-Fi Password** field blank and press the **On/Off** key of the instrument for twenty seconds to reset the Wi-Fi password to the factory default value. Release the **On/Off** key once you hear five beeps and wait thirty seconds more before reconnecting:

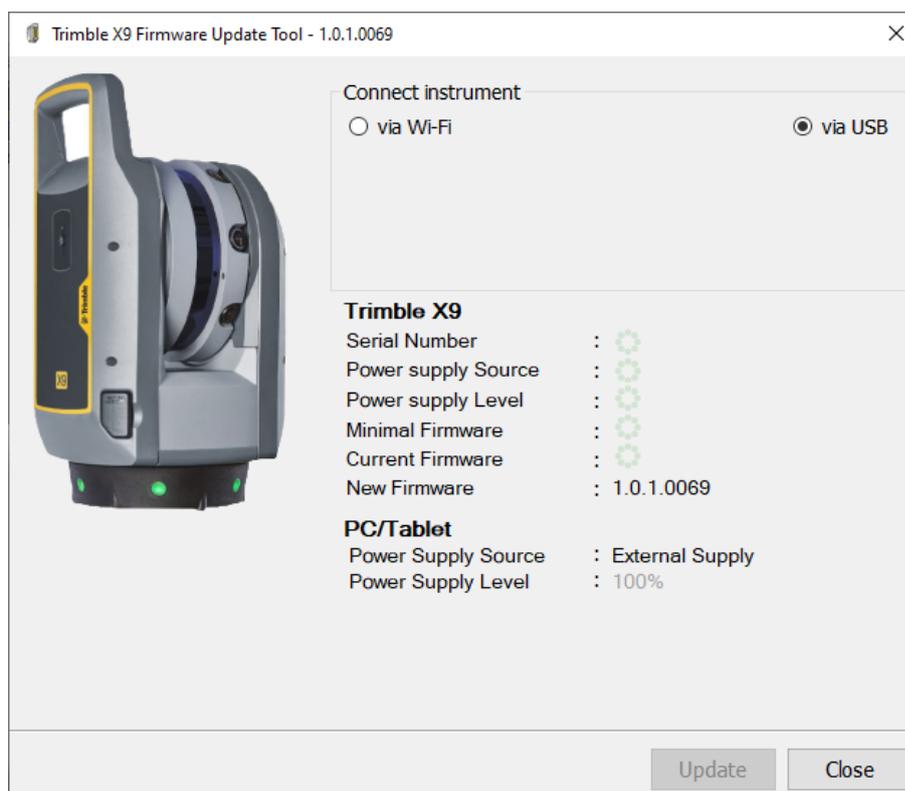


- If you select **via USB** option, you do not need to select an instrument.

Connect the controller to the instrument using the PC USB 2.0 cable (P/N 53099032).

The connection to the instrument is automatic. The serial number of the instrument, the level of the battery, and the version numbers of the firmware (minimal, current, and new) are listed.

NOTE – No Wi-Fi password is required when you update the firmware via the USB connection.



9. Click **Update**.
10. Follow the instructions in the **Trimble X9 Firmware Upgrade** wizard.
11. When complete, close the **Trimble X9 Firmware Update Tool** dialog.
12. Click **Finish** in Trimble Installation Manager.

Accessories

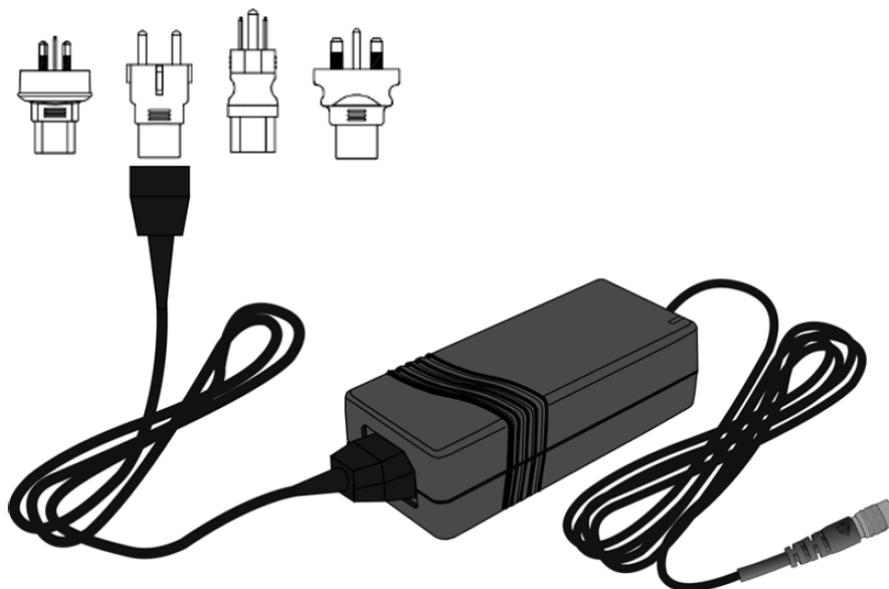
- Power supply
- SD card and memory card reader
- Trimble backpack
- Gitzo Series 3 tripod
- Quick release
- Triple mag mount

This chapter describes some of the optional accessories recommended by Trimble for use with the X9 3D laser scanner.

Power supply

A power supply (P/N 58027007-00) for indoor-use only is available for the instrument. The power supply has a Hirose connector that connects to the COM/12 V power connector on the front side of the instrument. A power supply cable and four different adapters are available to connect the power supply to the main power in different countries.

NOTE – The power supply must be only used with the supplied power cable that is part of the P/N 58027007-00.



CAUTION – The power supply is intended for indoor-use only and must not be exposed to moisture or liquids.

CAUTION – To avert the risk of an electric shock this device must only be connected to a power supply with a protective earth conductor. The device should be set up so that the power plug can be disconnected from the power supply quickly and easily without any tools. The pull of the power plug is used to disconnect the device from mains.

CAUTION – Use only the power cable and the four adapters (P/N 51695) authorized by Trimble. Any malfunction or damage caused by the use of an unauthorized power cable to the instrument may void the instrument warranty.

Technical data

For the complete technical specifications, please refer to the Trimble X9 3D laser scanner data sheet available from geospatial.trimble.com.

Battery (P/N 99511-30)

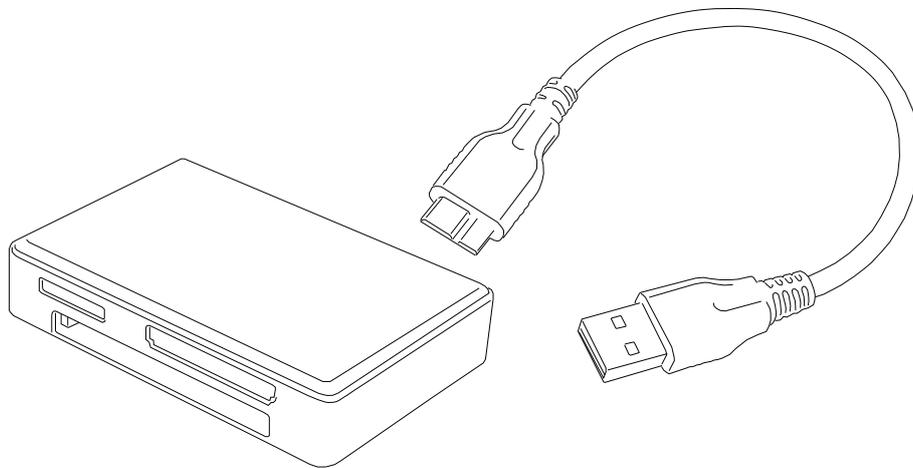
Supply voltage	11.1 V DC
Power consumption	Approximately 30 W

Power supply (P/N 58027007-00)

Supply voltage	Input: 100 to 240 V AC Output: 12 V DC
Frequency	Input: 47 to 63 Hz
Power consumption	Input: 1.6 A Output: Maximum 57 W

SD card and memory card reader

The X9 3D laser scanner is delivered with a 32 GB SDHC Class 10 UHS-I U3 SD card and a USB 3.0 multi-slot flash memory card reader.



SDXC cards with greater capacity can be used, however they must be formatted in the FAT32 file system. When using cards other than the one delivered with the instrument, please format the card with the instrument format function to ensure they are formatted in the FAT32 file system. SDXC cards formatted with Windows will be formatted in the Windows exFAT system; the X9 3D laser scanner does not support this file system.

Trimble backpack

A custom backpack (P/N X7-BP-01) is available for easy transport at the job site. The backpack has a custom foam insert to securely hold the X9 3D laser scanner, three batteries and dual charger, and additional pockets to carry the T10x Tablet, miscellaneous accessories, and straps to hold a Gitzo tripod (see [page 55](#)).

Backpack dimensions are 432 mm × 330 mm × 254 mm (17" × 13" × 10").

The backpack is compatible for airline carry-on on most aircraft. Check with the airline to confirm carry-on size restrictions for specific aircraft.



Gitzo Series 3 tripod

The Gitzo Series 3 tripod (P/N 90573-TR) is a compact tripod recommended for use with the X9 3D laser scanner. Trimble delivers the tripod with a custom head with $5/8 \times 11$ bell connector to thread into the female connection at the base of the scanner.



Quick release

The quick release adapter is an optional accessory for the Gitzo Series 3 tripod (P/N 90573-TR). The tripod is not included.

The Trimble X9 quick release (P/N 90573-QR) connects directly to the base of the instrument and includes a custom head for the Gitzo Series 3 tripod for quick attachment and release.



Triple mag mount

The Triple mag mount (P/N 5114-X7-TR) has three 3³/₄" magnets for securely attaching the X9 3D laser scanner to metal surfaces such as vehicles or structural members. The mounting plate has a connection for attaching the laser scanner with the quick release adapter (P/N 90573-QR) (see [page 56](#)). The magnets are strong enough to mount the laser scanner upside down when all three magnets are attached to a solid steel surface. The quick release adapter is also tested for mounting upside down, but care must be taken to ensure that the locking lever is secure and not accidentally unlocked when the scanner is attached.

