FARO Laser Tracker Accessories
October 2020

Includes Accessories for Vantage^{S}, Vantage^{E}, Vantage, ION, and earlier Models

Legal Notices

Release Notice

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Contents

Chapter 1: Introduction

This introduction contains information on how to reach FARO, how to read the manual, and a brief overview of the FARO Laser Tracker Accessories. Additional information about accessories and important guidelines on maintaining your new Laser Tracker is also included. If you have any questions or need further instructions about any procedure, contact your Customer Service Representative by Phone, Fax or E-Mail. *See "Technical Support" on page 109.*

Visit the FARO Customer Care area on the Web at *www.faro.com* to search our Knowledge Base. The Knowledge Base is available 24 hours a day, 7 days a week, and contains hundreds of solutions to product and application questions. Listed below are some visual and typographical conventions used in each of the sections.

How to Use This Manual

Listed below are some visual and typographical conventions used in each of the sections.

Bold text	Indicates directory names, menu names, buttons, tabs, key names, dialog box names, dialog box items, acronyms, and modes.
`monospaced` text	Indicates alphanumeric characters or values you enter in a field on the screen. For example, "Type `0.005` for the tolerance setting."

It is important that you understand the meaning of the following words before proceeding.

digitize	Indicates the recording of XYZ coordinates of a point or location in 3D space. The word digitize is the same as the term *measure* when referring to points.
choose or select	Indicates that you are initiating an action. For example, "Select **File** > **Insert** > **CAD Parts**."
left-click, right-click, click, or press	Indicates that you press and release the corresponding mouse button or keyboard key. Also used when referring to the hardware device buttons. For example, "After selecting a file from the **Open File** dialog box, *click* **OK** to open the file" or *"Press* **ESC** at anytime to cancel a command."
drag	Indicates that you press and hold the **left mouse** button down and move the mouse. Release the mouse button to finish. This word is often used when changing the size of a window or toolbar.

Warning

WARNING: A WARNING notice denotes a hazard. It calls attention to an operating procedure, practice, or event that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

Caution

CAUTION: A CAUTION notice denotes a hazard. It calls attention to an operating procedure, practice, or event that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a CAUTION notice until the indicated conditions are fully understood and met.

Note

NOTE: A NOTE notice denotes additional information that aids you in the use or understanding of the equipment or subject. Specifically, they are not used when a WARNING or CAUTION is applicable. They are not safety related and may be placed either before or after the associated text as required.

Product Environmental Information

Legislation is now in place within the European Union (EU) that regulates waste from electrical and electronic equipment (WEEE). European Directive
2012/19/EU on Waste Electrical and Electronic Equipment (the WEEE Directive) stipulates that WEEE is now subject to regulations designed to prevent the disposal of such waste and to encourage design and treatment measures to minimize the amount of waste that is placed into the waste stream. The objective of the WEEE Directive is to preserve, protect and improve the quality of the environment, protect human health, and stimulate the practical use of natural resources. Specifically, the WEEE Directive requires that producers of electrical and electronic equipment be responsible for the collection, reuse, recycling and treatment of WEEE which the Producer places on the EU market after August 13, 2005.

FARO Technologies, Inc., as a producer of electrical and electronic equipment (EEE), has endeavored to meet these environmental responsibilities for managing WEEE. In so doing, FARO is providing the following to inform its customers about the WEEE collection process:

In order to avoid any potential dissemination of hazardous substances into the environment, FARO has labeled this product with the WEEE symbol (see below) in order to alert the end-user that it should be disposed of within the proper waste management system. That system will recycle, reuse, and dispose of materials from this product in an environmentally sound way.

The symbol represented below, and found on this FARO Technologies, Inc. product, indicates that this product meets the European Directive 2012/19/EU on Waste Electrical and Electronic Equipment. This symbol, only applicable in European Union countries, indicates that when this product reaches the end of its useful life it should not be disposed of with normal household or municipal waste, but in an established waste stream for WEEE.

Each EU Member State country has established a system for the collection, disposal, and recycling of WEEE. End-users in the EU should contact their local waste administration system for collection instructions concerning this product.

Refer to *www.faro.com/support/rohs-and-weee-statement/* for further environmental information concerning this product.

This product is in compliance with the DIRECTIVE 2011/65/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHs).

WEEE Symbol

Chapter 2: Optical Targets

This chapter covers the optical targets available for the Laser Tracker. Please review the Optical Target Care guide for information on keeping your optical targets clean for optimal performance and accuracy.

Optical Target Care

Optical Target Care Overview

Optical Targets, such as the spherically mounted retroreflector (SMR), are an important part of the FARO Laser Tracker. Handle SMRs with great care to ensure accuracy and longevity.

Target care includes:

- Never touching the optical surfaces of the target.
- Never dropping the target.
- Keeping the target free of dust and moisture by storing it in the case when not in use.
- Cleaning the target *only* when there are problems acquiring the target or the Operational Checks indicates cleaning is necessary.
- Always using the proper cleaning materials and procedure when cleaning is required.

If the FAROLaser Tracker does not lock onto the target, use the Operational Checks command to check your SMR. If the Return Power value is "**GOOD**" your SMR does not need cleaning.

CAUTION: Unnecessary cleaning will degrade the reflective surface of the SMR and can cause damage to the coatings on silver surfaces that will eventually destroy the SMR. Only clean SMRs when required for good measurement and accuracy performance, not based on cosmetic conditions.

Cleaning Optical Targets

In many cases, the optical surfaces of the target are simply dusty and just require cleaning with compressed air from a can.

CAUTION: Do not clean with compressed air available from a hose in a workshop - the air is seldom clean and may coat the SMR with oil or some other contaminant.

- Spray the air away from SMR for a few seconds before spraying it onto the optical surfaces to remove any propellant in the can from the air nozzle. This prevents the propellant from being sprayed onto the SMR's optical surfaces. Always hold the can upright and never shake the can when spraying compressed air.

If the target is still not functional after blowing off any dust, use the following target specific procedures.

CAUTION: Never use a dry cotton swab or tissue to clean the optical surfaces because these will scratch the optical surfaces. Cleaning with any improper chemicals will destroy the reflective surface.

1. Breathe on the optical surfaces. The moisture in your breath will form a layer of condensation on the optical surfaces.
2. While condensation is still on the glass surface, gently slide a cotton swab in one direction while rotating it in the opposite direction. Use very little pressure; do not push the cotton swab onto the surface. Use one cotton swab for each pass and then discard it. You may need several swabs to clean the optical surfaces thoroughly. Using a cotton swab more than one time can cause debris to scratch the coatings. For silver SMRs, a scratch can lead to oxidation under the coatings and destroy the SMR.
3. If this does not successfully remove the residue, clean the optical surfaces with Optima Grade acetone for oil based residue or denatured alcohol for water based residue.
4. Moisten a clean cotton swab with solvent.

5. Gently slide the cotton swab in one direction while rotating it in the opposite direction. Use very little pressure; do not push the cotton swab onto the surface. Use one cotton swab for each pass and then discard it. You may need several swabs to clean the optical surfaces thoroughly.
6. Remove any remaining cotton dust with canned compressed air.

Spherically Mounted Retroreflector (SMR)

The Spherically Mounted Retroreflector (SMR) is the most commonly used target with the Laser Tracker. It consists of a hollow cornercube mirror precisely mounted within a tooling sphere. The distance between the outside of the sphere and the center of the tooling sphere is known (the radius of the tooling sphere) and the CAM2 software, and many other software packages, use this value to offset, or compensate, measurements. SMRs are available in 1½" (38.1 mm), ⅞" (22.225 mm) and ½" (12.7 mm) diameters. The SMR will reflect a laser beam with an incident angle of up to approximately ±30°.

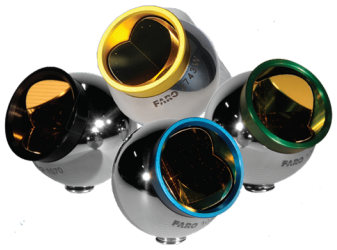


Figure 2-1 Spherically Mounted Retroreflector (SMR)

A colored ring band identifies each of the three SMR models available for each diameter size:

- **Black** - Standard Accuracy. The reflector vertex is centered within ± 0.0003" (0.0076mm).
- **Gold** - High Accuracy. The reflector vertex is centered within ± 0.0001" (0.0025mm).
- **Green** - Long Range. The reflector vertex is centered within ± 0.0003" (0.0076mm) and the dihedral angles have a tighter tolerance to permit the extended range.
- **Blue** - High Performance. The reflector vertex is centered within ± 0.0001" (0.0025mm) and the dihedral angles have a tighter tolerance to permit the extended range.

You can attach the SMR to a target adapter. The combination of the SMR and the adapter changes the compensation value. Use adapters to measure edges, inner and outer diameters and the position of bushed holes. There are a wide range of target adapters that are available from the FARO Electronic Product Catalog at *www.faro.com*.

6Probe

Part # 900-000102-000

The FARO® 6Probe is a wireless Six Degree of Freedom (6DoF) probing system for the Vantage^{S6} and Vantage^{E6} Laser Trackers. The 6Probe is battery powered and has a set of removable probe tips and extensions to measure your part.

NOTE: The 6Probe requires Vantage MCU firmware v2.11.0 or later.

1. Status LEDs
2. Power Indicator
3. Battery Power Indicator
4. Buttons 1- 4 (on side)
5. Battery Cover or 6Probe Handle
6. Battery Cover Locking Latch
7. Power On/Off Button
8. Kinematic Probe Adapter
9. Removable Probe Tip

Figure 2-2 6Probe Rear View

1. 6DoF Sensors (11 total)
2. 6Probe Corner Cube
3. Buttons 1- 4 (on side)
4. Kinematic Probe Adapter
5. Removable Probe Tip
6. Locking Handle

Figure 2-3 6Probe Front View

Indicator LEDs

The operational range of the 6Probe is 2.5 meters (8ft) to 15 meters (49ft) - 30 meters (98.4ft) spherical working volume. All setup, probe management, and measurement must be done within the operation range.

Figure 2-4 6Probe LED Indicators

The ① Power Indicator is **blue** when the 6Probe is powered and operating properly.

The ⑤ Battery Power Indicator displays the current battery level:

- **Green** - 60% to 100%
- **Orange** - 20% to 60%
- **Red** - 5% to 20%
- **Blinking Red** - less than 5%

The ③ Center Status LED displays the current pairing status:

- Off - no pairing
- **Blue** - successful pairing

The ② Left Status LED displays the probe tip and measurement status:

- Off - no pairing
- **Green** - Valid Probe Tip
- **Blinking Green** - Invalid Probe Tip
- **Red** - Measurement

The ④ Right Status LED displays the Corner Cube rotation to the Vantage:

- Off - Beam lost Off-Axis
- **Green** - On-Axis
- **Orange** - Moving towards Off-Axis

All ②③④ Three Status LEDs display the pairing process events:

- **Blinking Blue** - pairing in process
- **Blinking Red** - pairing failure, or loss of pairing

Shipping Case - 6Probe

1. Battery charger
2. 6Probe
3. Probe compensation nest
4. Batteries
5. Handle
6. Assembled Probe storage

Figure 2-5 6Probe Shipping Case

Probe Tip Case

1. Probe Tip Wrench
2. Probe Tip Wrench - small
3. Probe Tips

Figure 2-6 6Probe Probe Tip Case - Top Level

1. Kinematic Probe Adapter (2)
2. Hex Wrench
3. Probe Extension
4. Probe Extension Wrench

Figure 2-7 6Probe Probe Tip Case - Bottom Level

6Probe Setup

The following sections describe the proper setup of the 6Probe. This includes installing and compensating the probe so it measures accurately.

NOTE: The Vantage must be completely setup, warmed up, and compensated before connecting the 6Probe.

CAUTION: The 6Probe may not pair with the Vantage or operate accurately outdoors, in direct sunlight, or in high Infrared (IR) light conditions.

Installing the Battery

Install the battery into the 6Probe.

1. Remove the 6Probe from the shipping case.
2. Turn the locking latch clockwise or counterclockwise.

Figure 2-8 Turning the locking latch

3. Remove the battery cover.

Figure 2-9 Remove the battery cover

4. Slide the battery upwards into the 6Probe until it locks into place.

Figure 2-10 Installing the battery

5. Replace the battery cover and secure it by turning the locking latch.

Figure 2-11 Securing the locking latch

NOTE: You can also install the handle after installing the battery.

Figure 2-12 Installing the Handle

Installing a Probe

1. Remove a probe tip from the probe tip case and thread it onto the threaded end of the Kinematic Probe Adapter. Tighten the probe tip with the one of the provided wrenches in the probe tip case.

NOTE: FARO Technologies, Inc. does not guarantee the accuracy of the 6Probe with the use of any probe extension.

2. Open the locking handle. Notice the arrow printed on the handle.

Figure 2-13 Opening the Handle

3. Rotate the probe so the arrows are aligned. Insert the probe into the 6Probe until it is flush in the seat.

Figure 2-14 Installing Probe

4. Close the handle to lock the probe into the 6Probe.

Figure 2-15 Closing the Handle

Powering the 6Probe

1. Press the Power Button to start the 6Probe. You will see the Power (**blue**) and Battery Power (**green**/**orange**/**red**) indicators on, but the other three Status LEDs will remain off.

Figure 2-16 Power Button

Pairing the 6Probe and the Vantage

NOTE: The 6Probe requires Vantage MCU firmware v2.11.0 or later.

CAUTION: The 6Probe may not pair with the Vantage or operate accurately outdoors, in direct sunlight, or in high Infrared (IR) light conditions.

NOTE: The operational range of the 6Probe is 2.5 meters (8ft) to 15 meters (49ft) - 30 meters (98.4ft) spherical working volume. All setup, probe management, and measurement must be done within the operation range.

Wirelessly connect the 6Probe to the Vantage and create a pairing. The first pairing will store the 6Probe serial number in the Vantage and measure the position.

1. Track the laser with any SMR away from the Home position.
2. Acquire the laser beam with 6Probe and track it out to at least 2.5 m (8 ft) from your Vantage.
3. Press any of the 6Probe's four buttons to start the pairing process. The Status LEDs will flash **blue** during this process.
4. Hold the 6Probe stable until the Status LEDs switch to **green** and the pairing process completes.

NOTE: If the Status LEDs switch to **blinking red**, the pairing process has failed. Press and hold any button to repeat. Release the button once the pairing process begins.

NOTE: If the middle Status LED switches to **solid red**, the pairing has also been lost. Power off/on the Vantage and the 6Probe and try the pairing again. If this continues, contact your Customer Service Representative by Phone, Fax or E-Mail. *See "Technical Support" on page 109.*

You will lose the pairing if:

- You track the Vantage behind an obstruction that blocks the RF signal.
- The 6Probe battery completely drains.
- You track the 6Probe out of the operational range.
- The Vantage is powered off.

Pairing the 6Probe with Multiple Vantages

You can use a 6Probe with multiple Vantage systems. However, you must power off/on the 6Probe before pairing with another Vantage.

NOTE: You do not need to compensate existing probes when you pair the 6Probe to another Vantage.

Probe Management

Create, edit, select, compensate, and check, each Kinematic Probe Adapter and Probe Tip combination for use with the 6Probe. Kinematic Probe Adapters that have been installed to the current 6Probe are automatically added.

NOTE: The 6Probe requires Vantage MCU firmware v2.11.0 or later.

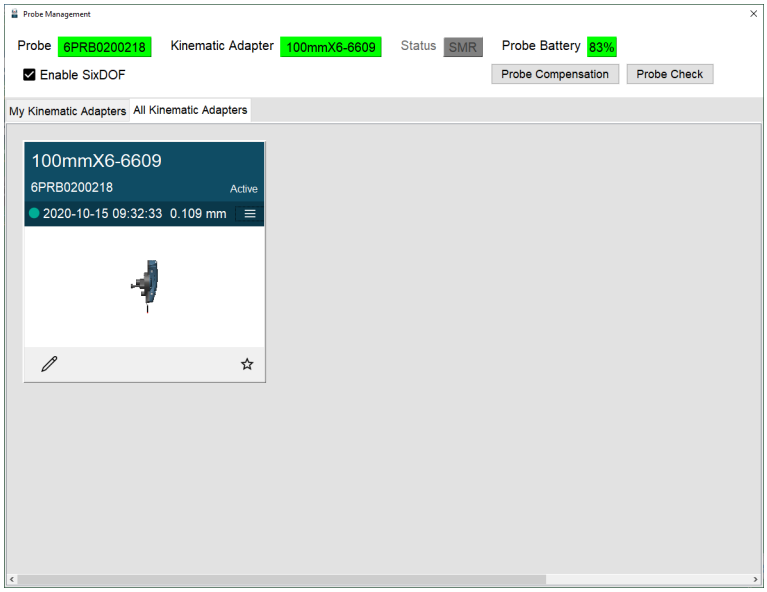
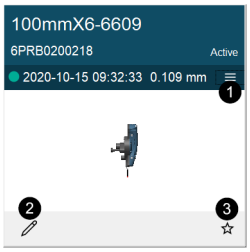


Figure 2-17 6Probe Probe Management

NOTE: Click the **Edit Probe** button to add the probe tip diameter information to the current probe.



1. Compensation Menu Button
2. Edit the Probe
3. Add to the **My Kinematic Adapters** tab

Figure 2-18 6Probe Probe

1. Select a probe and click **Edit Probe**.

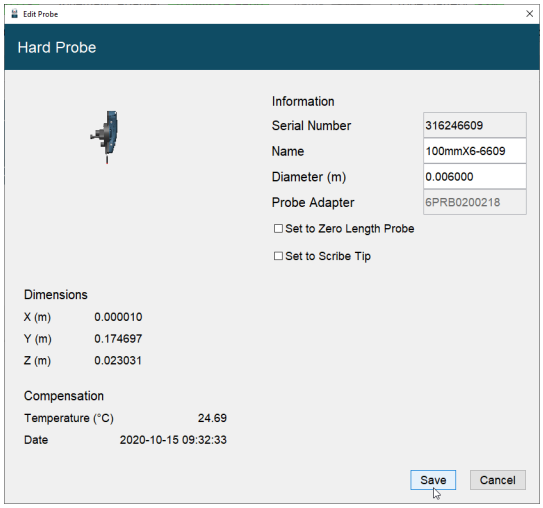


Figure 2-19 6Probe Edit a Probe

- Notice the 6Probe serial number (last four digits) is added to the probe name.
- Enter the name and probe tip diameter and click **Save**.

2. Select a probe to make it active.

Figure 2-20 Select a Probe

- Click the **Menu** button to see the last five compensations.

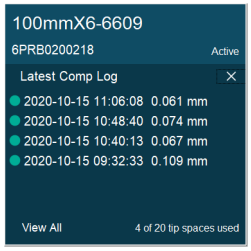


Figure 2-21 View Recent Compensations

- Click **View All** button to see the complete compensation history.

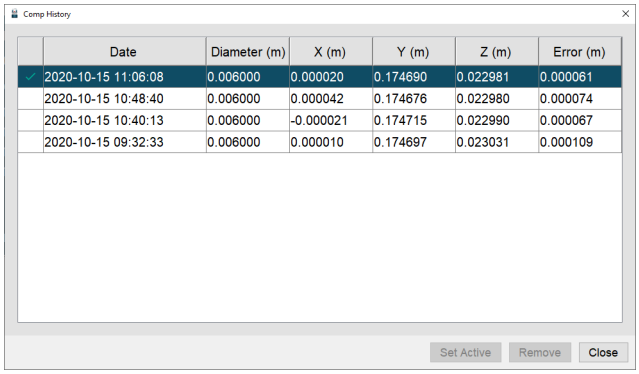


Figure 2-22 Compensation History

- Choose a compensation and click **Set Active** to use it.
- Click a compensation and click **Remove** to permanently delete the compensation.

3. Click **Probe Compensation** to compensate the probe. You must compensate each combination to measure accurately. Always compensate a Kinematic Adapter and Probe Tip combination after removing and reinstalling a probe tip or probe extension.
   - Click **Probe Check** to measure the probe and quickly check the active compensation. *See "Probe Check" on page 30.*

NOTE: It is not necessary to compensate a Kinematic Adapter and Probe Tip combination if removed and then later installed onto the 6Probe.

Probe Compensation

Probe compensation is a localized process by which a measurement device is optimized to perform measurements accurately. Since the probe tips are manually interchangeable, you must compensate, or measure, with the probe installed to determine the center of the ball location.

NOTE: Once a probe is compensated to a 6Probe, it is not necessary to compensate it again if paired with another Vantage.

Figure 2-23 6Probe Probe Compensation

NOTE: Once paired with the Vantage, the Center Status LED is **blue** and the Left Status LED blinks **green** indicating a successful pairing but an unsuccessful probe compensation.

1. Select a probe and click **Probe Compensation**.

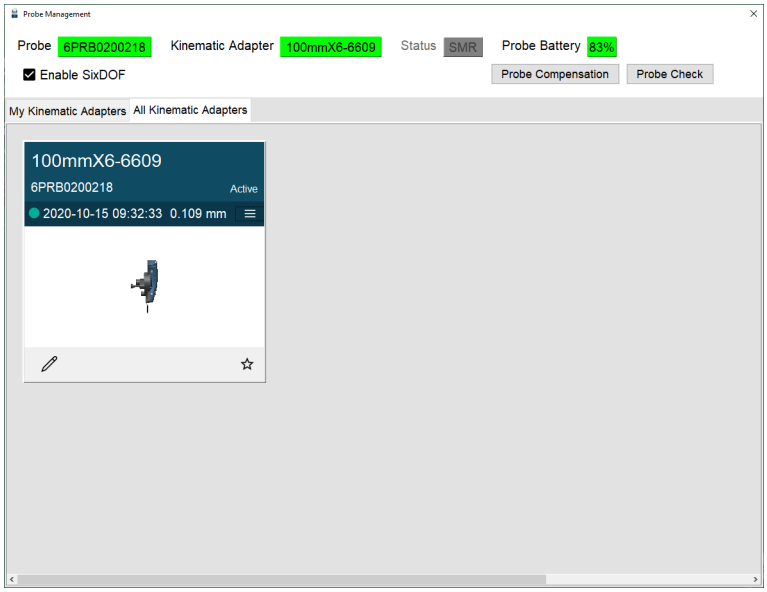


Figure 2-24 Select a Probe

2. Attach the probe compensation nest to a stable work surface between 3 m (10 ft) and 5 m (25 ft) from the Vantage.
   - Click **Continue**.
3. Acquire any SMR and track it to the center of the compensation nest. Once stable, the SMR is automatically measured.

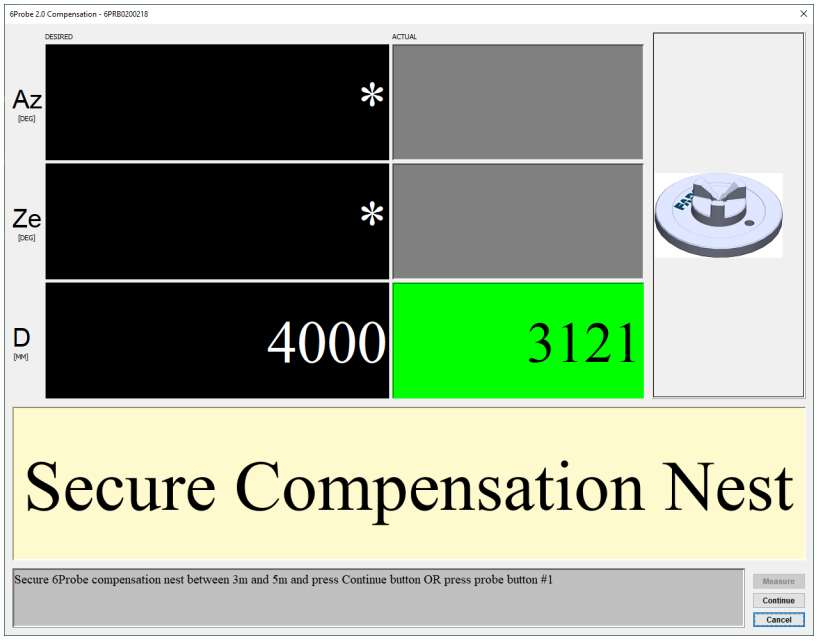


Figure 2-25 Secure the Compensation Nest

CAUTION: Ensure the compensation nest is secured to the measuring surface using the hole in the base or hot glue. If the nest moves at any time on the compensation process, the probe compensation may fail.

4. Track the SMR to position 1 on the base of the compensation nest. Once stable, the SMR is automatically measured.

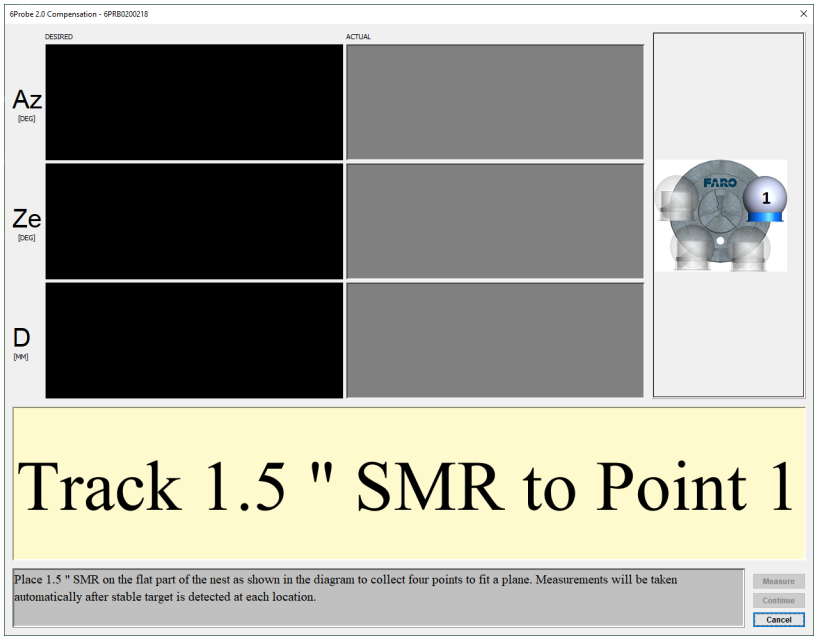


Figure 2-26 Measuring the Compensation Nest base

- Continue for positions 2 through 4 around the base of the compensation nest.

5. Acquire the 6Probe and track it to the center of the compensation nest and place the probe tip into the nest. You will measure a minimum of five points in different orientations.

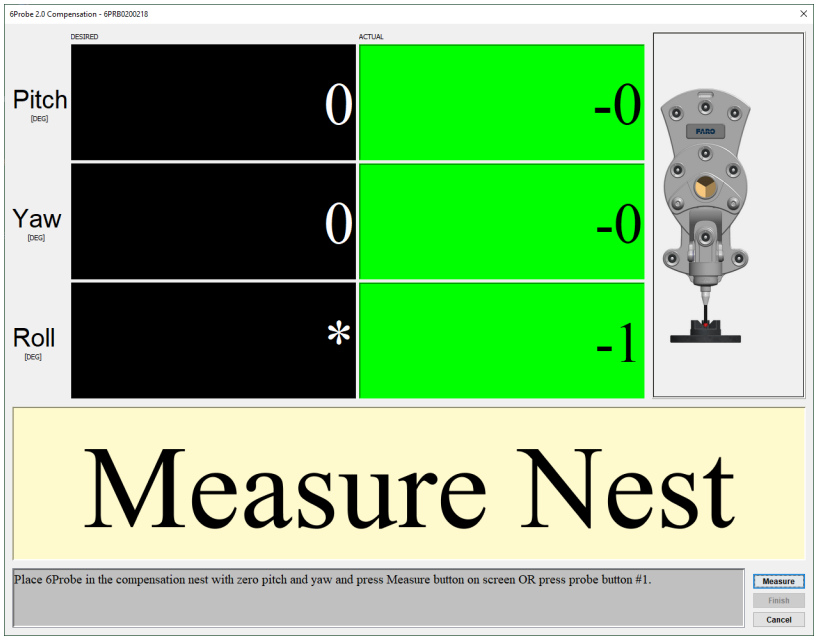


Figure 2-27 6Probe in Position 1

- Move and twist the 6Probe until it is straight up and directly facing the Vantage. The Pitch, Yaw and Roll values should be as close to zero (0) as possible.
- Press button **1** to measure position 1.

6. Continue measuring points in different orientations keeping the probe tip seated in the compensation nest. Press button **1** to measure each position.
   - Move the 6Probe 45° to each side (Roll Angle) for positions 2 and 3.
   - Move the 6Probe back to vertical center and then 15° forwards and backwards (Pitch angle) for positions 4 and 5.
   - If necessary, measure additional points in other orientations.
   - Press button **2** to continue.

CAUTION: The probe tip must be well-seated in the compensation nest when measuring all compensation points. Even one or two poorly measured points significantly affects the optimization process, which then has an effect on the accuracy of the 6Probe.

7. Compensation results:

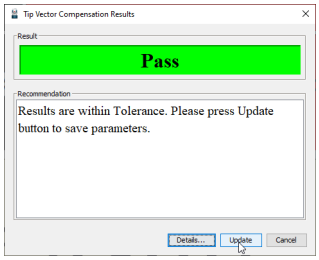


Figure 2-28 Probe Compensation Results

- **Pass** - Click **Update** to store the probe compensation and exit. The 6Probe is now ready for use.
- **Fail** - If the compensation fails, click **Cancel** and repeat the compensation.

CAUTION: *Do Not* remove the probe or power off the 6Probe until the command ends and the compensation information is written to the 6Probe.

Probe Compensation Details

Click **Details** to see the probe compensation details:

- XYZ values showing the previous and the current probe location.

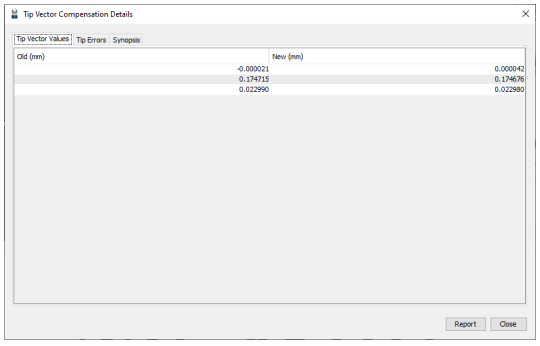


Figure 2-29 Probe XYZ Location

- Individual compensation point results.

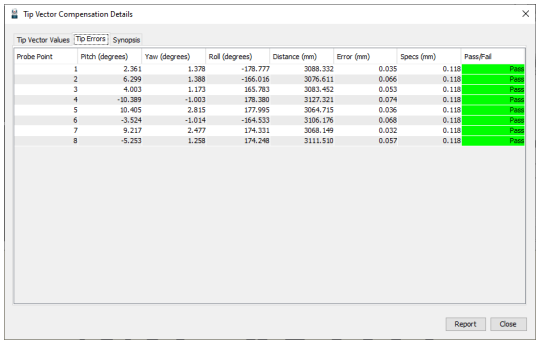


Figure 2-30 Probe Compensation Points

- Compensation Information.

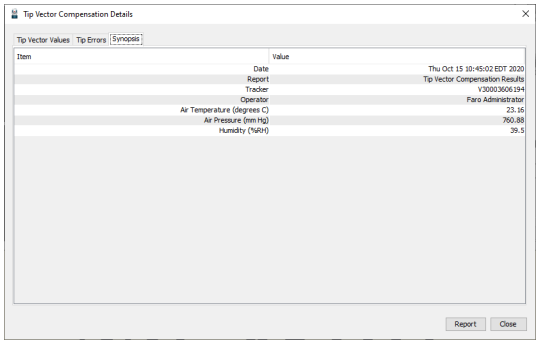


Figure 2-31 Probe Compensation Information

Probe Check

Probe Check is a method to measure the probe and compare it to the last stored compensation. This is useful when you remove and replace a probe or if you are not sure of the compensation of a probe.

Figure 2-32 6Probe Probe Check

1. Select a probe and click **Probe Check**.

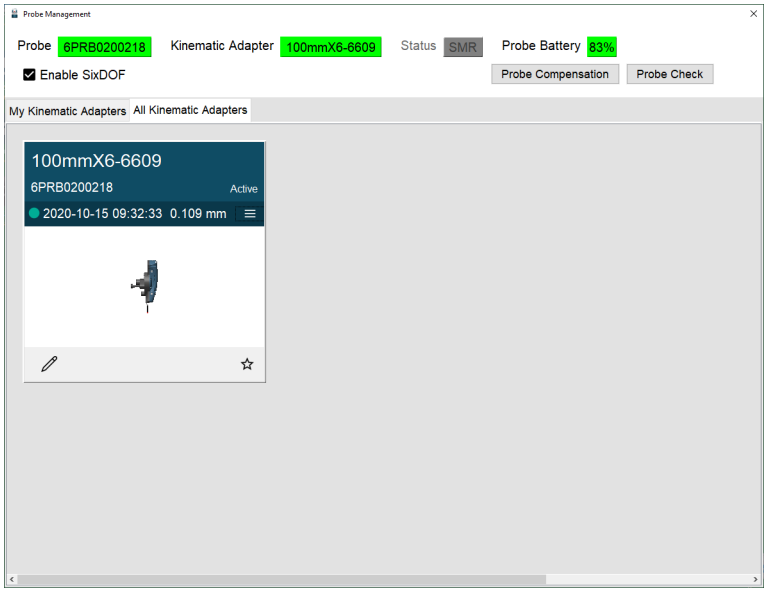


Figure 2-33 Select a Probe

2. Place the probe tip in the compensation nest or any hole smaller than the probe tip diameter.
3. Move and twist the 6Probe and watch the **green** indicators in the dialog box.

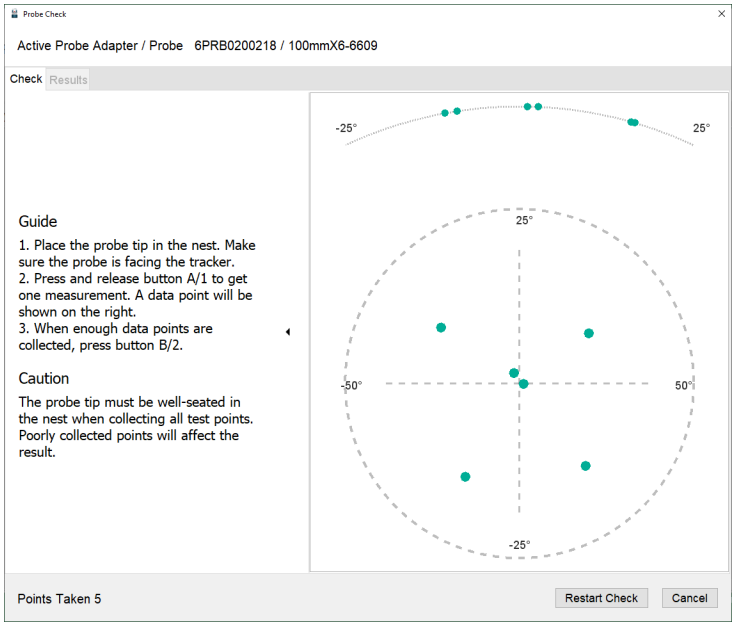


Figure 2-34 Probe Check Measurements

- Press button **1** to measure a point.

4. Measure at least four different points in different orientations.
   - Press button **2** to continue.
5. Probe Check results are Pass or Fail. If the probe fails, compensate it again. *For more information, see "Probe Compensation" on page 25.*
6. Click the **Results** tab to see the details.

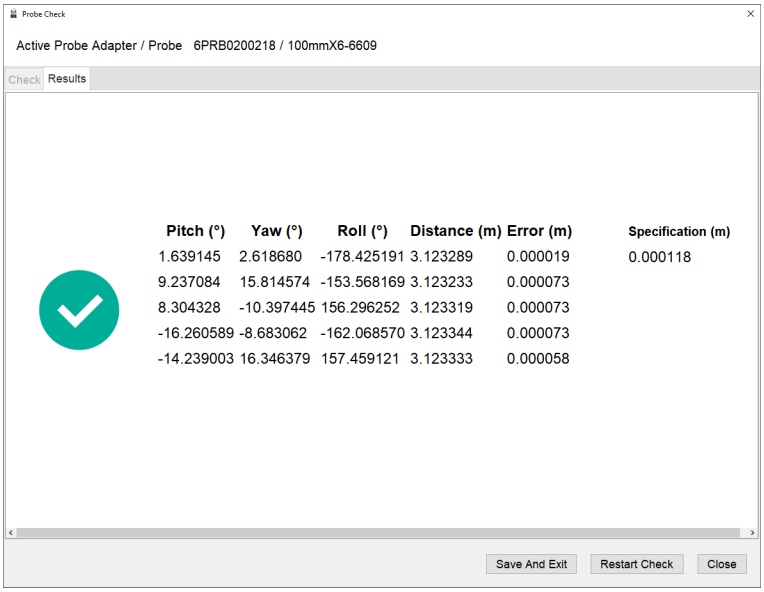


Figure 2-35 Probe Check Results

Installing the Wrist Strap

1. Remove the two straps from the 6Probe shipping case. Start with the longer strap with the cord loop on one end.
2. Feed the cord into the slot on top of the 6Probe. Ensure the loops on the strap are facing up.

Figure 2-36 Feed the Cord into the Slot

3. Pass the other end of this strap through the cord loop and pull tight.

Figure 2-37 Secure the strap

4. Attach the other strap. Feed the end without the plastic ring through the slot on the bottom of the 6Probe.

Figure 2-38 Feed the Strap into the Slot

5. Place the hooks on the loops of the strap to secure it to the 6Probe.

Figure 2-39 Secure the Strap

6. Feed the free end of the first strap through the plastic ring of the second strap. Press the hooks side of the first strap onto the loops side. Adjust the first strap until it fits your hand as you hold the 6Probe.

Figure 2-40 Connect the Straps

Break Resistant Spherically Mounted Retroreflector (SMR)

Available in ⅞” (22.225 mm), ½” (12.7 mm) and 1½” (38.1 mm) diameters, the Break Resistant SMR is an impact resistant target built with centering accuracy up to 0.0003” (7.6 µm) for the ⅞” (22.225mm) and ½” (12.7 mm) targets and 0.0001” (2.5 µm) for the 1½” (38.1 mm) target.

Figure 2-41 Break Resistant SMR

Repeatability Targets

Use the Repeatability Target for repeatability and drift testing. Attach the target to a surface using hot glue or a similar adhesive, or use FARO part C-ACC-04140-000 - Repeatability Target Mount. Use this target only for repeatability measurements, *DO NOT* use it for accuracy measurements.

Figure 2-42 Repeatability Targets

1.5" Window SMR

Part # 950-02237

The 1.5” Window SMR is a specially designed precision SMR with a glass window that protects the targets sensitive reflective surfaces.

Requirements

The target functions with the following system configurations:

- FARO CAM2 2020 and SmartInspect with MCU firmware 3.2 or higher
- CAM2 Measure, CAM2 Q, or CAM2 Measure X
- Any third party software updated since February 2005 that supports the FARO Tracker Pad.

Using The 1.5” Window SMR

Before using the 1.5” Window SMR, the target type must be set. Open the dialog box that controls the current SMR.

- In FARO CAM2 2020, CAM2 Measure or CAM2 Q, select **Hardware Configuration** from the **Device** tab on the ribbon. Click the **Probe Management** button.
- In CAM2 Measure X, select **Devices** < **Probes** from the **Device** menu.

Select 1.5” Window SMR from the target type dialog box.

It is critical that the target type be set correctly for measurement, as measurements taken with the 1.5” Window SMR with the incorrect target type setting will not be valid.

CAUTION: If you use the 1.5” Window SMR in the CompIT Angular Accuracy Checks, Pointing Interim Test, or a Pointing Compensation, the current target will reset to the standard 1.5” SMR after the routine completes. In your measuring software, run the **Home** command to change the current target back to the 1.5” Window SMR before measuring your part.

Do Not run the ADM Checks with the 1.5” Window SMR, the results will be invalid.

Target Care

To operate properly the SMR must be clean. *For more information, see “Optical Target Care” on page 6.*

0.5" SMR Kit

0.5" SMR Kit
Part # 950-00770

0.5" Break Resistant SMR Kit
Part # 950-02360

The FARO 0.5" SMR Kit contains accessories that enhance the capabilities of the SMR.

Components

The FARO 0.5" SMR Kit includes one 0.5" SMR, one 0.5” Target nest with 0.500” offset, 0.250” shank, one 0.5" SMR adapter, one 0.5” SMR Handle and carrying case with room for extra SMRs.

Using The 0.5" SMR

Before using the 0.5" SMR, the target type must be set. Open the dialog box that controls the current SMR.

- In FARO CAM2 2020, CAM2 Measure or CAM2 Q, select **Hardware Configuration** from the **Device** tab on the ribbon. Click the **Probe Management** button.
- In CAM2 Measure X, select **Devices** < **Probes** from the **Device** menu.

Select 0.5" SMR from the target type dialog box.

It is critical that the target type be set correctly for measurement, as measurements taken with the 0.5" SMR with the incorrect target type setting will not be valid.

Target Care

To operate properly the SMR must be clean. *For more information, see “Optical Target Care” on page 6.*

RetroProbe 100/400

RetroProbe 100
Part # 950-00-016

RetroProbe 400
Part # 950-00-054

The FARO RetroProbe is an accessory product which enhances the capabilities of the Laser Tracker. The FARO RetroProbe facilitates the measurement of features that are difficult or impossible to measure with a standard Spherically Mounted Retroreflector (SMR).

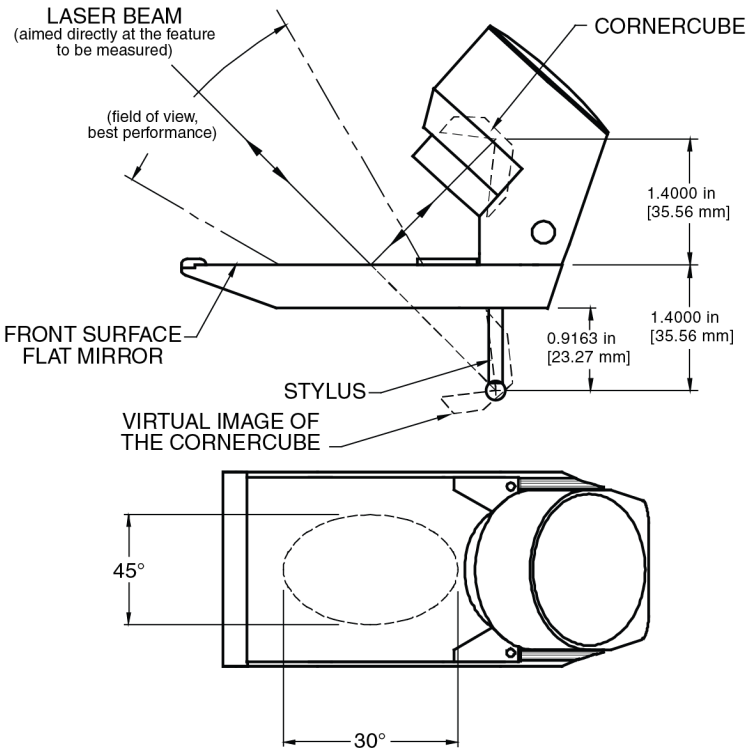
Principles Of Operation

Operation of the FARO RetroProbe is based on the concept of a virtual image; that is, any object viewed in a mirror appears to be located at a point in space behind the surface of that mirror. The distance of the virtual image seen behind the mirror is equal to the distance of the real object from the front of the mirror.

The FARO RetroProbe is designed so that the geometric center of the stylus tip is located precisely at the virtual image point of the cornercube. When the RetroProbe is in use, a beam from the Laser Tracker strikes a flat mirror on the front of the FARO RetroProbe. It is then reflected into the cornercube in the head of the unit and returned along the same path back to the Laser Tracker. When using the FARO RetroProbe with a ball tip stylus, the virtual image point is located at the center of the ball and the measurement is offset from the surface by the radius of the ball. When a point tip is used, there is no measurement offset.

Equipment List

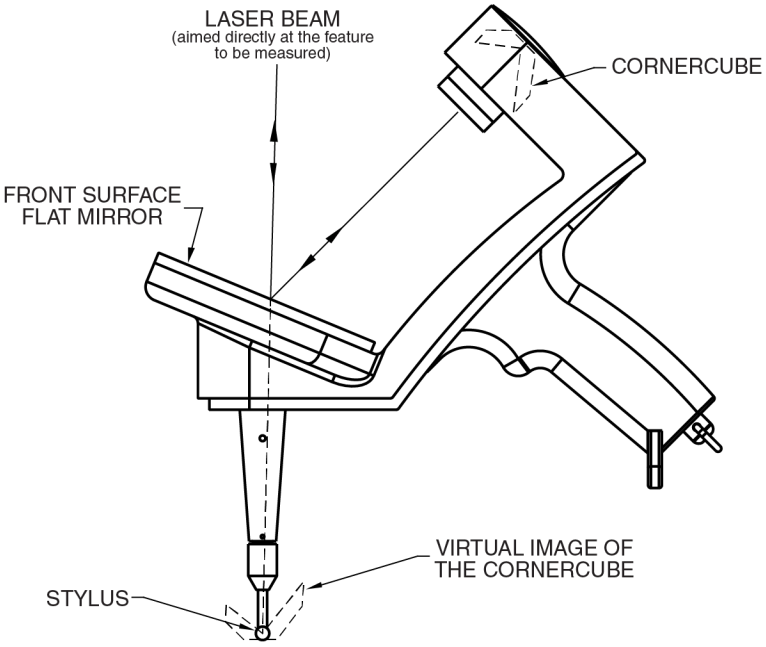
FARO RetroProbe100



- Point Tip Stylus
- 3mm Diameter Stylus
- Point Tip Reset Sphere
- 3mm Reset Sphere
- Checkpoint Fixture
- Protective Jacket for RetroProbe100
- Protective Carrying Case

NOTE: Other diameter sized styli are available and interchangeable.

FARO RetroProbe400



- Point Tip Stylus
- 3mm Diameter Stylus
- Point Tip Reset Sphere
- 3mm Reset Sphere
- Checkpoint Fixture
- Protective Carrying Case

NOTE: Other diameter sized styli are available and interchangeable.

Using The FARO RetroProbe

Establishing A Reset Point

A reset point is required when using the Laser Tracker in IFM only mode. If you plan to use the Laser Tracker in ADM only or IFM set by ADM mode, a reset point is not necessary.

NOTE: Some Laser Tracker models do not have IFM mode.

To measure a reset point:

1. Set up, power-up, and start the Laser Tracker.
2. Perform the Quick Backsight Check and either Self Comp or Pointing Compensation as necessary.
3. Secure a heavy-duty nest to the floor or other highly stable object. Place this nest so the laser beam will be within the field of view of the FARO RetroProbe.
4. Create the reset point:

FARO CAM2 2020 CAM2 Measure and CAM2 Q

- Select **Measure** < **Point**. Using the 1.5" SMR, track the laser beam out to the heavy-duty nest.

- Press the **G** key on the keyboard to measure and then the **H** key to complete the measurement.
- Select **Device** < **Laser Tracker** < **Manage Reset Points**.
- Choose the previously measured point and click **OK**.

CAM2 Measure X

- Select **Devices** < **Laser Tracker** < **Create Reset Point**. You will be prompted to measure the point. Using the 1.5" SMR, track the laser beam out to the heavy-duty nest.
- Press the **Insert** key on the keyboard to measure and then the **Home** key to complete the measurement.
- To set the measured point as a reset point, select **Devices** < **Laser Tracker** < **Manage Reset Points** and highlight the point in the dialog box.

5. Thread the desired stylus into the RetroProbe.
6. Set the correct probe size:

FARO CAM2 2020 CAM2 Measure and CAM2 Q

- Select **Device** < **Device Control Panel,** click the **Probe Management** button and select the correct RetroProbe stylus size in the **Probes** dialog box.

CAM2 Measure X

- Select **Devices** < **Probes** and select the correct RetroProbe stylus size in the **Probes** dialog box.

7. Place the appropriate size reset sphere into the heavy-duty nest named and place the RetroProbe into the reset sphere.
8. Reset the Laser Tracker by selecting **Devices** < **Laser Tracker** < **Reset**. Verify that the **green** light on the CAM2 2020 is solid.
9. Validate the location:

FARO CAM2 2020 CAM2 Measure and CAM2 Q

- On the **Features** panel, choose the point and select **View** < **show Feature Window.** Move the probe to the heavy-duty nest and verify that the 3D distance is less than 0.025mm (0.001").

CAM2 Measure X

- Select **File** < **Review Features.** In the **Review Features** dialog box, choose the point and click the **DRO** button. Move the probe to the heavy-duty nest and verify that the 3D distance is less than 0.025 mm (0.001 in).

If the distance is greater than 0.025 mm (0.001 in), repeat steps 4-9 after ensuring that the Laser Tracker is stable on the tripod and the heavy-duty nest is securely fixed.

Taking Measurements

The RetroProbes measure in the same manner as an SMR. The stylus tip should touch the surface of the feature during measurements. Care should be taken to keep the RetroProbe oriented in such a way that the laser beam is always within the RetroProbe's field of view. With practice and experience in positioning the Laser Tracker, the correct orientation of the RetroProbe becomes easier to retain.

Care And Cleaning

FARO RetroProbes require regular cleaning with normal use. Cleaning is recommended if the Target Return Intensity, as reported in the Operational Checks, is something other than "**GOOD**".

For more information, see "Optical Target Care" on page 6.

Storage

Always store FARO RetroProbes in their cases to protect them from impact and environmental hazards such as dust and dirt. A jacket is provided to protect the flat mirror for storage. In addition, FARO RetroProbes should be stored in an environment where they will not be subject to extreme temperature or other environmental conditions. Normal room temperature is the most desirable temperature for all Laser Tracker equipment storage. Storing FARO RetroProbes in areas where heavy vibrations occur may result in serious damage. If you suspect the RetroProbe has been damaged, follow the instructions in the RetroProbe Runout And Depth Error Check section of this manual.

RetroProbe Runout And Depth Error Check

Overview

This procedure outlines the steps required to check the FARO RetroProbe100/400 for runout and depth error using the Laser Tracker. An experienced operator can perform this check in less than 15 minutes.

The FARO RetroProbe100/400 was designed to be a Laser Tracker accessory not requiring adjustment in use. However, in case the probe has been dropped, excessively shocked, or used over a long period of time, there may be a need to check its proper operation and performance.

The runout and depth error values obtained from these procedures are related to the certification parameters attained during the FARO qualification process on our optical alignment bench, but may not be the same values because of the differences between the laboratory condition of the alignment bench as compared to the field use of the Laser Tracker when performing these checks. However, if the above procedures are performed periodically under the same conditions and geometric configuration, the repeatability of the RetroProbe100/400 can be determined and the impact of damage or wear established.

Equipment List

- Laser Tracker and Support Equipment
- Heavy-Duty Nest
- SMR
- FARO RetroProbe100/400 (with 3 mm stylus)
- RetroProbe Check Fixture
- Reset Sphere
- FARO CAM2 2020, CAM2 SmartInspect, CAM2 Measure, CAM2 Q, or CAM2 Measure X

Procedures

Use the following procedures with either CAM2 Measure, CAM2 Q, or CAM2 Measure X software. You should make a copy of the Runout and Depth Error Check Log at the end of this chapter.

Setup And Operator Checks

1. Setup, power-up and start the CAM2 2020.
2. Complete Operational Check.
3. Perform Quick Backsights, and Self Comp or Pointing CompIT, if necessary.

Preparation

Prepare the equipment:

1. Secure the heavy-duty nest to a wall, floor, or any surface that has complete stability at a height that will allow the RetroProbe100/400 to be conveniently oriented relative to the Laser Tracker.

NOTE: Convenient positioning of both the heavy-duty nest and the check fixture is important so that these measurements can be made easily. The nest and check fixture should be positioned such that the laser beam can point directly to the center of them. If you affix the nest and check fixture to a wall, do so at approximately the same height of the laser beam. If you affix the nest and check fixture to the floor, the measurements will easier the higher the Laser Tracker is mounted off the floor.

2. Locate the RetroProbe Check Fixture on a stable surface in a suitable orientation relative to the CAM2 2020.
3. Record the date and the RetroProbe100/400 serial number on the Runout and Depth Error Check Log . *See "Runout and Depth Error Check Log " on page 47.*
4. Create a new file and save it as "RP runout".
5. Record the ambient temperature on the Runout and Depth Error Check Log . To find the ambient temperature start the Operational Checks:

   FARO CAM2 2020, **CAM2 Measure**
   - On the **Device** tab of the ribbon, select **Hardware Configuration** to access the **Device Control** panel. Click the **Environmental Check** button.

   CAM2 Q
   - Select **Device** < **Device Control Panel** to access the **Device Control** panel**,** Click the **Environmental Check** button.

   CAM2 Measure X
   - Select **Devices** < **Laser Tracker** < **Operational Checks** and note the temperature on the **General** tab.

Runout Check (FARO CAM2 2020 and CAM2 Measure)

To measure runout in CAM2 Measure:

1. Track the RetroProbe100/400 to the RetroProbe Check Fixture.

NOTE: For the following steps, ensure that the laser beam is always kept at the approximate center of the flat mirror.

2. On the **Measure** tab, select **Point** and measure the first reading at the check fixture location. Press the **G** key to take the reading.
3. Rotate the RetroProbe100/400 approximately 45° about the laser beam axis and again take a reading.
4. Press the **G** key to take an additional reading. Repeat until a total of nine readings have been measured.
5. Press the **H** key on the keyboard to complete the measurement. Rename the point `RP_RUNOUT`.
6. Track the RetroProbe100/400 to the Reset Sphere and check closure. Closure should be under 0.005 mm (0.0002 in). If it is larger, reset the system and repeat the above steps.
7. Reset the laser and continue with the depth error check below.

Runout Check (CAM2 Q)

To measure runout in CAM2 Q:

1. Track the RetroProbe100/400 to the RetroProbe Check Fixture.

NOTE: For the following steps, ensure that the laser beam is always kept at the approximate center of the flat mirror.

2. Select **Measure** < **Point** and measure the first reading at the check fixture location. Press the **G** key to take the reading.
3. Rotate the RetroProbe100/400 approximately 45° about the laser beam axis and again take a reading.
4. Press the **G** key to take an additional reading. Repeat until a total of nine readings have been measured.
5. Press the **H** key on the keyboard to complete the measurement. Rename the point `RP RUNOUT`.
6. Track the RetroProbe100/400 to the Reset Sphere and check closure. Closure should be under 0.005 mm (0.0002 in). If it is larger, reset the system and repeat the above steps.
7. Reset the laser and continue with the depth error check below.

Runout Check (CAM2 Measure X)

To measure runout in CAM2 Measure X:

1. Track the RetroProbe100/400 to the RetroProbe Check Fixture.

NOTE: For the following steps, ensure that the laser beam is always kept at the approximate center of the flat mirror.

2. Select **Measure** < **Point** < **Comp Off** and measure the first reading at the check fixture location. Press the **Insert** key to take the reading. The prompt bar will indicate “Measure Point# 1 on Point” prior to taking the reading.
3. Rotate the RetroProbe100/400 approximately 45° about the laser beam axis and again take a reading.
4. Press the **Insert** key to take an additional reading. Repeat until a total of nine readings have been measured. When nine readings have been recorded, the prompt bar will indicate, “Measure Point# 10 on Point”.
5. Press the **Home** key on the keyboard to complete the measurement. Name the point `RP_RUNOUT`.
6. Track the RetroProbe100/400 to the Reset Sphere and check closure. Closure should be under 0.005 mm (0.0002 in). If it is larger, reset the system and repeat the above steps.
7. Reset the laser and continue with the depth error check below.

Evaluate Runout Check Results (FARO CAM2 2020 and CAM2 Measure)

To evaluate runout in CAM2 Measure:

1. On the **Features** list in the **Navigation** window, select the RP_RUNOUT point.
2. On the **Readings** panel, look at the X, Y, and Z readings for the point RP_RUNOUT.
3. Record the maximum and minimum values for X, Y, and Z on the Runout and Depth Error Check Log .
4. Determine the difference between the maximum and minimum numbers for all three coordinates.
5. If any of the resulting values exceed 0.076 mm (0.003 in), the RetroProbe100/400 may be damaged or in need of realignment. Contact your Customer Service Representative by Phone, Fax or E-Mail. *See “Technical Support” on page 109.*
6. If none of the resulting values exceed 0.076 mm (0.003 in), then proceed with the depth error evaluation below.

Evaluate Runout Check Results (CAM2 Q)

To evaluate runout in CAM2 Q:

1. On the **Features** panel, select the RP_RUNOUT point.
2. On the **Readings** panel, look at the X, Y, and Z readings for the point RP_RUNOUT.

3. Record the maximum and minimum values for X, Y, and Z on the Runout and Depth Error Check Log .
4. Determine the difference between the maximum and minimum numbers for all three coordinates.
5. If any of the resulting values exceed 0.076 mm (0.003 in), the RetroProbe100/400 may be damaged or in need of realignment. Contact your Customer Service Representative by Technical Support, Technical Support or Technical Support. *See "Technical Support" on page 109.*
6. If none of the resulting values exceed 0.076 mm (0.003 in), then proceed with the depth error evaluation below.

Evaluate Runout Check Results (CAM2 Measure X)

To evaluate runout in CAM2 Measure X:

1. Select **File** < **Review Features**. In the **Review Features** dialog box, look at the X, Y, and Z readings on the **Readings** tab for the point RP_RUNOUT.
2. Record the maximum and minimum values for X, Y, and Z on the Runout and Depth Error Check Log .
3. Determine the difference between the maximum and minimum numbers for all three coordinates.
4. If any of the resulting values exceed 0.076 mm (0.003 in), the RetroProbe100/400 may be damaged or in need of realignment. Contact your Customer Service Representative by Phone, Fax or E-Mail. *See "Technical Support" on page 109.*
5. If none of the resulting values exceed 0.076 mm (0.003 in), then proceed with the depth error evaluation below.

Depth Error Check (FARO CAM2 2020 and CAM2 Measure)

To measure depth error in CAM2 Measure:

1. Track the RetroProbe100/400 back to the RetroProbe Check Fixture.
2. Tilt the RetroProbe100/400 left and right until the laser beam hits the extreme limits of the minor axis of the flat mirror's elliptical field of view. On the **Measure** tab, select **Point** and measure a single reading at each position. Press the **G** key to take each reading.
3. Continue taking readings at the extremes of the RetroProbe's field of view, for a total of between four and six readings.
4. When finished, press the **H** key on the keyboard to complete the measurement. Rename the point RP_DEPTH.
5. Track the RetroProbe100/400 to the Reset Sphere and check closure. Closure should be under 0.005 mm (0.0002 in). If it is larger, reset the system and repeat the above steps.
6. Remove the RetroProbe100/400 and Reset Sphere and proceed with the check results evaluation below.

Depth Error Check (CAM2 Q)

To measure depth error in CAM2 Q:

1. Track the RetroProbe100/400 back to the RetroProbe Check Fixture.
2. Tilt the RetroProbe100/400 left and right until the laser beam hits the extreme limits of the minor axis of the flat mirror's elliptical field of view. Select **Measure** < **Point** and measure a single reading at each position. Press the **G** key to take each reading.
3. Continue taking readings at the extremes of the RetroProbe's field of view, for a total of between four and six readings.
4. When finished, press the **H** key on the keyboard to complete the measurement. Rename the point RP_DEPTH.
5. Track the RetroProbe100/400 to the Reset Sphere and check closure. Closure should be under 0.005 mm (0.0002 in). If it is larger, reset the system and repeat the above steps.
6. Remove the RetroProbe100/400 and Reset Sphere and proceed with the check results evaluation below.

Depth Error Check (CAM2 Measure X)

To measure depth error in CAM2 Measure X:

1. Track the RetroProbe100/400 back to the RetroProbe Check Fixture.
2. Tilt the RetroProbe100/400 left and right until the laser beam hits the extreme limits of the minor axis of the flat mirror's elliptical field of view. Select **Measure** < **Point** < **Comp Off** and measure a single reading at each position. Press the **Insert** key to take each reading. The prompt bar will indicate “Measure Point# 1 on Point” prior to taking the first reading.
3. Continue taking readings at the extremes of the RetroProbe's field of view, for a total of between four and six readings.
4. When finished, press the **Home** key on the keyboard to complete the measurement. Name the point `RP_DEPTH`.
5. Track the RetroProbe100/400 to the Reset Sphere and check closure. Closure should be under 0.005 mm (0.0002 in). If it is larger, reset the system and repeat the above steps.
6. Remove the RetroProbe100/400 and Reset Sphere and proceed with the check results evaluation below.

Evaluate Depth Error Check Results (FARO CAM2 2020 and CAM2 Measure)

To evaluate depth error in CAM2 Measure:

1. On the **Features** list in the **Navigation** window, select the RP_DEPTH point.
2. On the **Readings** panel, look at the X, Y, and Z readings for the point RP_DEPTH.
3. Record the maximum and minimum values for X, Y, and Z on the Runout and Depth Error Check Log .
4. Determine the difference between the maximum and minimum numbers for all three coordinates.
5. If any of the resulting values exceed 0.076 mm (0.003 in), the RetroProbe100/400 may be damaged or in need of realignment. Contact your Customer Service Representative Phone, Fax or E-Mail. *See “Technical Support” on page 109.*

Evaluate Depth Error Check Results (CAM2 Q)

To evaluate depth error in CAM2 Q:

1. On the **Features** panel, select the RP_DEPTH point.
2. On the **Readings** panel, look at the X, Y, and Z readings for the point RP_DEPTH.
3. Record the maximum and minimum values for X, Y, and Z on the Runout and Depth Error Check Log .
4. Determine the difference between the maximum and minimum numbers for all three coordinates.
5. If any of the resulting values exceed 0.076 mm (0.003 in), the RetroProbe100/400 may be damaged or in need of realignment. Contact your Customer Service Representative by Phone, Fax or E-Mail. *See “Technical Support” on page 109.*

Evaluate Depth Error Check Results (CAM2 Measure X)

To evaluate depth error in CAM2 Measure X:

1. Select **File** < **Review Features**. In the **Review Features** dialog box, look at the X, Y, and Z readings on the readings tab for the point RP_DEPTH.
2. Record the maximum and minimum values for X, Y, and Z on the Runout and Depth Error Check Log .
3. Determine the difference between the maximum and minimum numbers for all three coordinates.

4. If any of the resulting values exceed 0.076 mm (0.003 in), the RetroProbe100/400 may be damaged or in need of realignment. Contact your Customer Service Representative by Phone, Fax or E-Mail. *See "Technical Support" on page 109.*

Runout and Depth Error Check Log

Serial Number:	
Date:	
Tamb.	

Value	X	Y	Z
Max.			
Min.			
Diff.			

Value	X	Y	Z
Max.			
Min.			
Diff.			

Chapter 3: Target Tooling

This chapter covers the available tooling to attach to optical targets.

Target Tooling Kit - Metric

Target Tooling Kit - Metric, Hardcase
Part # C-ACC-05456-001

Target Tooling Kit - Metric, Softcase
Part # C-ACC-05456-002

The FARO Target Tooling Kit - Metric contains accessories that enhance the capabilities of the SMR.

Figure 3-1 Target Tooling Kit - Metric

Components

The FARO Metric Target Tooling Kit includes:

- (10) 1.5” Target Drift Nest
- (1) Offset Plate 3” x 2” x 0.25”, 6 mm Diameter
- (1) 125 mm Bar Extension
- (1) 250 mm Bar Extension
- (1) 1.5” Pin Nest, BXT, Off 25 mm, Shank 6 mm
- (1) Tooling Ball Adapter, Off 25 mm
- (1) 12 mm Tooling Ball, Off 12 mm, Shank 6 mm
- (1) 1.5” Target Nest, Off 25 mm, Shankless, NEG
- (1) 1.5” Large Edge Adapter, Off 25 mm
- (1) 1.5” Target Nest, Off 25 mm, Shank 4 mm, NEG
- (1) 1.5” Target Nest, Off 25 mm, Shank 8 mm, NEG
- (2) 1.5” Negative Drift Nest
- (1) 1.5” Center Punch Adapter, Off 29 mm
- (1) Replacement Transfer Punch
- (1) 1.5” SMR Pole Adapter
- (1) 0.5” SMR Magnetic Clamp
- (1) Hard Point, Off 25 mm, Hole 6 mm

Usage

The items in the Target Tooling Kit are used as follows:

1.5” Drift Nests - Hot glue the nests to the part for use as reference points during an inspection. The position of the nests are monitored by the CAM2 2020 to determine if any movement has occurred during an inspection, and may also be used as common points for device position moves.

1.5” Pin Nests - These target nests with 4 and 6 mm shanks enable the measurement of inner diameters, outer diameters, and edges.

1.5” Shankless Nest - This target nest holds the center of the SMR at 25 mm above a flat surface. It may also be used to measure inner and outer diameters with its precision 1.6 in diameter.

Small Edge Sphere Tool - This edge finding tools enables the measurement of a straight edge by holding the center of the SMR directly above the edge.

250 mm Extension Bar - This bar is used to measure hidden points when assembled with the hard point or sphere fit adapter and a pin nest. The adapter is placed against a surface or over a tooling ball, and the SMR is measured as the bar sweeps a sphere with the center at the point or tooling ball center.

Linear Bushings - These bushings allow the standard target nest with 6 mm shank to be used as a 8, 10, 12, and 16 mm shank for measurement that requires these sizes.

0.5” Construction Ball - This tooling ball with a 0.25 in shank is used to measure the position about a 0.25 in hole. It may also be used with the 250 mm extension bar to find its center when it is not visible to the Laser Tracker.

Target Tooling Kit - Imperial

Target Tooling Kit - Inches, Hard case
Part # C-ACC-05455-001

Target Tooling Kit - Inches, Soft-case
Part # C-ACC-05455-002

The FARO Target Tooling Kit - Inches contains accessories that enhance the capabilities of the SMR.

Figure 3-2 Target Tooling Kit - Inches

Components

The FARO SAE Target Tooling Kit includes:

- (10) 1.5” SMR Drift Nests
- (1) Offset plate 3” x 2” x 0.25” with 0.25” Diameter Hole
- (1) 5” Bar Extension
- (1) 10” Bar Extension
- (1) Pin Nest for Bar Extension with 0.25” shank
- (1) Tooling Ball Adapter
- (2) 1.5” Pin Nests NEG ⅛” & ¼” Pin
- (1) 1.5” Shankless Nest with Negative Cut
- (1) 1.5” Large End Adapter
- (1) 0.5” Construction Ball with 0.25” shank
- (2) 1.5” Negative Drift Nest
- (1) Center Punch Adapter with Transfer Punch
- (1) Pole Adapter
- (1) Magnetic handle for 0.5” SMR
- (1) Hard Point

Usage

The items in the Target Tooling Kit are used as follows:

1.5” Drift Nests - Hot glue the nests to the part for use as reference points during an inspection. The position of the nests are monitored by the CAM2 2020 to determine if any movement has occurred during an inspection, and may also used as common points for device position moves.

1.5” Pin Nests - These target nests with 0.25 in shanks enable the measurement of inner diameters, outer diameters, and edges.

1.5” Shankless Nest - This target nest holds the center of the SMR at 1.000 inches above a flat surface. It may also be used to measure inner and outer diameters with its precision 1.6 in diameter.

Small Edge Sphere Tool - This edge finding tool enables the measurement of a straight edge by holding the center of the SMR directly above the edge.

10” Extension Bar - This bar is used to measure hidden points when assembled with the hard point or sphere fit adapter and a pin nest. The adapter is placed against a surface or over a tooling ball, and the SMR is measured as the bar sweeps a sphere with the center at the point or tooling ball center.

Linear Bushings - These bushings allow the standard target nest with 0.25 in shank to be used as a 0.375 in and 0.5 in shank for measurement that requires these sizes.

0.5” Construction Ball - This tooling ball with a 0.25 in shank is used to measure the position about a 0.25 in hole. It may also be used with the 10 inch extension bar to find its center when it is not visible to the Laser Tracker.

Hidden Surface Bar

Hidden Surface Bar - 12 inch
Part # C-ACC-06702-012-01

Hidden Surface Bar - 6 inch
Part # C-ACC-06702-006-01

The FARO Hidden Surface Bar is a precision extension bar that allows you to measure points that are not in the line of sight of the Laser Tracker head.

Usage

Attach a 1.5” SMR to the top of the 12” bar. This creates a 24” diameter SMR and measures the point at the other end of the bar.

Before using the Hidden Surface Bar and 1.5” SMR, the target type must be set. Open the dialog box that controls the current SMR.

- In FARO CAM2 2020, CAM2 Measure or CAM2 Q, select **Hardware Configuration** from the **Device** tab on the ribbon. Click the **Probe Management** button.
- In CAM2 Measure X, select **Devices** < **Probes** from the **Device** menu.

Select 1.5" SMR from the target type dialog box, and 12” Hidden Surface Bar from the tooling type dialog box.

It is critical that the target and tooling type be set correctly for measurement, as measurements taken with the Hidden Scale Bar and 1.5" SMR with the incorrect target type setting will not be valid.

NOTE: Using the 6” Hidden Scale Bar and 1.5” SMR creates a 12” diameter SMR.

Target Care

To operate properly, the SMR must be clean. *For more information, see “Optical Target Care” on page 6.*

Chapter 4: Stands and Mounts

This chapter covers the rolling stands, portable tripods, and other accessories that help you setup and support your Laser Tracker to measure your part.

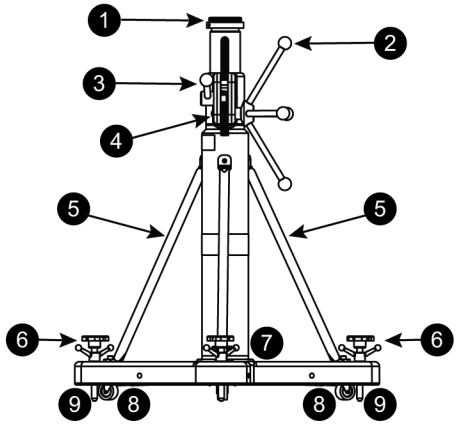
Heavy-Duty Rolling Stands

Part # IG-18
Part # IG-10
Part # IG-24
Part # IG-9

Heavy-duty rolling stands come in four sizes. They are designed for maximum portability and stability and have retractable wheels that can be raised and lowered. The stands' heights are adjustable and lockable and the legs of the heavy-duty stands do not fold.

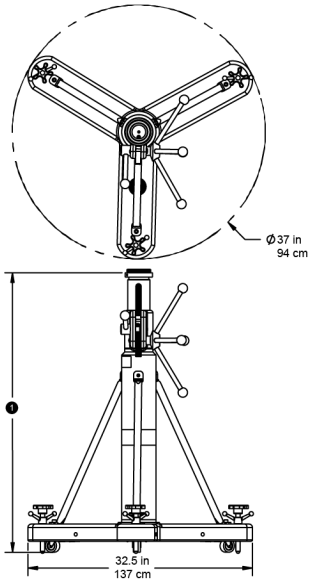
Heavy-duty rolling stands are available in the following sizes:

- 21½" - 27" (54.6 - 68.5 cm) - Part # IG-18
- 30"- 43" (76-109 cm) - Part # IG-10
- 37"- 56.5" (94-143.5 cm) - Part # IG-24
- 43" - 68.5" (109 - 174 cm) - Part # IG-9



1. 3½” Mounting Ring
2. Tripod Tube Height Adjustment Handle
3. Collar Locking Handle
4. Locking Tripod Brake
5. Tripod Base Stabilizers (3)
6. Leveling Screws (3)
7. Foot Pedal
8. Casters (3)
9. Trivet (3)

Dimensions



1

21½" - 27" (54.6 - 68.5 cm) - Part # IG-18

30"- 43" (76-109 cm) - Part # IG-10

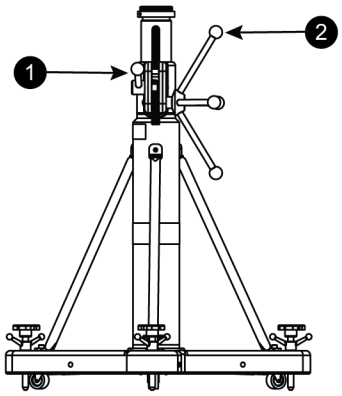
37"- 56.5" (94-143.5 cm) - Part # IG-24

43" - 68.5" (109 - 174 cm) - Part # IG-9

Adjusting the Stand

To raise the stand’s main tube:

1. Loosen the locking collar. This loosens the spring-loaded clamp and allows for movement of the main tube.
2. Turn the four-sided handle counterclockwise and extend the height of the stand’s main tube.
3. When the tube has reached the desired height, tighten the locking collar. This prevents the tube from moving.



1 Collar Locking Handle
2 Tripod Tube Height Adjustment Handle

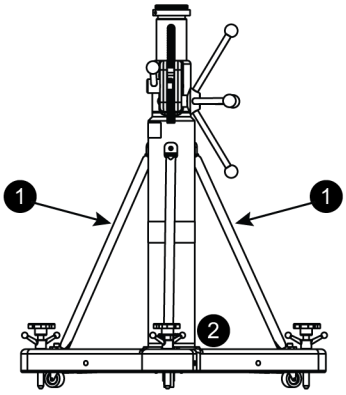
To lower the stand's main tube:

1. Loosen the locking collar.
2. Turn the four-sided handle counterclockwise about an inch and depress the spring-loaded clamp.
3. Allow the four-sided handle to rotate clockwise. This lowers the height of the main tube.
4. Tighten the locking collar.

Adjusting the Stand's Base for Transport

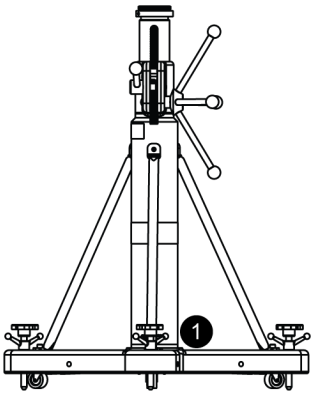
To raise the stand's base:

1. Step on the foot pedal and push it down and toward the center of the stand while simultaneously grasping and lifting the stand's stabilizer rods. This raises the base of the stand so that you can use the wheels to roll the stand to where it is needed.
2. Remove your foot from the foot pedal and the pedal should lock in position.

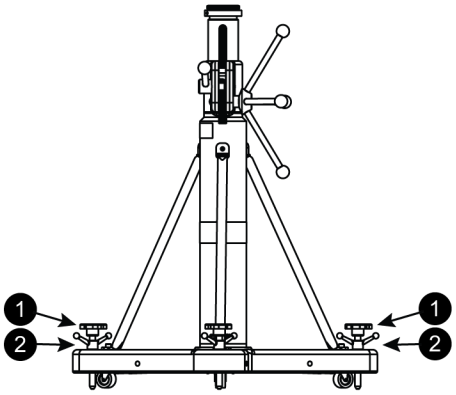


To lower the stand base:

1. Step on the foot pedal and push it down and away from the center of the stand. This drops the base of the stand, causing the wheels to retract. The pedal then pops up.



Adjusting the Stand for Stability



1 Leveling Screws (3)
2 Locking Collars (3)

To stabilize the stand on an uneven space:

1. Adjust the three leveling screws with your hand. This keeps the stand from rocking back and forth on an uneven surface.
2. Tighten the three locking collars located at the base of the stand. This keeps the stand from rocking back and forth on an uneven surface.

MCU Mounting Kit

Part # 950-02448

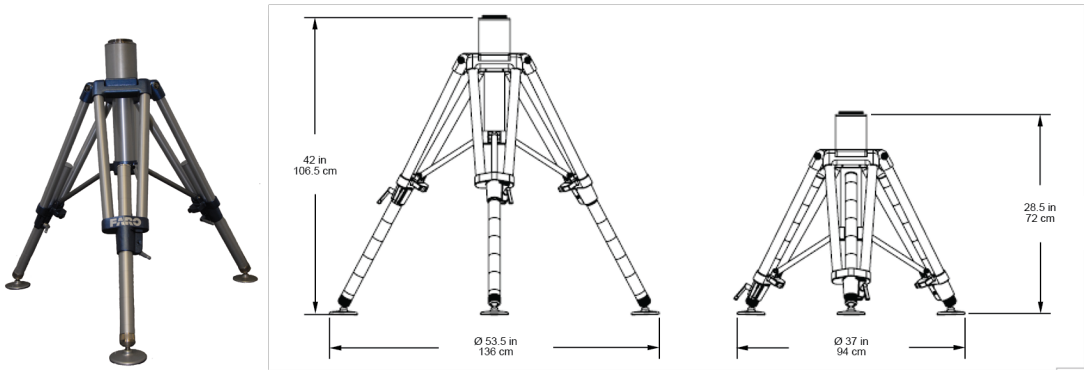
The Master Control Unit (MCU) Mounting kit provides an easy solution to attach the Laser Tracker's MCU to the base of any . The mount includes a mounting fixture and 2 meter cable to connect the MCU to the Laser Tracker Measuring Head.

For more information, see the assembly instructions included with the kit.

Folding Tripod

Part # 15532

The Folding Tripod is a lightweight portable instrument stand for the Laser Tracker with collapsible legs.



To use the Folding Tripod:

1. Remove the Folding Tripod from its case.
2. Spread the legs from the center and place the pads flat on the floor. Fully extend the tripod legs.
3. Tighten the center knob to provide further support to the legs.

To adjust the Folding Tripod height:

1. Loosen the handle on each of the three legs.
    - Each leg has etched lines to help adjust the height of the tripod.
2. Tighten all three handles to ensure that the tripod remains stable.
3. Thread the mandrel mount onto the tripod.

For more information, see the *Folding Tripod Assembly Instructions* document in the case.

Trivet Point Foot
Part # C-ACC-03545-002

The Trivet Point Foot replaces the pad on each of the three legs on the folding tripod.

To install the Trivet Point Foot:

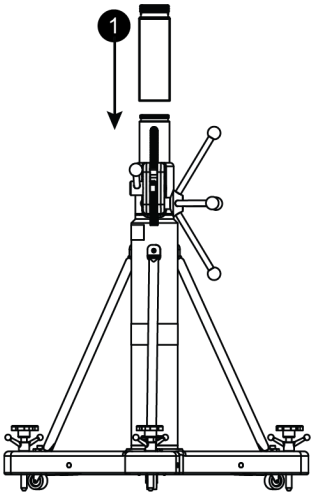
1. Loosen the threaded locking collar at the base of the tripod leg.

2. Remove the pad and replace it with the Trivet Point Foot.
3. Hand tighten the threaded locking collar.

Tripod Tube Extensions

The Tripod Tube Extensions are available for both heavy-duty tripods. The extensions come threaded at both ends.

1. Thread one end of the extension into the main tube on the tripod.
2. Mount the Laser Tracker directly on top of the extension.



NOTE: Two holes are drilled into the tube extensions for tightening the extension to the main tube. Using a metal rod or a similar object, insert the rod into the holes and twist to tighten the tube extension.

The following tube extensions are available:

- 3” Tripod Tube Extension - Part # XH14-0139
- 5” Tripod Tube Extension - Part # XH14-0140
- 10” Tripod Tube Extension - Part # XH14-0141
- 20” Tripod Tube Extension - Part # XH14-0153
- 200mm Tripod Tube Extension - Part # XH14-0166
- 400mm Tripod Tube Extension - Part # XH14-0167
- 600mm Tripod Tube Extension - Part # XH14-0168

Side Mount

Part # 099-01138 ION Model
Part # C-ACC-07885-000 Vantage Model

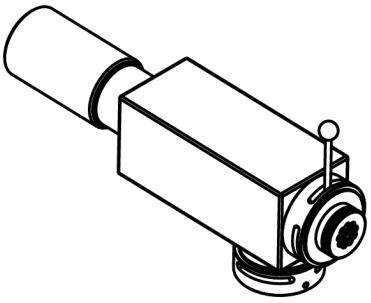


Figure 4-1 ION Model

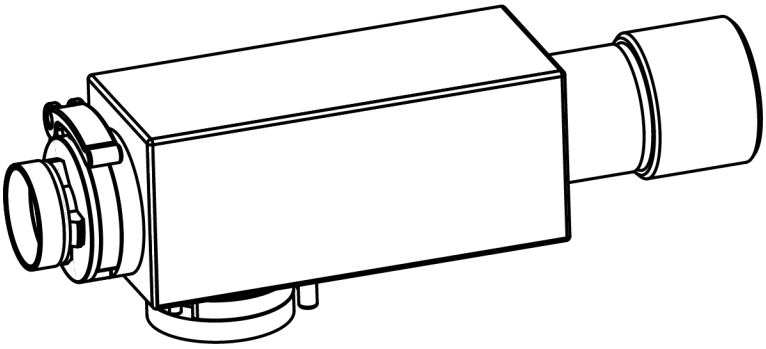
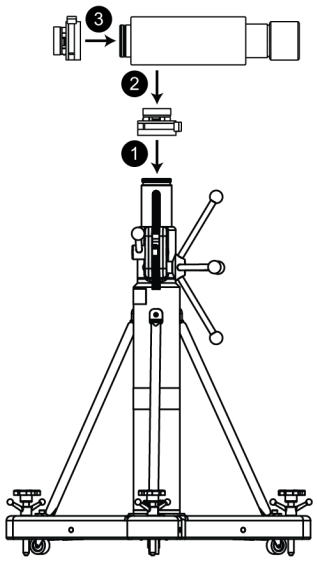


Figure 4-2 Vantage Model

The Vantage Side Mount mounts the Vantage sideways on Heavy-Duty Rolling Stands . The mount includes mount housing, counterweight, mandrel receptacle, and one mandrel. *See "Heavy-Duty Rolling Stands " on page 56.*



To use the Side Mount:

1. Thread your existing mandrel onto your heavy-duty instrument stand.
2. Install the Side Mount onto your heavy-duty instrument stand.
3. Thread the mandrel onto the Side Mount.
4. Install the Laser Tracker onto the Side Mount.

Control Station Computer Platform Arm

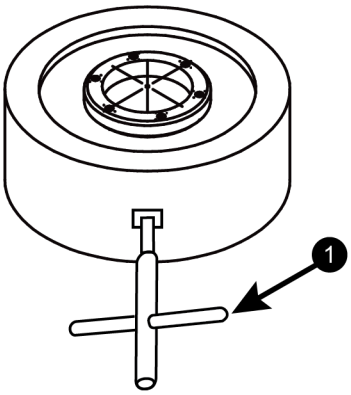
Part # ACCS0213

The Control Station Computer Platform Arm is an adjustable platform that holds laptop computers. It attaches to the Control Station Base Plate or to other measuring surfaces. Refer to the instructions sheet for more information on using the additional parts to setup the arm on other measuring surfaces.

Magnetic Mount

Part # 11516

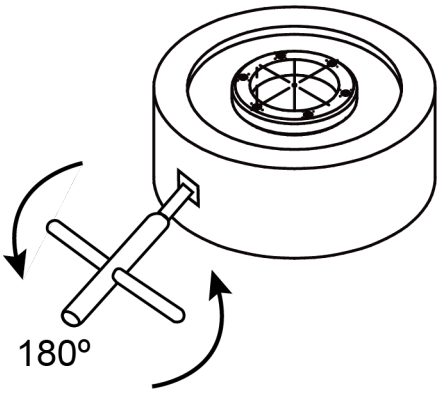
The FARO Magnetic Mount consists of a magnetic base that allows your Laser Tracker to be mounted to surface plates, tools, and other ferrous surfaces. There is a 3½” ring on top to attach the Laser Tracker and a tool to turn the magnet on and off.



1 Tool that turns the magnet

Figure 4-3

Turn the magnet on or off by placing the tool in the hole on the side of the mount. Turn the tool clockwise 180° to activate the magnet, and counterclockwise 180° to turn off the magnet.



- Turn the tool 180º to the left to turn off the magnet

Figure 4-4

Surface Requirements

Magnetic power is often pictured as lines of magnetic force flowing from north pole to south pole. Anything that limits the flow of these magnetic lines of force reduces the magnet's capacity. The following is a list of important factors which limit the flow of these lines of force.

1. **Surface Conditions**
   Anything that creates an air gap between the magnet and the mounting surface reduces the magnet's capacity.
   - The bottom surface of the Magnetic Mount must be clean, smooth, and free of nicks and burrs. This minimizes the air gap between the magnet and the mounting surface. This mount has been designed with low carbon steel in order to maximize the capacity; therefore, use special care to protect the surface. Do not attach or weld other materials to the magnet in order to reduce wear. This reduces the magnet's capacity.
   - Paper, dirt, rags, dust, paint, and scale act the same as air. Also, a rough surface finish creates air gaps between the magnet and the surface.
2. **Surface Thickness**
   - Thin material means less iron is available, reducing the magnet's capacity.

- Thick steel surfaces are preferred.

3. **Surface Area Alloy**
   Low carbon steels, such as SAE 1020 steel, are nearly as good conductors of magnetic force as pure iron. However, many other alloys contain non-magnetic material which reduces the ability of magnetic force to flow into the surface area. Alloys such as SAE 300 series stainless steel are poor conductors.
4. **Portion of the Magnetic Mounts Surface in Contact with Surface Area**
   To achieve maximum magnetic force, the full surface of the mount must contact the mounting surface.

Magnetic Mount Operation Instructions

To operate the Magnetic Mount:

1. The mounting surface and the bottom surface of the Magnetic Mount must be clean, perfectly flat, and free of burrs. Check both surfaces. If they are not flat, imperfections can be removed by lightly stoning with a hand-held grinding stone.
2. The full area of the Magnetic Mount must be in contact with the mounting surface for maximum holding stability.
3. The mounting surface should be at least 0.50" (12.7mm) thick. The better the surface condition (flat and smooth), the higher the holding force and stability. The ideal material is mild steel (low carbon steel, SAE 1020). Other materials may result in lower holding force and thinner material may also decrease holding and stability. For more information, see the table below.
4. Before mounting, make sure that the Magnetic Mount is in the “OFF” position. Place it on a good base material.
5. Turn the handle to the “ON” position. This will take 1.25 turns to go from fully “OFF” to fully “ON”.

CAUTION: This Magnetic Mount is a strong magnetic device. Make sure that loose metal items are not near the mount when it is “ON”.

The reduction factors in the following table represent a percentage of the total holding force of a magnet when used on SAE 1020 steel. For example, 416 stainless steel has a reduction factor of 0.50 (50%). This means that the total holding force for this material is half of SAE 1020 steel.

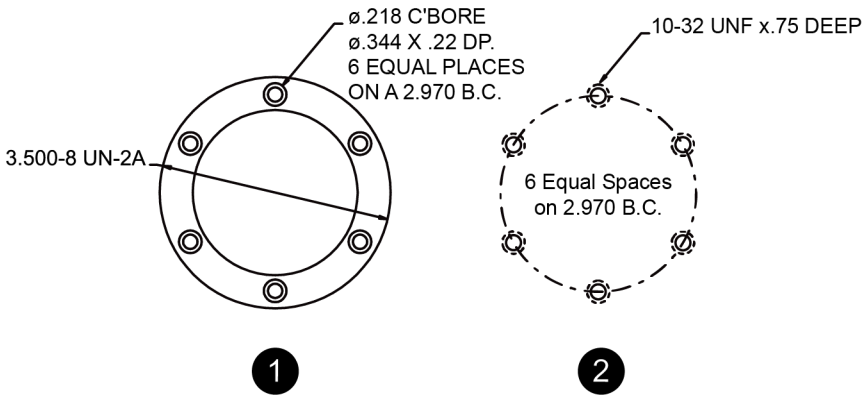
Material	Reduction Factor
Cast Steel	.90 (90%)
3% Silicon Steel	.80 (80%)
SAE 1095 Steel	.70 (70%)
416 Stainless Steel	.50 (50%)
Cast Iron (non-chilled)	.45 (45%)
Pure Nickel	.10 (10%)
4140 Steel	.90 (90%)
P20	.80 (80%)
H13	.70 (70%)

This is a random sampling of materials. Contact your Customer Service Representative by , or with any questions for a reduction factor for a particular material that you need to use as a base.

3½” Mounting Ring

Part # IG-27

The 3½” Mounting Ring is a portable mounting ring that can be attached to a surface to mount the Laser Tracker. The ring has six holes, allowing it to be mounted to any flat surface. The outside of the ring is threaded to accept the mandrel of your Laser Tracker.



1. Threaded Ring
2. Ring Mounting Hole Pattern

Vacuum Mount

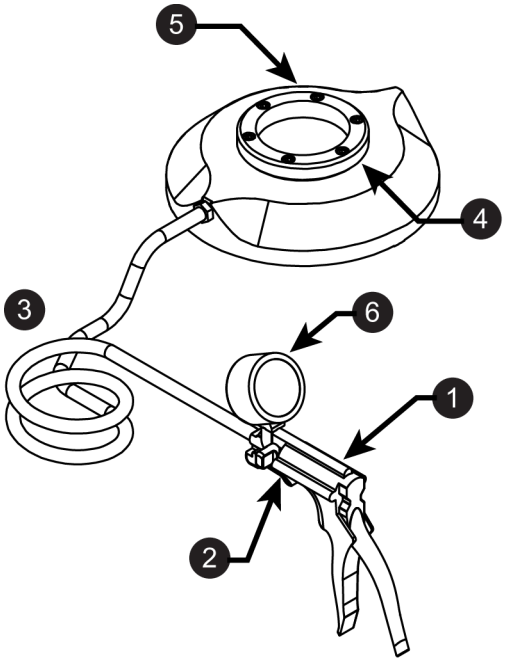
Part # 13402-001, Imperial
Part # 13402-002, Metric

The FARO Vacuum Mount quickly, easily, and rigidly mounts the Laser Tracker to granite surfaces without a degradation in accuracy. The kit includes the mount, hand pump, oil, and case.

CAUTION: Always disconnect the Laser Tracker from the Vacuum Mount before moving. Moving the Laser Tracker and Vacuum Mount together may cause damage to the Laser Tracker.

A bottle of Vacuum Oil for the vacuum mount is included in the kit. Use the oil to create the vacuum seal between the mount and the granite surface. The reorder part number is XH26-0030.

NOTE: *Do not* apply oil to any metal part of the mount, to the granite surface. Any oil on the metal may cause the mount to slide.



1. Vacuum Pump
2. Pressure Relief Valve
3. Flexible Tubing
4. 3½” Mounting Ring
5. Vacuum Mount
6. Pressure Gauge

To use the Vacuum Mount:

1. Make sure the granite surface is clean and free of debris.
2. Attach the Laser Tracker to the 3½” Mounting Ring 4, and tighten the threaded collar clamp.
3. Tighten the knob 2 to close the Pressure Relief Valve.
4. Squeeze the handle 1 and pressurize the vacuum base the initial pressure, 30 in Hg. This is the **Blue** area of the pressure gauge.

NOTE: Check the vacuum pressure gauge 6 periodically. Re-pressurize to 25 in Hg if the vacuum falls below 15 in Hg. On the pressure gauge the **Green** area is the normal range, 15 to 25 in Hg, and the **Red** area is below the normal range, 0 to 15 in Hg.

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5. When you finish measuring, loosen the knob 2 to open the Pressure Relief Valve and release the vacuum.

Battery-Operated Vacuum Mount

Part # 15320

The Battery-Operated Vacuum Mount secures your Laser Tracker to granite and other air-impermeable surfaces. A battery-powered mini vacuum pump creates a vacuum between the Laser Tracker base and the surface to secure the Vacuum Mount via suction. Adapters secure the Laser Tracker to the mount’s upper plate.

1. Charging connection
2. Upper plate
3. Ventilation
4. Vacuum manometer
5. On/Off switch
6. Surface
7. Base
8. Charging level LEDs
9. Double seal

Components

Upper Plate

There are six large and nine small threaded holes in the upper plate. The threaded holes accommodate the Laser Tracker adapter.

Base

There are two sintered filters on the bottom of the base. The air is evacuated through one of the sintered filters, producing the vacuum. The sintered filters are also sound-absorbing. The seal seals the area under the base. Three state feet ensure the safe state of the Vacuum Mount.

Housing

A buzzer makes a sound as soon as the pressure falls below the minimum level set by the manufacturer. The rechargeable batteries power a miniature vacuum pump. The vacuum pump creates a vacuum between the base and surface to hold them together.

The vacuum pump is controlled using the pressure switch. When the vacuum of -11.60 psi (-0.8 bar) is reached, the automatic pressure switch turns off the vacuum pump. If the pressure goes below the minimum value, the pressure switch turns the vacuum pump back on.

Structure and Function

Operating Elements

Charging level LEDs show the charging level of the batteries. The LEDs indicate the following:

- **Red**: batteries depleted, charge needed
- **Yellow**: batteries half charged, charge soon
- **Green**: batteries fully charged, optimal conditions for use

The Vacuum Mount is switched on at the On/Off switch.

The vacuum manometer gives the current pressure in bar. The measuring range is 0 to -14.50 psi (0 to -1 bar).

The ventilation lets air in to fill the vacuum.

Transport, Packing, and Storage

Transport

Upon receipt, immediately verify complete delivery and that the Vacuum Mount has not been damaged in transit.

Packing

Always transport the device in the aluminum case in which it was delivered. The aluminum case should be used to protect, store, and transport the Vacuum Mount and any accessories for its entire service life. The aluminum case and device can be transported by hand.

Storage

Store the Vacuum Mount as follows:

- Always store the device and accessories in the aluminum case in which the device was supplied.
- Do not store outside.
- Store in a dry and dust-free area.
- Do not expose to any aggressive medium.
- Keep out of the sun.
- Prevent mechanical vibration.
- Storage temperature: 15-35 °C (59-95 °F).
- Relative humidity: maximum 60%.
- If storing for more than 3 months, regularly check the general condition of all components and the packaging. If necessary, renew or replace packaging.

Operation

Safety

CAUTION: Improper operation may result in injury!

The vacuum must be constant and there must be a pressure of -11.60 psi (-0.8 bar).

Constantly check the pressure on the vacuum manometer during operation.

Ensure that the leverage forces of the measuring arm are always less that the holding force.

If the holding force does not suffice, the vacuum base may break free of the surface causing injury and damage to property.

Preparation

Make sure that the mounting surface is air-impermeable, smooth, clean, and flat.

Ensure that the batteries are at least halfway charged (yellow or green LEDs must be illuminated). If necessary, charge the batteries by connecting the charger to the charging connection.

Operation

To operate the Vacuum Mount:

1. Place the Vacuum Mount onto the mounting surface.
2. Turn the Vacuum Mount on.
3. Check at the vacuum manometer to ensure a vacuum of -12.32 psi (-0.85 bar) has been reached. The vacuum is reached after five seconds on an optimal surface. If the surface is not optimal, the vacuum is reached after approximately 10 or 15 seconds.
4. Secure appropriate adapters to the threaded holes.
5. Secure the FaroArm to the adapter.

Maintenance

After use, wipe the Vacuum Mount with a damp, clean cloth and let it dry.

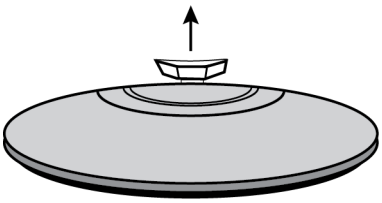
If the Vacuum Mount is not used for extended periods, store it in the aluminum case.

Clean the Vacuum Mount at regular intervals, depending on requirements, purpose of use, and actual soiling. Clean it as needed using a damp, clean cloth.

Tripod Feet, Rubber (Set of 3)

Part # XH15-0127

The Tripod Rubber Feet screw into the tripod leveling screws and prevent slippage on very smooth surfaces.



Chapter 5: Super 6DoF FARO TrackArm

Part # 21605

NOTE: Part # 21605 TrackArm kit is compatible with the FaroArm Quantum and all Laser Trackers.

Part # 15366

NOTE: Part # 15336 TrackArm kit is compatible with all FaroArms and Laser Trackers, except the FaroArm Quantum.

Part # 950-02368

NOTE: Part # 950-02368 TrackArm kit is compatible with all FaroArms (except the FaroArm Edge and Quantum) and all Laser Trackers (except Vantage).

The Super 6DoF FARO TrackArm combines the FARO Laser Tracker and FaroArm to provide a six-degrees-of-freedom probe. Switching between the Laser Tracker and the FaroArm, you can reach hidden points – even around corners and inside hole features. Line of sight issues are eliminated. This solution enables you to inspect, reverse engineer or perform CAD-to-Part analysis with greater ease than ever before.

This seamless combination of the CAM2 2020 and FaroArm simplifies even the most challenging measurements, delivering high accuracy with an easy to use interface. Through synchronized measurement between the CAM2 2020 and FaroArm, the Super 6DoF TrackArm can be employed in seconds.

The TrackArm system is compatible with FARO CAM2 2020, CAM2 Measure (10.2 or later), and Innovmetric Polyworks (12.1.4 or later). It requires a FaroArm USB and a Laser Tracker with Master Control Unit (MCU) hardware updated from October 2005. If you have an MCU dated before October 2005, contact FARO for update information by Phone, Fax or E-Mail. *See "Technical Support" on page 109.*

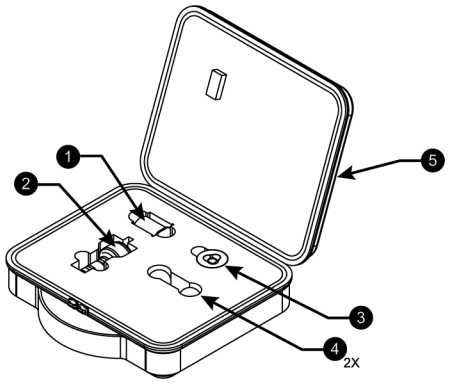
Hardware Components

The Super 6DoF FARO TrackArm system includes the following:

Part # 21605	Part # 15336	Part # 950-02368
• Laser Tracker	• Laser Tracker	• Laser Tracker (SI, X, Xi, or ION)
• FaroArm (USB - 6 or 7 axis)	• FaroArm (USB - 6 or 7 axis)	• FaroArm (No FARO Edge)
• TrackArm Kit:	• TrackArm Kit:	• TrackArm Kit:
• Quantum Magnetic SMR Probe Adapter	• SMR FARO Edge Bracket	• SMR FaroArm Bracket
• ⅞” SMR in packaging tube	• ⅞” SMR in packaging tube	• ⅞” SMR
• ⅞” Drift Nest	• ⅞” Drift Nest	• ⅞” Drift Nest
• Two (2) ⅞” Spheres	• 3/32” Hex Wrench	• 5/32” Hex Wrench
	• Two (2) ⅞” Spheres	• TrackArm Trigger Cable
	• Magnetic SMR Probe Adapter	• TrackArm Software installation disk
	• Probe Adapter	

Table 5-1 TrackArm System Components

Case Layout - Part # 21605



1. ⅞” SMR in packaging tube
2. Magnetic SMR Probe Adapter
3. ⅞” Drift Nest
4. ⅞” Sphere
5. Storage Case

Figure 5-1 Part # 21605 Case Layout

Case Layout - Part # 15336

1 2 ⅞” SMR in packaging tube
3 Probe Adapter
4 Magnetic SMR Probe Adapter
5 3/32” Hex Wrench
6 ⅞” Sphere
7 ⅞” Drift Nest
8 SMR Bracket for the FARO Edge
9 Storage Case

Figure 5-2 Part #15336 Case Layout

Hardware Setup

The hardware setup involves attaching a ⅞” SMR to the FaroArm using a mounting bracket or assembling and installing a ⅞” Magnetic SMR FaroArm probe that allows you to use the backside of the SMR or a ⅞” Sphere to take measurements.

NOTE: Make sure the FaroArm and Laser Tracker are powered “**OFF**” before adding the TrackArm hardware and connecting to your computer.

Using the Magnetic SMR Probe Adapter:

1. Install the Magnetic SMR Probe Adapter onto the FaroArm Quantum.
2. Place the ⅞” Sphere onto the Magnetic SMR Probe Adapter for compensation.

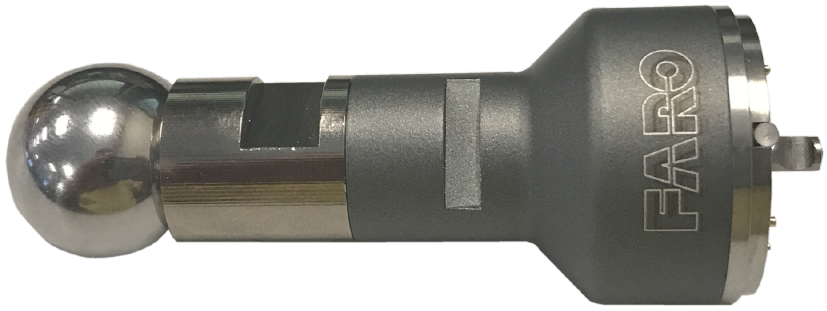


Figure 5-3 Magnetic SMR Probe Adapter

3. After probe compensation, remove the ⅞” Sphere and replace it with the ⅞” SMR for compensation.

Figure 5-4 Magnetic SMR Probe Adapter

4. For measuring your part, change to the ⅞” Sphere.

Continue to the Connecting To The Computer section to connect and enable the TrackArm system. *See “Connecting To The Computer” on page 76.*

Hardware Setup - Part # 15336

There are two hardware setup options with the Part # 15336 kit. The bracket will only fit on the FaroArm Edge. If you have an older FaroArm USB, use the Magnetic SMR Probe Adapter parts.

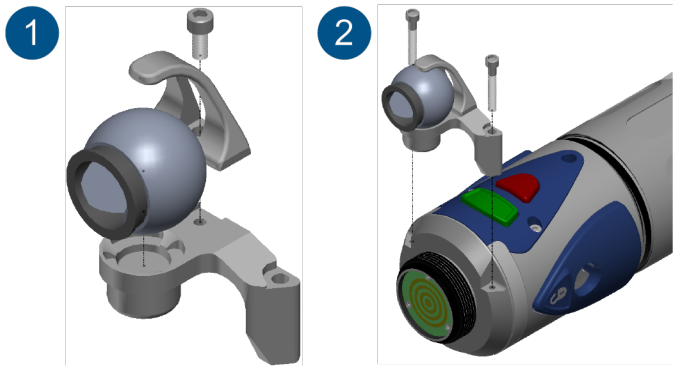


Figure 5-5 FaroArm Edge SMR Bracket

Using the FaroArm Edge SMR Bracket:

1. Place the ⅞” SMR into the FaroArm Edge SMR Bracket and tighten the set screw with the 3/32” hex wrench.

NOTE: After tightening the set screw, the ⅞” SMR still moves freely in the bracket mount.

❷ Attach the FaroArm Edge SMR Bracket to the handle of your FaroArm Edge. Tighten both set screws.

Using the Magnetic SMR Probe Adapter:

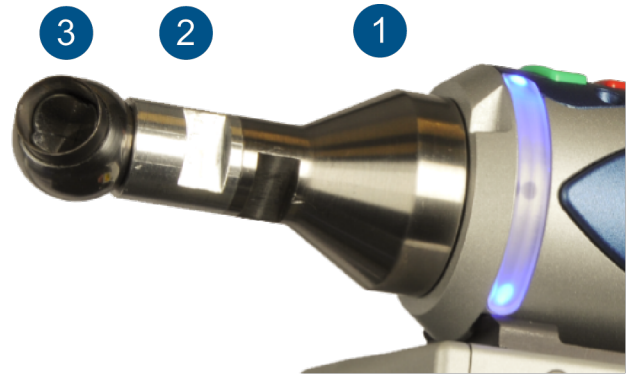


Figure 5-6 Magnetic SMR Probe Adapter

❶ Thread the Probe Adapter onto the FaroArm handle. Tighten with the FaroArm 12 mm wrench.

❷ Thread the Magnetic SMR Probe Adapter onto the Probe Adapter. Tighten with the FaroArm 12 mm wrench.

❸ Place the ⅞" Sphere onto the Magnetic SMR Probe Adapter for compensation.

❹ After probe compensation, remove the ⅞" Sphere and replace it with the ⅞" SMR for compensation.

❺ For measuring your part, change to the ⅞" Sphere.

Continue to the Connecting To The Computer section to connect and enable the TrackArm system. *See "Connecting To The Computer" on the next page.*

Hardware Setup - Part # 950-02368

The Part # 950-02368 kit contains a SMR Mounting Bracket to attach a ⅞" SMR onto a FaroArm. This bracket will not fit on a FaroArm Edge.

Figure 5-7 SMR FaroArm Bracket

Mount the bracket on the FaroArm probe as shown in Figure 5-7.

1. Tighten the two screws equally on the bracket with the supplied 5/32" hex wrench so the gap on each side is the same.
2. Place the ⅞" SMR on the bracket and tighten the thumb screw to lock in the SMR protection bar.

Connecting To The Computer

After installing all of the TrackArm hardware, connect the cables to your computer and switch on your computer, the FaroArm, and the Laser Tracker. The cables and connections differ slightly between the two TrackArm kits. Please refer to your Laser Tracker and FaroArm user manuals for more details.

Connect the cables to your computer and switch on your computer, the FaroArm, and the Laser Tracker:

1. Connect the Laser Tracker to your computer using the Computer to MCU Ethernet cable.

NOTE: You can also connect the Laser Tracker Vantage to your computer wireless using WLAN.

2. Connect the FaroArm to an available USB port on your computer using any USB cable.

NOTE: You can also connect the FARO Quantum and Edge to your computer using an Ethernet cable, wireless using Bluetooth, or wireless using WLAN.

3. Switch your Computer on and start the software (CAM2 or Polyworks). Switch on the Laser Tracker and the FaroArm.

Connecting To The Computer - Part # 950-02368

Connect the cables:

1. Connect the Laser Tracker to your computer using the Computer to MCU Ethernet cable.

NOTE: You can also connect the FARO Laser Tracker Vantage to your computer wireless using WLAN.

2. Connect the Laser Tracker and the FaroArm using the TrackArm Trigger Cable. The RJ-45 connector plugs into the TrackArm connector on the front of the Laser Tracker Master Control Unit (MCU). The other end of the cable plugs into the auxiliary port on the FaroArm.

Device Center Panel - CAM2 Software

In FARO CAM2 2020, click **Device Center** on the **Devices** tab to open the **Device Center** panel to make sure that both the Laser Tracker and the FaroArm are connected to CAM2 Measure. You can also press the **P** keyboard shortcut on the keyboard.

- Click **Add New Device** if you do not see either measurement device.

  For more information, see the FARO CAM2 2020 chapter in the Laser Tracker or FaroArm manual for more details about the hardware setup and configuration. An Electronic Help for each device is also available on the FARO CAM2 2020 Help page.

Continue to the SMR Compensation section to compensate the ⅞" SMR. *See "SMR Compensation" on the next page.*

SMR Compensation

Before measuring with the TrackArm, the position of the SMR *must* be compensated on the FaroArm. This process is only necessary when the bracket is installed on the FaroArm or if the system is being used with a new computer.

NOTE: If you are using Part # 21605 or the Magnetic SMR Probe Adapter in Part # 15336, simply create and compensate a custom probe. The diameter is 0.875 in (22.225 mm). Part # 21605 is automatically recognized as soon as it is attached to the FaroArm Quantum and the probe diameter is automatically set.

Compensate the SMR:

1. To prepare for SMR calibration, mount the FaroArm on a stable mount, stand, or table.
2. Mount the Compensation tool:
   - **Magnetic SMR Probe Adapter** - Glue the ⅞" drift nest on a stable table approximately ⅔ of the reach of the FaroArm.
   - **SMR Bracket** - Glue or clamp the FaroArm probe hole calibration tool at the same distance.
3. Replace the ⅞" SMR with the ⅞" Sphere.

NOTE: You can also use the ⅞" SMR for compensation.

Compensation Setup - Part # 950-02368

Compensate the SMR:

1. To prepare for SMR calibration, mount the FaroArm on a stable mount, stand, or table.
2. Glue or clamp the FaroArm probe hole calibration tool at the same distance.
3. Loosen or remove the SMR protector by unscrewing the thumbscrew and lifting off the protection bar.
4. Replace the ⅞" SMR with the ⅞" tooling ball.

NOTE: You can also use the ⅞" SMR for compensation.

SMR Compensation Using the CAM2 Software

Either the Magnetic SMR Probe Adapter or the SMR Bracket must be defined as a probe before you can properly use it with CAM2 Measure.

NOTE: This step must only be done once. Once you define the probe, you can use it again.

1. In the **Device Center**, double-click the FaroArm. FaroArm Quantum - Click the **Hole Compensation** button.

   FaroArm Edge and older models only:
2. Create a new probe. In the **Modify Probe** dialog box:
   - Enter a new probe name in the **Name** field.
   - Enter `0.875` (`22.225`) in the **Probe Diameter** field.
   - If selected, clear the **Guidance** check box.
   - Click the **Create New** button.

3. Choose your new probe.
4. Click the **Hole Compensation** button and compensate the TrackArm probe:
    - **Magnetic SMR Probe Adapter** - Place the SMR in the ⅞” drift nest and follow the Hole Compensation Method. Ensure that the window of the SMR does not interfere with the rotation of the SMR in the drift nest.

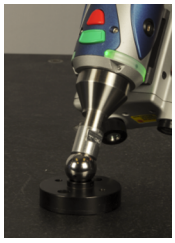


Figure 5-8 SMR Magnetic SMR Probe Adapter Compensation

- **SMR Bracket** - remove the SMR from the clamp and place the ⅞” tooling ball sphere in its place. Place the tooling ball in the Hole Compensation Tool and follow the Hole Compensation method.

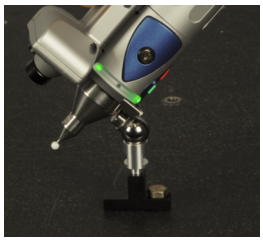


Figure 5-9 SMR Bracket Compensation

NOTE: See the Hole Compensation *Hole Compensation Method* section of any FaroArm manual for more details on compensation.

5. Once you compensate the probe successfully, select it as the Current Probe, and click the **OK** button.
6. Remove the ⅞” tooling ball sphere from the SMR Bracket. You will track the ⅞” SMR back to the bracket later.

At this point, the CAM2 software is prepared for you to setup the two devices for use in the same measurement space, so now you must define the TrackArm device position.

TrackArm Position

Now that the SMR location is known on the FaroArm, you will measure the SMR with the Laser Tracker in the working volume of the FaroArm. This allows the FaroArm to measure within working volume of the Laser Tracker.

Select **Device** > **Locate TrackArm** from the **Devices** tab to start the TrackArm wizard.

1. If you have already compensated the TrackArm probe, click **No**.
2. Track the SMR to the TrackArm probe, or press the **green Front** button to start **Find Me**.
3. Press the **green Front** button to begin measuring points.

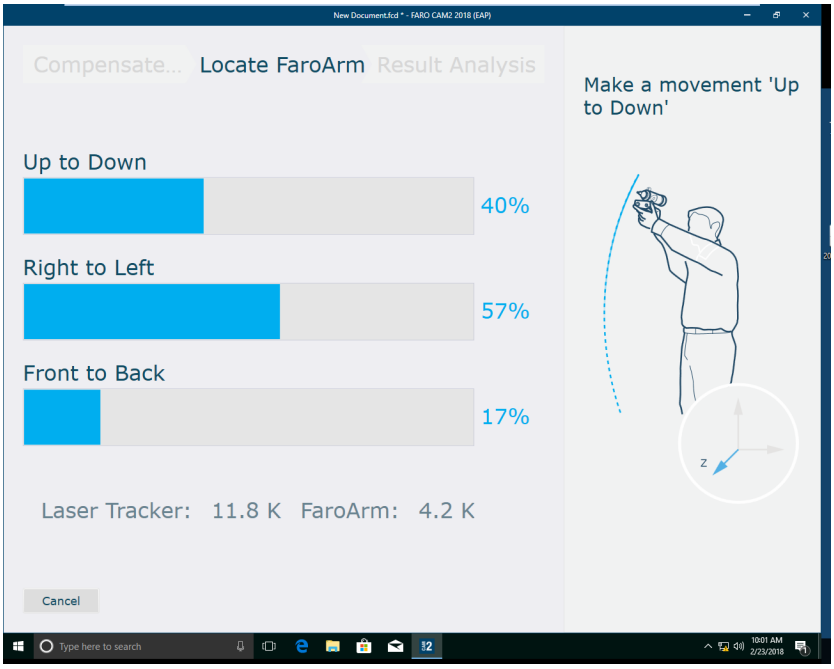


Figure 5-10 SMR Magnetic SMR Probe Adapter Compensation

- Move the probe in the working volume of the FaroArm; Up and Down, Left and Right, Forward and Backwards. Ensure you are measuring in the 3D volume of the FaroArm.
- Watch the status bars for each direction and keep measuring until each is 100% complete.
- Press the **green Front** button to pause the measurement.
- If you should loose the beam, press the **green Front** button to start **Find Me**.

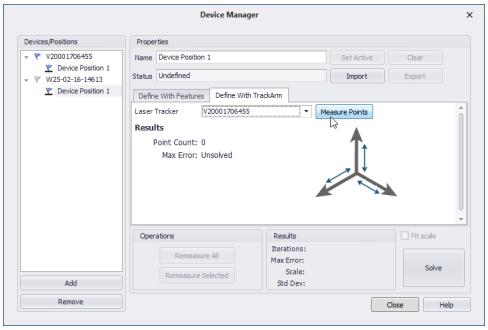
4. Press the **red Back** button to complete the measurement. Notice the results of the TrackArm position.
5. Press **Accept** to store the TrackArm system compensation, or **Retry** to discard and repeat.

Device Manager Panel

To position the FaroArm:

1. Position the FaroArm so the probe will reach the measurement area and also have a clear line of sight to the Laser Tracker.
2. Select **Device** > **Manage Devices** from the **Devices** tab to access the **Device Manager** panel.

3. Ensure that the Laser Tracker is the root device. In the **Device Manager** panel, right-click the Laser Tracker Device Position 1 and choose **Make Root**.
4. In the **Device Manager** panel, select the FaroArm Device Position 1 and click the **Define with** TrackArm tab.
5. A drop-down window lists all Laser Trackers connected to the CAM2 software. If you are using multiple Laser Trackers, ensure that the correct one is selected.



Measuring Points

After compensation and positioning, the TrackArm system is ready to measure points with either the Laser Tracker or the FaroArm.

To measure points:

1. Click the **Measure Points** button to open the **Measurement** panel and start the measurement of the SMR.

NOTE: The ⅞" SMR is automatically selected for both devices.

2. Find a location where the SMR can be held still, lock the Laser Tracker beam onto the SMR and press the **green Front** button to begin measuring. Both the FaroArm and the Laser Tracker are measuring so the SMR should be held still.
   - Move the probe in the working volume of the FaroArm; Up and Down, Left and Right, Forward and Backwards. Ensure you are measuring in the 3D volume of the FaroArm.
3. After taking the points, press the **red Back** button on the FaroArm to finish measurement of the point.
4. Press the green **Front** button again and move the FaroArm in space while the beam is locked onto the SMR. To achieve best results, exercise the FaroArm in all 3 axes (X, Y and Z) within all of the FaroArm volume. Do not move the probe too quickly.
5. Press the **red Back** button to complete the measurement. Notice the results of the TrackArm position.
   - If necessary click **Measure Points** and repeat the measurement process.
6. In the **Device Manager** panel, click **Close**.

Moving the FaroArm

If you need to move the FaroArm to another location to measure, simply run the **Locate TrackArm** command again.

You can also add another device position to the FaroArm and measure more points. To move the FaroArm:

1. Select **Device** > **Manage Devices** from the **Devices** tab to access the **Device Manager** panel.
2. In the **Device Manager** panel, select the FaroArm and click **Add**.

3. Select the new device position and click the **Define with TrackArm** tab. Click **Measure Points** to measure a new position.

Chapter 6: FARO TargetCAM

Part # 950-03532 ION model
Part # 950-01101 X and V2 models

The TargetCAM is a fully integrated wireless video camera for the Laser Tracker. The camera supplies live video via wireless Ethernet to the computer to enable point and click target acquisition.

FARO Laser Tracker ION model FARO Laser Tracker V2 model

The camera enables visual identification of any SMR in the camera's field of view, and easy point and click functionality to direct the Laser Tracker to lock on to them. The camera includes a blink function, 4-times digital zoom, and a static view for easy target recognition and acquisition.

This chapter covers hardware setup, computer configuration, and user guidelines. The TargetCAM is compatible with FARO CAM2 2020, CAM2 Measure, CAM2 Q, and CAM2 Measure X, as well as all third party software that uses the FARO Laser Tracker Software Development Kit released September 2005 or later. Contact the vendor of the third party software to verify compatibility.

Hardware Components

The TargetCAM includes the following:

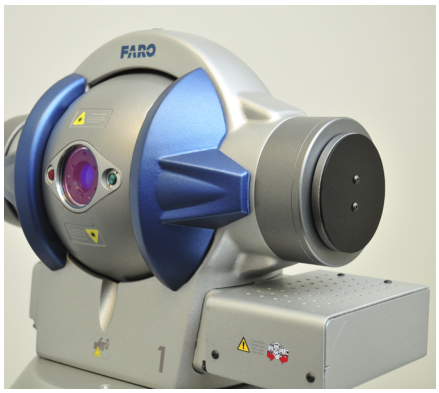
- Camera Assembly
- Camera Antennas (2)
- 1/16” L hex wrench
- Ethernet Cable (for wired use only)
- TargetCAM Case

Hardware Setup

CAUTION: When lifting the Laser Tracker with the camera assembly, be aware that the azimuth axis is not balanced and can swing around.

1. Turn the Laser Tracker power off and locate the side of the Laser Tracker axis as shown in Figure 6-1.

ION	X and V2



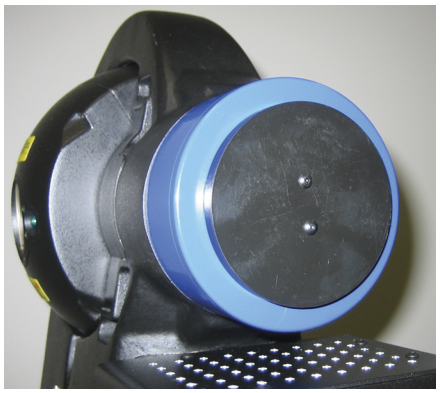
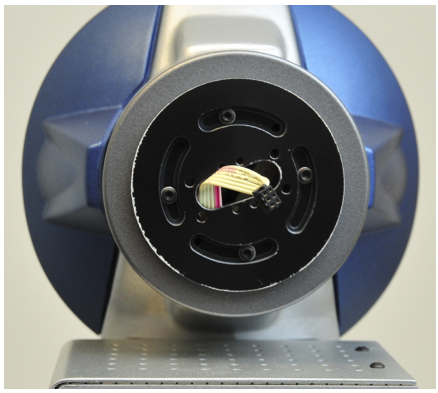


Figure 6-1 TargetCAM Side View

CAUTION: *DO NOT* hot plug the camera. Ensure that the power is off on the Laser Tracker before attaching or detaching the ribbon cable connector.

2. Remove the two screws using a 1/16” Allen wrench (provided) and lift the Shipping Cover off to expose the camera interface shown in Figure 6-1. Retain the cover and screws inside the Camera Kit for later use when transporting the Laser Tracker in its shipping case.

ION	X and V2



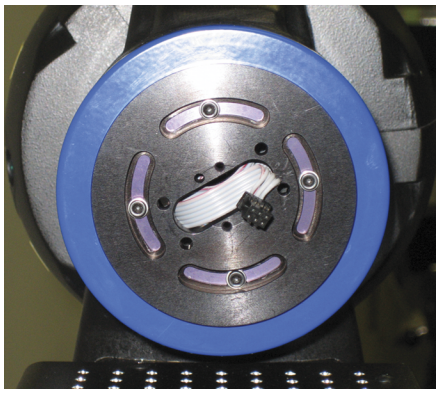


Figure 6-2 TargetCAM Camera Interface

3. Touch a metal surface inside the exposed camera interface to discharge any static electricity.

CAUTION: Always discharge static before you touch any parts or install any components inside the camera assembly. To avoid generating static electricity, do not walk around the room until you have finished working and closed the camera assembly.

4. Connect the ribbon cable shown in Figure 6-1 to the connector on the back of the camera as shown in Figure 6-3 and Figure 6-4. There are small tabs on the cable side of the connector and small slots on cameras side. These prevent the cable from being connected in the wrong direction. If the cable does not easily slide into the camera connection, reverse the cable and try again. Do not force the cable into the camera connection.

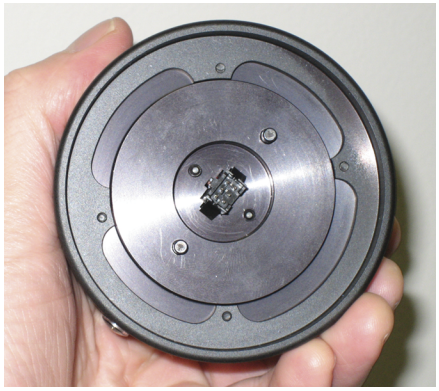
ION	X and V2
	

Figure 6-3 TargetCAM Connector

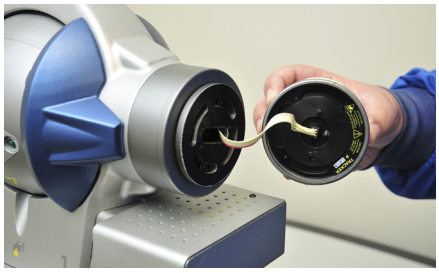
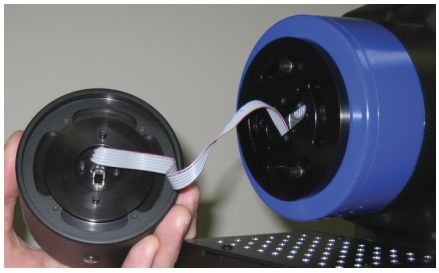
ION	X and V2
	

Figure 6-4 Connecting the Ribbon Cable

CAUTION: *DO NOT* hot plug the camera. Ensure that the power is off on the Laser Tracker before attaching or detaching the ribbon cable connector.

5. Mount the camera to the Laser Tracker by lining up the dowel pins in the back of the camera with the dowel holes on the side of the Camera Adapter Plate. Excess cable should be pushed back into the housing on the axis of the Laser Tracker
(Figure 6-5). Ensure that the lens of the camera is pointing in the same direction and on the same plane as the aperture on the CAM2 2020 that emits the laser beam.

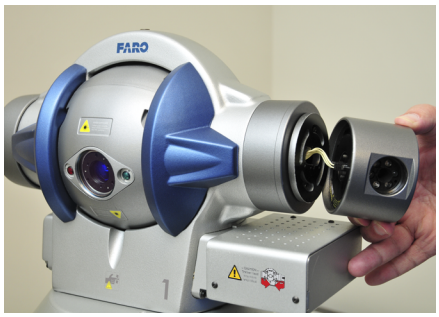
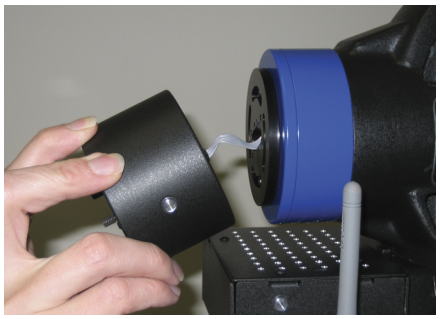
ION	X and V2
	

Figure 6-5 Attaching the TargetCAM

6. Tighten the two thumbscrews on the end of the camera as shown in Figure 6-6.

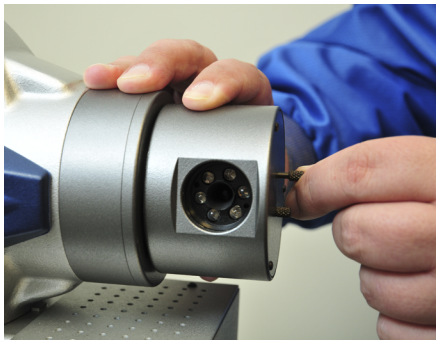
ION	X and V2
	

Figure 6-6 Secure the TargetCAM

Figure 6-7 shows the final result.

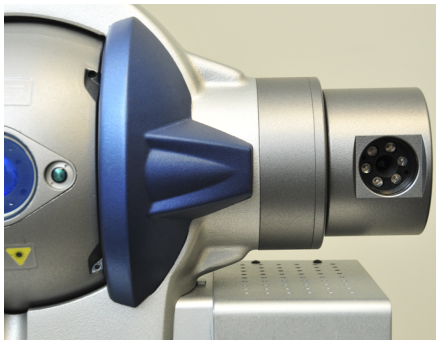
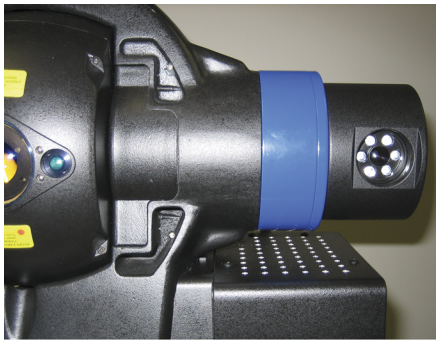
ION	X and V2
	

Figure 6-7 TargetCAM Finished Assembly

7. If using wireless Ethernet to communicate with the camera, connect the two antennas to the back of the camera electronics and position the antennas as shown in Figure 6-8. If wired Ethernet is preferred, connect the cable from the electronics box to the computer.
   - If connecting directly from the camera to the computer, use a cross-wired cable.

- If connecting to a router or a network, use a straight cable.

The Ethernet connection is shown to the left of the antennas in Figure 6-8.

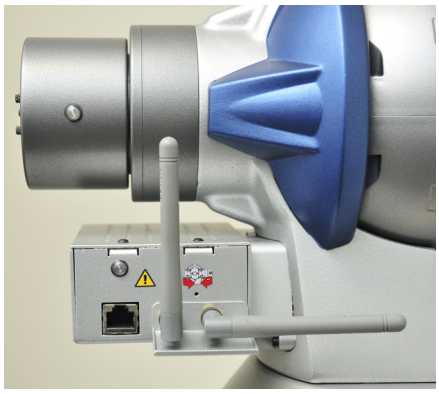
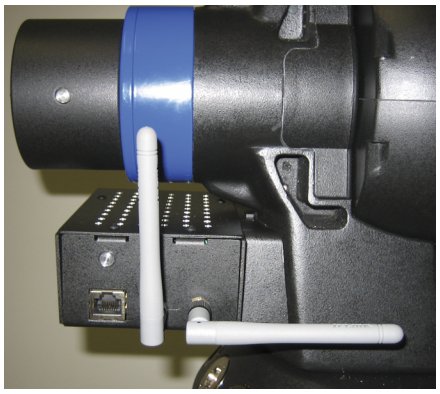
ION	X and V2
	

Figure 6-8 TargetCAM Communications

CAUTION: When lifting the Laser Tracker with the camera assembly, be aware that the azimuth axis is not balanced and can swing around.

PC Network Card Configuration

The network card on the PC must be configured to communicate with the camera. The IP address for the camera is configured at the factory. Assuming that the Laser Tracker IP address is set using the default configuration set at the factory of 128.128.128.100, a second network card is required for the camera.

Wireless Mode

1. Access Network Connections via the Control Panel.
2. Right click on the Wireless Control and select Properties.

NOTE: The computer must have wireless capabilities in order to communicate with the TargetCAM via wireless. The TargetCAM is compatible with 802.11b and 802.11g technologies.

3. On the **Wireless Network Communication Properties** window, click TCP/IP and select Properties.
4. Select the **Use the following IP Address** radio button.
5. Manually configure the network as follows:
   - IP Address - **129.129.0.1** If another network connection has the same IP address, please use another address such as 129.129.0.2.
   - Subnet Mask - **255.255.0.0**
   - Click OK to accept the changes.
   - Click OK on the **Wireless Network Connection Properties** window to configure the wireless connection.
6. On the bottom right in the Task bar area, right click the network symbol and select View Available Wireless Networks.

7. The unique SSID of the TargetCAM is “Faro-Camera-P###”. The ### represents the last three digits of the Laser Tracker serial number. Therefore, a Laser Tracker that has a serial number that ends in 600 has an SSID of “Faro-Camera-P600”.
8. Select the correct TargetCAM and check the box for “Allow me to connect to the selected wireless network, even though it is not secure”. Then click Connect.
9. The network should be successfully connected to the TargetCAM. Start the camera application to verify connectivity.

Wired Mode

1. Access Network Connections through the Control Panel.
2. Right click on the network card being used to connect to the camera and select Properties.

   If connecting the network card directly to the camera, a cross-wired cable must be used.
3. On the **Connection Properties** window, click TCP/IP and select Properties.
4. Select the **Use the following IP Address:** radio button.
5. Manually configure the network as follows:
   - IP Address - **129.129.0.1** If another network connection has the same IP address, please use another address such as 129.129.0.2.
   - Subnet Mask - **255.255.0.0**
6. Click OK to accept the changes.
7. Click OK on the Network Connection Properties window to configure the wired connection.
8. The network should be successfully connected to the TargetCAM. Start the camera application to verify connectivity.

Accessing TargetCAM

The TargetCAM interface is accessed through the **Drive Beam** button on the Tracker Pad. See the instructions for your specific application on how to access the Tracker Pad.

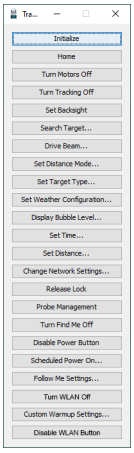


Figure 6-9 TrackerPad Menu

The **Camera Drive** button on the Drive Beam menu is enabled if the appropriate version of software is installed on the PC (version 1.7.0 or newer for the Laser Tracker utilities) and installed on the Laser Tracker (MCU firmware version 3.4.0 or newer). The Laser Tracker must be configured to work with the TargetCAM.

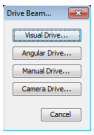


Figure 6-10 Drive Beam Menu

Interacting With The TargetCAM Interface

Once the TargetCAM interface has been opened, it may be used to direct the Laser Tracker to lock on to targets within its field of view. When a target has been acquired, the measurement application (CAM2 Measure or other) may be switched back to for point measurement. This can be done by clicking on the application on the screen or Windows Taskbar. The TargetCAM and application software can also be switched between by pressing Alt+Tab on the keyboard.

The TargetCAM interface can be left in the background and accessed when needed.

TargetCAM Interface

Click the **Camera Drive** button to display the **Camera Drive** dialog box as shown in Figure 6-11. This is the live picture and shows the field of view for the TargetCAM. As the Laser Tracker head moves, this picture changes in real-time, and any targets in this view flash to make them easy to spot. Move the cursor to a particular spot on the picture and left click with the mouse, the Laser Tracker points toward the laser at that location.

Use the **Estimated Range** button to help improve how close the Laser Tracker points to the selected target, especially when choosing targets that are at different distances.

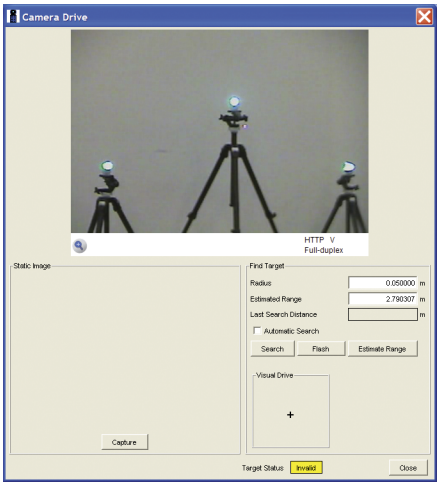
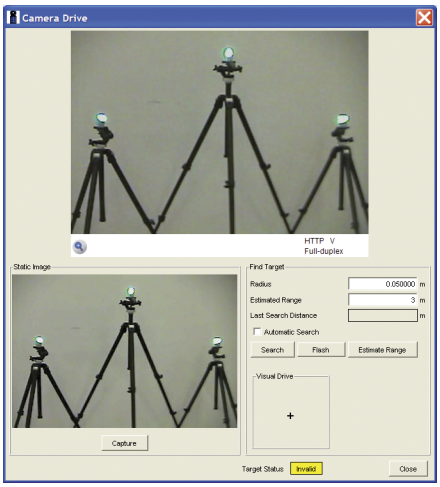


Figure 6-11 Camera Drive

Each key section of the dialog box is explained below.

The **Static Image section** allows you to take a snapshot of the live picture section. This image only changes when the **Capture** button is pressed. This is helpful especially when working with a wide field of targets where targets near the edge of the live picture may fall out of the field of view when the Laser Tracker points at another target. When you move the cursor to a particular spot on the picture and left click with the mouse, the Laser Tracker points the laser toward that location.

Use the **Estimated Range** button to help improve how close the Laser Tracker points to the selected target, especially when choosing targets that are at different distances.



The **Zoom button** allows you to enlarge or shrink the live picture. This is helpful when working with small targets that are far away from the Laser Tracker.

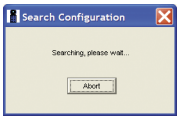
The **Radius box** indicates the Laser Tracker's target search radius of the laser beam at the current Estimated Range during an automatic search or when the **Search** button is clicked.

The **Estimated Range box** indicates the approximate distance to the target. An estimated distance should be within 25% of the true distance to the target for searches to work properly.

The **Last Distance box** indicates the last measured distance to the target and is useful for estimating distances to other targets.

The **Search button** commands the Laser Tracker to perform a search for the target using the laser beam. The maximum search radius is governed by the Radius box.

The **Automatic Search checkbox** indicates whether the Laser Tracker searches automatically after you click on a section of the live or static picture. If this box is selected, the Laser Tracker laser beam searches for the target after the Laser Tracker moves to the specified location.

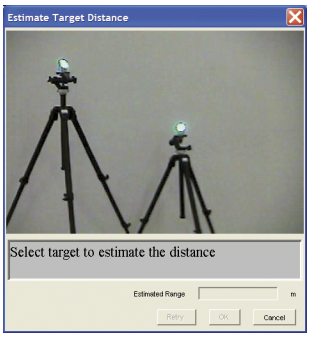


The **Steady button** causes targets to be illuminated at all times. The button changes to **Flash**. Click the **Flash** button to revert to blinking targets and change the button back to **Steady**.

The **Target Status box** indicates whether the Laser Tracker has acquired a target with its laser. *Valid* indicates that the Laser Tracker has a target and can measure it. *Invalid* indicates that no target has not been found.

The **Visual Drive box** allows you to steer the Laser Tracker to a given location. By moving the cursor inside the Visual Drive box and clicking, the Laser Tracker moves in the direction based on the location of the cursor with respect to the center of the box (indicated by +). For example, if you click to the right of center, the Laser Tracker moves right. The speed of movement is based on the distance of the cursor from the center. You can also press the arrow keys on the keyboard to move the axes.

The **Estimate Range button** displays the **Estimate Target Distance** dialog box.



Select a target on the screen and the Laser Tracker measures the distance and switches sights. Select the target again. The two measurements are used to calculate the estimated range to the target. The estimated range improves the ability of the Laser Tracker to locate the target. If no target is found, the Laser Tracker searches for the target.

Chapter 7: Miscellaneous

This chapter covers the miscellaneous accessories available for the Laser Tracker.

Battery Box Kit

Part # C-ACC-08989

FARO Laser Tracker Vantage^{S} and Vantage^{E}only

The FARO Battery Box Kit provides portable power to the Laser Tracker for up to 8 hours. The Battery Box Kit consists of the Battery Box and up to two removable Battery Packs. The Battery Packs are hot-swappable, enabling continuous power to the Laser Tracker.

Figure 7-1 Battery Pack Kit

Operation

The Battery Box Kit supports two modes of operation:

- **Power Mode** - enables the Laser Tracker to be truly portable. This is advantageous when you need to operate the Laser Tracker in areas where AC power is not available.
- **Uninterruptible Power Supply (UPS) Mode** - provides uninterrupted power if the AC power is disconnected, interrupted, sags, or is generally unreliable.

NOTE: The individual Battery Pack does not charge in this mode. Use the Battery Pack Charging Base to charge the Battery Pack. *For more information, see "Battery Pack Charging Base " on page 100.*

Transportation

THE BATTERY BOX KIT CONTAINS HAZARDOUS MATERIAL IN THE FORM OF CLASS 9 LITHIUM-ION BATTERIES

HANDLING, PACKAGING, SHIPPING, AND DISPOSAL MUST BE CONDUCTED IN ACCORDANCE WITH THE LATEST REGULATIONS (IATA/ICAO, DOT 49 CFR, AND IMDG)

For more information,

https://knowledge.faro.com/Hardware/Laser_Tracker/Tracker_Accessories

or contact your Customer Service Representative by Phone, Fax or E-Mail. *See "Technical Support" on page 109.*

General Setup

1. Ensure the Power Switch on the Laser Tracker is in the Off position.
2. Unpack the Battery Box, cable, and battery packs, and tripod hooks.

Figure 7-2 Battery Kit Components

3. Install the battery pack:
   - On the top of the Battery Box, remove the Battery Pack Caps to access the battery compartments. Firmly press along the sides of the cap to release the latch.
   - Position the Battery Pack upside down (with the connector facing down), and rotate so the connectors are aligned.
   - Slide the Battery Pack into the compartment and press until it engages into place.

Figure 7-3 Installing the Battery Pack

   - Replace each Battery Box cap and ensure the latch on both sides engages.

WARNING: Only use the rechargeable battery pack (FARO part # C-ACC-08888) supplied with your Battery Pack Kit. For information on ordering additional or replacement battery packs, contact FARO's Customer Service by Phone, Fax or E-Mail. *See "Technical Support" on page 109.*

Connectors, Power Switch, and Indicators

The Battery Box contains the following connectors, switches and indicators:

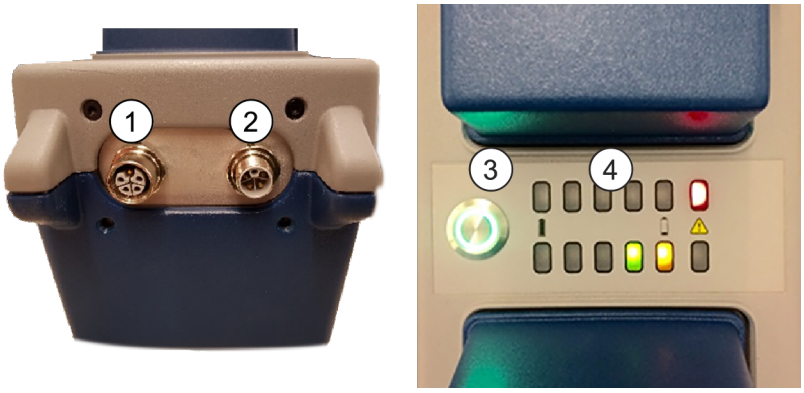


Figure 7-4 Battery Box Connectors, Power Switch, and Indicators

1. DC Output Connector
   - UPS and Power Modes
   - Connects to the rear of the Laser Tracker using the DC Power Cable (FARO part # C-CBL-08701)
2. DC Input Connector
   - UPS Mode only
   - Connects to the Laser Tracker Power Supply using the DC Power Cable (FARO part # C-CBL-08701)
3. Power On/Off Switch
   - Switch to turn the power On/Off
   - Lights Green when On
4. Battery Power LEDs
   - Five segment LEDs indicating capacity in 20% increments
   - An Alarm LED indicates empty battery (solid) or a battery failure (blinking)
   - One set of LEDs for each Battery Pack slot

Power Mode Setup

Place the Battery Box on the ground or hang it from the center post of the Folding Tripod (FARO part # 15531) using the specialized hook mount (FARO part # C-MET-09072). *For more information, see "Tripod Mount" on page 97.*

1. Ensure the Power Switch on the Battery Box is Off.
2. Ensure the Power Switch on the Laser Tracker is Off.
3. Connect the DC Power Cable (FARO part # C-CBL-08701) to the DC Output connector on the Battery Box.
4. Connect the other end of the DC Power Cable to the DC Input connector on the Laser Tracker.
5. Press the Power Switch on the Battery Box to turn in On.
6. Press the Power Switch on the Laser Tracker to turn it On.

Uninterruptible Power Supply Mode Setup

Place the Battery Box on the ground or hang it from the center post of the Folding Tripod (FARO part # 15531) using the specialized hook mount (FARO part # C-MET-09072). *For more information, see "Tripod Mount" on page 97.*

1. Ensure the Power Switch on the Battery Box is Off.
2. Ensure the Power Switch on the Laser Tracker is Off.
3. Connect the DC Power Cable (FARO part # C-CBL-08701) to the DC Output connector on the Battery Box.
4. Connect the other end of the DC Power Cable to the DC Input connector on the Laser Tracker.
5. Connect a second DC Power Cable to the DC Input connector on the Battery Box.
6. Connect the other end of the DC Power Cable to the DC Output connector on the Laser Tracker Power Supply (FARO part # C-SUB-09022).
7. Connect the AC Power cable (FARO part # C-CBL-08768) to the AC Input connector on the Laser Tracker Power Supply.
8. Connect the other end of the AC Power cable to your power source.
9. Press the Power Switch on the Battery Box to turn it On.
10. Press the Power Switch on the Laser Tracker to turn it On.

Removing a Battery

1. On the top of the Battery Box, remove the Battery Pack Cap to access the compartment. Firmly press along the sides of the cap to release each latch.
2. Hold the Base Unit and grasp the Battery Pack. Firmly pull it out.
3. Replace the Battery Pack Cap and ensure the latch on both sides engages.

NOTE: Store the Battery Pack properly when not in use.

Operation

The Battery Box operates with a single or dual battery packs and provides portable power to the Laser Tracker for up to 8 hours (4 hours for each battery pack). The second compartment allows for the "hot swapping" of a single battery without losing power to the Laser Tracker.

Turn On the Battery Box:

- Press the Power Switch to turn the Battery Box on and notice the Power Switch lights **green** when the Battery Box is on.
- The Battery Box starts an LED "lamp test", which illuminates all the LEDs and lasts for approximately two seconds.
- When complete, the green LED indicators display the charge level (in 20% increments) of each Battery Pack.
- The **red** LED indicates:
  - **Steady** – Battery Pack charge level is 0, or Battery Pack is not installed
  - **Blinking** – Battery Pack error

CAUTION: Immediately remove a Battery Pack from the Battery Kit that generates an error.

Charging the Battery Pack

Use the Battery Pack Charging Base to charge each Battery Pack. Charge time for a completely empty battery is approximately 6 Hours.

NOTE: The Battery Pack will not charge if the Battery Box is connected to the Power Supply and a power source.

Tripod Mount

The tripod mount includes:

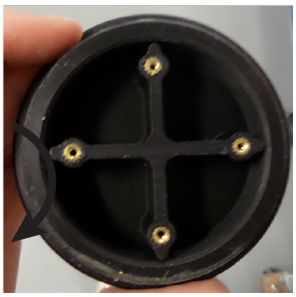
- Hook
- Plate
- Screwdriver
- 4 Screws
- 4 Washers

To install the Tripod Mount:

1. Slide a washer onto each screw.
2. Remove the Plastic Ring from the bottom of the Tripod Tube by turning it in a counter-clockwise direction.

Figure 7-5 Removing the Tripod Plastic Ring

3. Insert the Hook onto the bottom of the Plastic Ring.



Removing the Tripod Plastic Ring

4. Turn the ring over and place the Plate onto the bottom of the Plastic Ring. Insert a screw into each hole of the Plate and thread it into the top of the Hook. Hand tighten each screw with the Screwdriver.

Figure 7-6 Attaching the Plate

5. Install the Plastic Ring to the bottom of the Tripod Tube by turning it in a clockwise direction.

Figure 7-7 Installing the Tripod Plastic Ring

6. Hang the Battery Box Kit from the Hook.

Figure 7-8 Hanging the Battery Box Kit

Battery Pack

Part # C-ACC-08888

The individual battery pack for the Battery Box is a 24V Lithium Ion Smart-Battery. The battery pack includes dual five segment LCD capacity indicators, one for each internal cell. This provides a quick indication of the charge capacity.

Figure 7-9 Battery Pack

The battery pack operating temperature is -32°C (-25°F) to 60°C (140°F).

The battery pack storage temperature is -32°C (-25°F) to 60°C (140°F).

The battery pack cycle life -is > 300 cycles.

Transportation

THIS IS A 230 WATT-HOUR CAPACITY LITHIUM-ION BATTERY CLASSIFIED AS A CLASS 9 HAZARDOUS MATERIAL

HANDLING, PACKAGING, SHIPPING, AND DISPOSAL MUST BE CONDUCTED IN ACCORDANCE WITH THE LATEST REGULATIONS (IATA/ICAO, DOT 49 CFR, AND IMDG)

For more information,

https://knowledge.faro.com/Hardware/Laser_Tracker/Tracker_Accessories

or contact your Customer Service Representative by Phone, Fax or E-Mail. *See "Technical Support" on page 109.*

Charging the Battery Pack

Use the Battery Pack Charging Base to charge each Battery Pack. Charge time for a completely empty battery is approximately 6 Hours.

NOTE: The Battery Pack will not charge if the Battery Box is connected to the Power Supply and a power source.

Battery Pack Charging Base

Part # C-ACC-09312

The Battery Pack Charging Base is an external charging base for a single Battery Pack, (FARO part # C-ACC-08888). The Charging Base includes a mating connector that plugs directly onto the Battery Pack and the connector is keyed for proper insertion. An instruction sheet is included with the charging unit; please refer to this instruction sheet for proper setup and operation. Charge time for a completely empty battery is approximately 6 Hours.

Figure 7-10 Battery Pack Charging Base

WARNING: *Do Not* attempt to charge any battery except but the FARO Laser Tracker Battery Pack (FARO part # C-ACC-08888) in this charging base.

The Charging Base includes dual LED Status indications, one for each internal cell of the Battery Pack. The LED Status indications are:

- **Off** – No battery detected
- **Green blinking** – Charging
- **Green steady** – Charge Complete
- **Red blinking** – Error in battery pack.

Figure 7-11 Charging a Battery

Dual Battery Pack Charging Base

Part # C-ACC-09312

The Dual Battery Pack Charging Base is an external charging base for one or two Battery Packs, (FARO part # C-ACC-08888). The Charging Base includes two slots for charging Battery Packs and the connector is keyed for proper insertion. An instruction sheet is included with the charging unit; please refer to this instruction sheet for proper setup and operation. Charge time for a completely empty battery is approximately 6 Hours.

Figure 7-12 Battery Pack Charging Base

WARNING: *Do Not* attempt to charge any battery except but the FARO Laser Tracker Battery Pack (FARO part # C-ACC-08888) in this charging base.

You can connect this charging base to AC or DC power. Use the proper cable to connect the power. After the making this connection move the power switch to the AC or DC position to power the charging bays.

The Charging Base includes LED Status indications, one for each internal cell of the Battery Pack.

Auxiliary Box

Part # C-ACC-08970-000

FARO Laser Tracker Vantage^{S} and Vantage^{E}only

The FARO Auxiliary Box provides additional connection ports for the Laser Tracker.

Figure 7-13 Auxiliary Box

Currently the Auxiliary Box provides additional connection ports for:

- **Temperature Sensors** - 4 additional ports on the top of the box.
- **External Trigger-Input** - 1 port to trigger the Laser Tracker to measure using an external device.

NOTE: Additional ports are for future Laser Tracker expansion. *Do Not* connect any cables to ports A, C, D, or E.

Setup

To setup the Auxiliary Box:

1. Ensure the Power On/Off button on the rear panel of the Laser Tracker is in the Off position.
2. Unpack the Auxiliary Box and cables.
3. Connect the Auxiliary Box to the Laser Tracker:

Figure 7-14 Connecting to the Laser Tracker

- Use the cable (FARO part # C-CBL-08703-000) and connect port B on the Auxiliary Box to port B on the rear of the Laser Tracker.

4. Connect each Temperature Sensor to the port on the top of the Auxiliary Box.

Figure 7-15 Connecting a Temperature Sensor

NOTE: Temperature sensors and the Multi-use Integrator cable from previous FARO Laser Trackers will not work with this Auxiliary Box.

5. Connect the Multi-use Integrator cable to the port on the Auxiliary Box.

Figure 7-16 Connecting the Multi-use Integrator cable

6. Press the Power On/Off button on the rear panel of the Laser Tracker to power the Laser Tracker.

NOTE: The **blue** LED on the Auxiliary Box illuminates when the Laser Tracker is powered on.

External Trigger-Input

The **External Trigger-Input** port enables measurement requests to be initiated from external equipment, such as PLC equipment. An optional Multi-use Integrator cable (FARO part # C-CBL-08796-000) is available to provide access. The cable has four (4) twisted pair conductors for external access.

FARO CAM2 2020, SmartInspect, FARO Tracker Utilities Measure Pad, and the FARO Software Developer's Kit support this port.

The **External Trigger-Input** to the Auxiliary Box works by using a +3.3 Volt CMOS (+5 Volt tolerant) input signal. The standard way to do this when using isolated contacts is to have the contacts normally open. This allows the internal 2.74 kΩ resistor to pull the signal up to +3.3V. When the contacts are closed, the input is pulled down to ground making this an active low trigger. When the Auxiliary Box senses this change, it causes the Laser Tracker to record a measurement.

The External Trigger-Input uses the White-Brown and Brown wire pair of the Multi-use Integrator cable. The Brown wire is connected to the internal Auxiliary Box ground and the White-Brown wire is the external trigger signal input.

NOTE: Only use the Brown wire from the White-Brown and Brown pair for the ground. Using a wire from another pair can cause improper signaling. Isolate the remaining wire pairs to prevent a short circuit.

To trigger a measurement, FARO recommends opening the contacts for at least 1ms. The Laser Tracker records subsequent measurements for as long as the contact remains open.

Barcode Scanner

Part # 15168

The Barcode Scanner is hand-held and utilizes area imaging technology to read popular linear (1D), stacked linear, and matrix (2D) bar codes.

The scanner has a view finder that projects a bright green aiming beam corresponding to the scanner's horizontal field of view. To read single or multiple symbols (on a page or on an object), hold the scanner at an appropriate distance from the target, pull the trigger, and center the aiming beam on the symbol.

Connecting the Scanner

To install the Barcode Scanner:

NOTE: Install the latest barcode scanner driver before you connect the scanner to your computer. You will need to obtain the driver from FARO. Contact your Customer Service Representative by Phone, Fax or E-Mail. *See "Technical Support" on page 109.*

1. Power the computer down.
2. Connect the interface cable to the scanner.

NOTE: For the scanner to work properly, you must have the correct cable for your type of terminal/computer.

3. Plug the USB connector into a USB port on your computer.
4. After you have connected the scanner to your computer, turn on the computer.
5. Your computer will recognize the scanner, and you can begin scanning.

Maintenance

The scanner provides reliable and efficient operation with a minimum of care. Although specific maintenance is not required, the following periodic checks ensure dependable product operation:

Cleaning the Scanning Window

Reading performance may degrade if the scanner's window is not clean. If the window is visibly dirty, or if the scanner isn't operating well, clean the window with a soft cloth or lens tissue dampened with water (or a mild detergent- water solution). If a detergent solution is used, rinse with a clean lens tissue dampened with water only.

Cleaning the Scanner Housing

The scanner is IP54 rated when the cable is attached, meaning that means that liquids and dusts will not penetrate into the housing; however, the scanner should never be submerged in water or other liquids. It is also good practice to dampen the cleansing cloth vs. spraying the scanner directly.

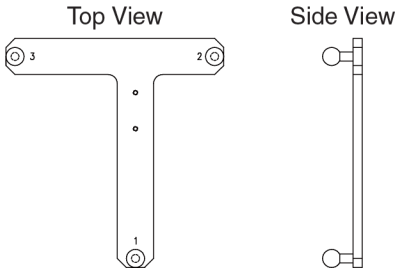
Interface Cable

Inspect the scanner's interface cable and connector for wear or other signs of damage. A badly worn cable or damaged connector may interfere with scanner operation. Should the cable be damaged, the cable can be replaced in the field.

Leapfrog Jig

Part # IG-1

The Leapfrog Jig is a set of three tooling spheres mounted in a triangular shape on a single piece of steel. Use this jig with the **Move Device** command and increase the measuring volume of the Laser Tracker.



Leapfrog Magnetic Spheres

Leapfrog Magnetic Spheres and the Leapfrog Magnetic Cone Tips are used to protect the part you are measuring. They come with an adjustable magnetic base and can be ordered as a single sphere or cone tip, as a kit with three spheres, or a kit with three cone tips. You also receive an Allen wrench and an open-ended wrench to adjust the height of the feet on the magnetic base.

Adjusting the Height

To adjust the height of the feet:

1. Place the Allen wrench in the socket of the Allen screw and turn the Allen screws until the desired height of the feet is obtained.

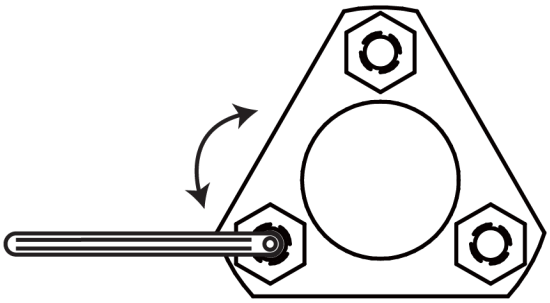


Figure 7-17 Top View

2. Tighten the lock nuts with the open-ended wrench.

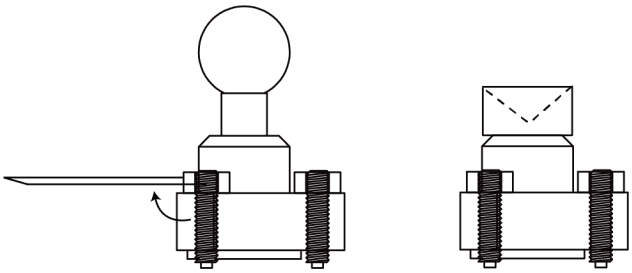


Figure 7-18 Side View

Listed below are the part numbers of the single sphere, single cone tip, the sphere kit, and magnetic cone tip kit.

- Leapfrog Magnetic Sphere (single sphere) - Part # ACCS0023
- Leapfrog Magnetic Sphere Kit (includes three spheres) - Part # ACCS0078
- Leapfrog Magnetic Cone Tip (single cone) - Part # ACCS0026
- Leapfrog Magnetic Cone Tip Kit (includes three cone tips) - Part # ACCS0039

Temperature Sensor

Part # 15167

The Temperature Sensor works directly with the USB port on your PC, and has a measurement accuracy up to ca. 0.1°C. The calibrated digital sensor head is capable of high speed measurements (about 20 measurements per

second) and features an integrated USB 1.1 interface with all electronics completely integrated into the USB connector. No external power supply is needed.

NOTE: You will need to obtain the temperature sensor driver from FARO. Contact your Customer Service Representative by Phone, Fax or E-Mail. *See "Technical Support" on page 109.*

The temperature range is -10°C to +60°C. To prevent damage to the sensor, do not expose it to temperatures below -20°C and over +60°C.

Cable length is 2 meters.

Trigger Cable Assembly

Trigger Cable Assembly - Vantage
Part # C-CBL-04297-000-03

Trigger Cable Assembly - ION
Part # 288-02872

The Laser Tracker is capable of recording measurements at the command of a remote trigger connected to the Master Control Unit (MCU) external trigger port. The FARO Trigger Cable Assembly allows for remote use of the trigger from an external controller, and includes a two pin trigger connector and 3 meter cable.

Both cables are a shielded 3 meter cable that can be used to connect the MCU to the controlling device. The cable can be as long as is physically required for the application provided that the voltage at the MCU is at least +3V. A shielded cable is recommended for use in electrically noisy environments.

Vantage Systems

The Laser Tracker Vantage MCU has an External SYNC, or Remote Input Trigger, port that you can use to synchronize measurements with another controller, such as a robot, CNC, or other external device.

FARO CAM2 2020, CAM2 Measure, FARO Tracker Utilities Measure Pad, and the FARO Software Developer's Kit support this port.

Remote Triggering

The trigger input to the MCU works by using a +3.3 Volt CMOS (+5 Volt tolerant) signal. The standard way to do this when using isolated contacts is to have the contacts normally open. This allows the internal 2.74 kΩ resistor pull the signal up to +3.3V. When the contacts are closed, the input is pulled down to ground making this an active low trigger. When the MCU senses this change, it records a measurement.

The trigger uses the Green/Black wire pair of the MultiUse Integrator Cable. The Black wire is connected to the internal Tracker ground and the Green wire is the trigger signal input.

NOTE: Only use the Black wire from the Green/Black pair. Using a Black wire from another pair can cause improper signaling. Isolate the remaining wire pairs to prevent a short circuit.

To trigger a measurement, FARO recommends opening the contacts for at least 1ms. The MCU records subsequent measurements for as long as the contact remains open.

Signaling Another Device

There are two options for the Vantage MCU to signal another device that a measurement has started, CMOS (+3.3V logic) and RS485 Differential.

1. **CMOS**

   To use the CMOS output signal, use the Red/Black wire pair of the MultiUse Integrator Cable. Connect the Black wire to ground and connect the Red wire to the input device. The signal from the Red wire will be below +0.6V when measuring is active and higher than +2.2V when measuring is inactive.

NOTE: Only use the Black wire from the Red/Black pair. Using a Black wire from another pair can cause improper signaling. Isolate the remaining wire pairs to prevent a short circuit.

2. **RS485 Differential**

   To use RS485 Differential, the Blue and Black pair of the MultiUse Integrator Cable are connected to an RS485 driver which provides a minimum 2 Volt differential output into a 100 Ohm load. The Black wire is (–) Negative and the Blue wire is (+) Positive.

NOTE: Only use the Black wire from the Blue/Black pair. Using a Black wire from another pair can cause improper signaling. Isolate the remaining wire pairs to prevent a short circuit.

ION Systems

The trigger input to the MCU works by using a +3.3V (+5V tolerant) signal. The standard way to do this when using isolated contacts is to have the contacts Normally Closed and supplying between +3.3V and +5V to the trigger input. When the contacts are opened, the input is pulled down by an internal 50 Ohm resistor making this an active low trigger. When the MCU senses this change, a measurement is taken.

To trigger a measurement, FARO recommends opening the contacts for at least 1ms. The MCU will take subsequent measurements for as long as the contact remains open.

The cable from the machine controller to the MCU can be as long as is physically required for the application, provided that the voltage at the MCU is at least +3V. FARO recommends a shielded cable for use in electrically noisy environments. On the MCU's trigger port, connect the top pin to the positive voltage and connect the bottom pin to ground.

Technical Support

FARO Technologies, Inc. is committed to providing the best technical support to our customers. If you have any problem using one of our products, please follow these steps before contacting our Technical Support Team:

- Be sure to read the relevant sections of the documentation to find the help you need.
- Visit the FARO Customer Care area on the Web at *www.faro.com* to search our Knowledge Base. This is available 24 hours a day 7 days a week.
- Document the problem you are experiencing. Be as specific as you can. The more information you have, the easier the problem will be to solve.
- If you still cannot resolve your problem, have your device's Serial Number available *before calling*.

Support Hours (Monday through Friday)

North America:
8:00 a.m. to 7:00 p.m. Eastern Standard Time (EST).

Europe:
8:00 a.m. to 5:00 p.m. Central European Standard Time (CET).

Asia:
8:30 a.m. to 5:30 p.m. Singapore Standard Time (SST).

Japan:
9:00 a.m. to 5:00 p.m. Japan Standard Time (JST).

China:
8:30 a.m. to 5:30 p.m. China Standard Time (CST).

India:
9:30 a.m. to 5:30 p.m. India Standard Time (IST).

You can also e-mail or fax any problems or questions 24 hours a day.

Phone

North America:
800 736 2771, +1 407 333 3182 (Worldwide)

Mexico:
001-866-874-1154

Brazil:
0800-047-4271, +55 11 3500-4600

Europe:
+800 3276 7378, +49 7150 9797-400 (Worldwide)

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E-Mails or Faxes sent outside regular working hours usually are answered before 12:00 p.m. the next working day. Should our staff be on other calls, please leave a voice mail message; calls are always returned within 4 hours. Please remember to leave a description of your question and your device's Serial Number. Do not forget to include your name, fax number, telephone number and extension so we can reach you promptly.

End User Documents

All documents related to the Software End User License Agreement, Purchase Conditions, and FARO Products Service Policy can be found on the FARO Knowledge Base at the following URL: *https://knowledge.faro.com/Essentials/General/FARO_End_User_License_Agreement_Location*.

Glossary

3

3D
Three dimensional

A

Accuracy
The deviation between the measured value and the nominal or actual value.

B

Best Fit
Creating a feature that fits a set of points so each point is the shortest distance to the feature.

Bluetooth
Bluetooth is a wireless technology standard used for exchanging data between fixed and mobile devices over short distances using short-wavelength UHF radio waves in the industrial, scientific and medical radio bands,and building personal area networks (PANs).

Button
Refers to the switches on the Laser Tracker.

C

Calibration
A series of measurements that check the accuracy of the Laser Tracker against known standards.

Capture (of data)
Digitizing or Scanning. Storing data points in the computer system. See also "Digitizing." See also "Scanning."

Circle
A closed planar curve in which every point on the curve is equidistant from the center.

Circularity
Circularity measures the form deviation of a circle.

CMM
Coordinate Measuring Machine

Collinear
Data points which lie on the same line.

Compensated points
Refers to the compensation for the radius of the SMR.

Compensation
The procedure by which the Laser Tracker is optimized to perform accurate measurements. Thousands of data points are captured to determine the true geometry and kinematics of each Laser Tracker. This electronic “finger print” is stored on the device.

Coordinate Measuring Machine (CMM)
These machines capture 3D data from objects to give the position (XYZ) of the object.

Coordinate System
A system of representing points in a space of given dimensions by coordinates, such as the Cartesian coordinate system or the system of celestial longitude and latitude. A

coordinate system is a system by which uses one or more features, or coordinates, to uniquely determine the position of a point or other geometric element as a frame of reference.

Custom tooling
Tooling for the Laser Tracker that attaches to tartgets and SMRs.

Cylinder
A geometric feature formed by extruding a circle along its centerline in a direction normal to its plane.

Cylindricity
Cylindricity measures the form deviation of a cylinder.

D

Datum
A datum (plural datums or data) is a reference from which measurements are made. In engineering and drafting, a datum is a reference point, surface, or axis on an object against which measurements are made.

Datum Coordinate
The XYZ values of a feature used to establish an alignment.

Device
A piece of equipment or a mechanism designed to serve a special purpose or perform a special function. Measurement device; FARO CAM2 2020.

Dial indicator
Dial indicators are instruments used to accurately measure a small distance. They may also be known as a Dial Gauge, Dial Test Indicator (DTI), or as a “clock”.

Diameter
The width of a circular of cylindrical feature.

Digitizing
Storing data points in the computer system. See also "Scanning."

DRO
Digital ReadOut. The display of XYZ coordinates on the screen.

E

Electrostatic Discharge (ESD)
Electronic pulses generated by the discharge of loaded objects and/or people.

End Click
To accept collected readings by pressing the H keyboard shortcut.

ESD
Electronic pulses generated by the discharge of loaded objects and/or people.

Ethernet
Ethernet is a family of computer networking technologies commonly used in local area networks (LAN), metropolitan area networks (MAN) and wide area networks (WAN).

F

Flatness
Flatness measures the form deviation of a plane.

Form
The maximum bandwidth (Max. Error added to the Min. Error) of error that a set of measured points deviates from the true form of the resultant feature calculated from that set of points.

H

Hardware
Refers to the mechanical portion of a computer-based system. Opposite of Software.

Hot Keys
See also "Keyboard Shortcuts."

I

Inputting
Refers to the keying in of data.

Intersection
A meeting or crossing at a point.

ISO
International Organization for Standardization

J

Jump drive
See also "USB Drive."

K

Key-in
To manually enter data using a keyboard.

Keyboard Shortcuts
One keystroke commands which invoke a software function.

M

Max. (Maximum) Error
The largest distance from a reading above or outside a best-fit feature.

Maximum Permissible Error (MPE)
The extreme value of measurement error, with respect to a known reference quantity value, permitted by specifications or regulations for a given measurement, measuring instrument, or measuring system.

Measure
To capture data points to determine the size, position, and form of feature. See also "Digitizing" and "Scaning."

Min. (minimum) Error
The largest distance from a reading below or inside a best-fit feature.

N

NIST
National Institute of Standards and Technology

O

Origin
The point from which the axes of a coordinate system emanate.

Orthogonal coordinates
Coordinates which are perpendicular.

P

Plane
A geometric feature defined by a point and a vector. A flat surface.

Plane Compensation
The movement of a measured plane in a direction the distance of the SMR radius.

R

Readout
The visual display of data on a computer screen. See also "Digital ReadOut."

Repeatability
The ability of a device to obtain consistent results. Although the terms are generally used interchangeably, repeatability differs from accuracy in that a device can consistently obtain the wrong result.

Resolution
The number of decimal places that a measurement device can reliably display.

Right Hand Rule
A coordinate system where the positive direction of each axis is described by three fingers of the right hand.

Rotation
Angular motion about a specified point or axis.

Roundness
The deviation of the measured data points from the true form of the resultant circle.

S

Scanning
To capture large quantities of data points quickly and storing the points in the computer system. See also "Digitizing."

SMR Compensation
The ability of the software to account for the distance between the SMR point of contact with the surface being measured and the center of the SMR. Measured readings are moved this distance in a specific direction during the calculation of a feature. Gross errors can result if this is not done correctly. See also "Compensation."

Software
Refers to the application of a computer-based system. Opposite of Hardware.

Spherically Mounted Retroreflector (SMR)
Spherically Mounted Retroreflector The probe for the Laser Tracker

Stream
A continuous input of data points.

T

Temperature Compensation
The ability of a measurement device to adjust to changes in ambient temperature. A measurement device that is temperature compensated will maintain its accuracy through a wide range of temperatures. A device that is not temperature compensated cannot.

Thread
A screw thread. A machined surface with a helical shape. Normally parts are fastened together with a screw and a threaded hole or a threaded bolt and nut.

Thread mount
A metal piece that is used as an interface between a mating thread and a tripod or a mating thread and a table mountable device.

Tolerance
A zone of accuracy in both size and placement of a feature. For example, a hole of a diameter of 1.00 ± 0.01 located at the x, y, z of 1.000, 1.000, 0.000 ± 0.005 means a 1 unit diameter hole can be between 1.01 and 0.99 in size and the location can be plus or minus 0.005 units from the specified nominal location. You determine the quality of a part by comparing your actual values to the nominal values within a tolerance range.

Traditional CMM
There are many types of CMMs that fall into this category. These include the bridge type, cantilever type, gantry type, etc. These are floor-mounted machines that require you to bring the parts to the CMM, unlike FARO's "portable" CMM, the Laser Tracker.

U

Unit Vector
A directional line with a non-dimensional magnitude of one. The line may be associated with the normal vector of a surface at a specific location. The vector is described in relation to the current alignment using the letters I, J, and K that are associated to X, Y, and Z.

Universal Serial Bus (USB)
Universal Serial Bus (USB) is an industry standard that establishes specifications for cables and connectors and protocols for connection, communication and power supply (interfacing) between computers, peripherals and other computers.

USB
Universal Serial Bus (USB) is an industry standard that establishes specifications for cables and connectors and protocols for connection, communication and power supply (interfacing) between computers, peripherals and other computers.

USB Drive
A storage device integrated with the USB interface.

V

Vector
A term used to describe the direction of a line or object that may or may not have a magnitude. The line may be associated with the normal vector of a surface at a specific location. The vector is described in relation to the current alignment using the letters I, J, and K that are associated to X, Y, and Z.

Volume
The amount of space occupied in three dimensions.

X

X, Y, Z

Refers to the Cartesian Coordinate System for three-dimensional space.

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