

# FOCUS 50 TOTAL STATION

## USER GUIDE



**Legal Notices**

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**Release Notice**

This is the October 2021 release Revision A of the *Spectra Geospatial FOCUS 50 Total Station User Guide*, P/N 57045052-ENG. It applies to the Spectra Geospatial® FOCUS® 50 total stations.

The original document is written in English. All documents in other languages are translations from the original English document.

**Product Warranty Information**

For applicable product warranty information, please refer to the Warranty Card included with this Spectra Geospatial product, or consult your Spectra Geospatial dealer.

**Regulatory Information**

For applicable regulatory information, please refer to the *Spectra Geospatial FOCUS 50 Total Station Regulatory Information Document* included with this Spectra Geospatial product, or consult your Spectra Geospatial dealer.

**Registration**

To receive information regarding updates and new products, please contact your local dealer or visit [www.spectrageospatial.com](http://www.spectrageospatial.com). Upon registration you may select the newsletter, upgrade or new product information you desire.

## Safety Information

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For safety information please refer to the *Spectra Geospatial FOCUS 50 regulatory information document* delivered with the product.

### **ESD Information**

The instrument has been tested and complies with ESD regulations.

The Panel Attachment Cover P/N 50019052 should be attached for full ESD and environmental protection.





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# Introduction

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**Welcome** Welcome to the Spectra Geospatial FOCUS 50 Total Station user guide. This manual describes how to set up and use the Spectra Geospatial FOCUS 50 total station. Even if you have used an optical total station before, Spectra Geospatial recommends that you spend some time reading this manual to learn about the special features of this product.

The FOCUS 50 total station is available in several models and configurations.

Through out this user guide the Spectra Geospatial FOCUS 50 total station will be referred to as the instrument. If a feature unique for a specific model is described it will be referred to by it's model name.

**Related Information** For more information about this product, please go to [www.spectrageospatial.com](http://www.spectrageospatial.com).

**Technical Assistance** If you have a problem and cannot find the information you need in the product documentation, please contact your local Spectra Geospatial Distribution Partner. To find a Spectra Geospatial Distribution Partner near you, or if you would like to be contacted, visit our Dealer Locator page at: [www.spectrageospatial.com](http://www.spectrageospatial.com)

**Registration** To receive information regarding updates and new products, contact your local dealer or visit the Spectra Geospatial product registration website at [www.spectrageospatial.com](http://www.spectrageospatial.com). When you register your device, you can select the newsletter, upgrade, or new product information. To register your device, you will need the serial number. The serial number is a unique number for your FOCUS 50 total station and is located on a label on the underside of the instrument.



## Getting Started

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**Battery Safety** For battery safety and environmental information, please refer to the *Spectra Geospatial FOCUS 50 regulatory information document* delivered with the product.

**Battery** The instrument battery is a rechargeable Lithium-ion battery. The battery has an integrated power gauge that will display the condition of the battery. The power gauge is activated by pressing the button on the battery.



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

When the button is pushed and all the LEDs flash, the battery needs to be reconditioned in the battery charger.

When the battery capacity is between 0 and 10% one LED is flashing. A battery with a flashing LED might not be able to start an instrument. If started, with a battery with a flashing LED, the operating time will be between 5 and 15 minutes.

**Charging the Battery** The battery is supplied partially charged. Charge the battery completely before using it for the first time.

Please refer to the *Dual Slot Battery Charger User Guide* for more information.

### Connecting an Internal Battery

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

1. Press the battery compartment lock downwards to unlock.
2. Open the battery compartment.
3. Slide the battery into the battery compartment.
4. Close the battery compartment.



### Connecting an External Power Supply

The instrument has two external connectors in the base of the instrument. Both connectors can be used to connect an external power supply to the instrument. Spectra Geospatial recommends to connect the external power supply to the connector marked 12 V to keep the communication connector marked COM free for communication purposes.

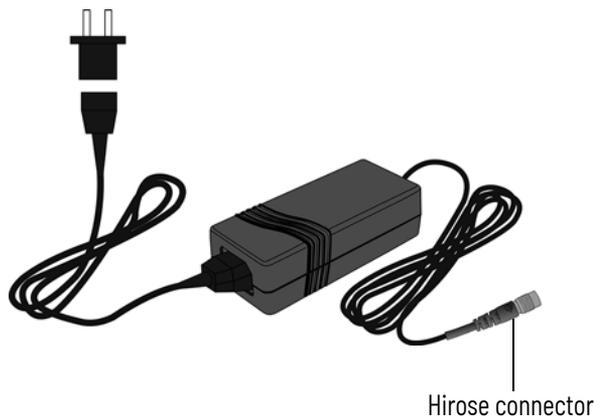
**Note** - Use only an external power supply approved by Spectra Geospatial with the instrument.

### Indoor Instrument Power Supply

A power supply for indoor use is available for the instrument. The power supply has a Hirose connector that connects to the instrument foot connector.

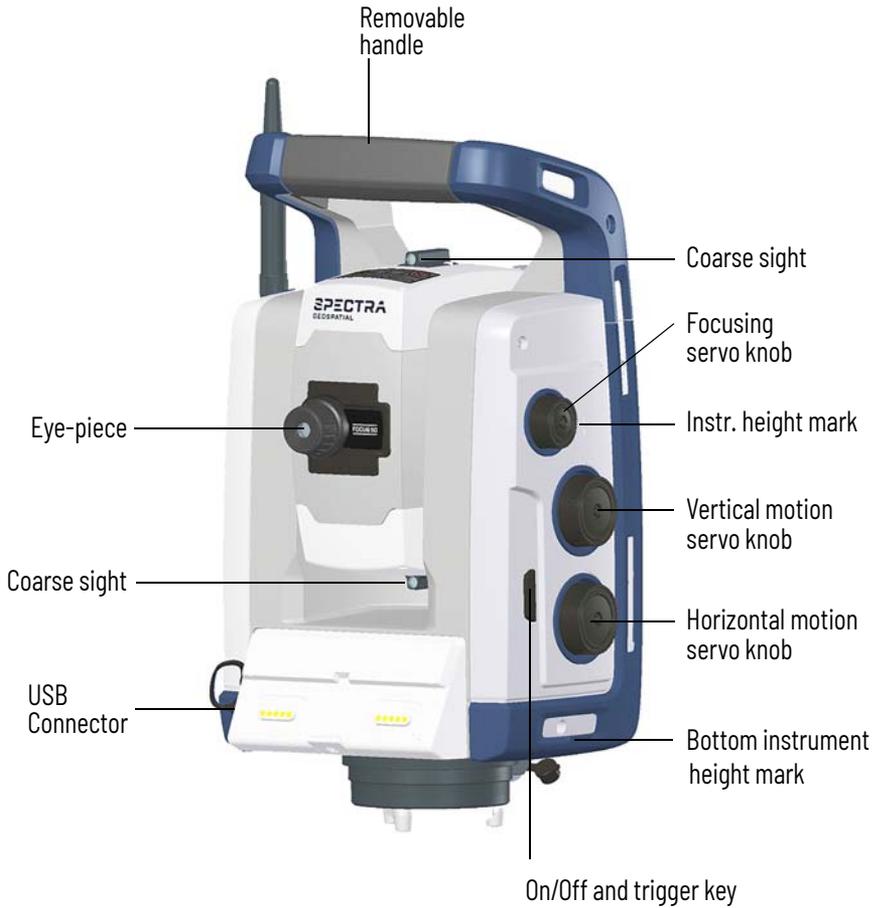


**WARNING** - The optional power supply for the FOCUS 50 total station is intended for indoor use only and shall not be exposed to moisture or liquids.



**Instrument Description**

This section describes the instrument controls. Spectra Geospatial recommends that you take some time to familiarize yourself with the names and the locations of the controls.





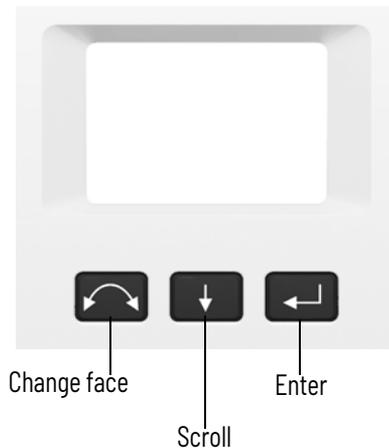
## Trigger Key

When there is no Spectra Geospatial data collector connected to the instrument, the trigger key functions as an On/Off key. An LED in the trigger key indicates if the instrument is turned on. A solid light indicates on and a flashing light indicates suspend mode.

When there is a Spectra Geospatial data collector running a field application software connected to the instrument, the trigger key performs the same function as the Enter key on the Spectra Geospatial data collector.

## Face 2 Display

The face 2 display is a graphical display with a built-in backlight, and three control buttons.



When a secondary function is available on a button, an icon appears at the bottom of the display. To access the secondary function, press and hold the appropriate key.

When a Spectra Geospatial data collector is connected to the instrument, the software running on the unit controls the face 2 display and keyboard, and determines which secondary functions are available. For details on how the software controls the face 2 display, refer to the field software documentation.

When there is no Spectra Geospatial data collector connected to the instrument, and you turn on the instrument using the trigger key, the face 2 display shows an electronic leveling screen.



For information on how to access the compensator menu and instrument setup menu from the face 2 display and keyboard, see *Instrument Setup on page 24*.

### **Optical Plummet**

The instrument is equipped with an optical plummet, which has 2x magnification and a focusing range of 0.5 m to infinity. The instrument can be positioned to an accuracy of 0.5 mm at 1.5 m over a ground mark.



As shown:

- To focus the crosshairs, rotate the eye-piece.
- To focus the optical plummet to the ground, push in or pull out the optical plummet.

For information on how to adjust the optical plummet, see *Adjusting the Optical Plummet on page 58*.

### **Handle**

The handle on the instrument is detachable for measurements in confined spaces, or for instances where the handle obstructs the sighting line.

The instrument handle is placed so that it will not obscure measurements in the face 1 position, or restrict plumbing vertically beneath an overhead marker or sighting up a vertical shaft.

The handle can be removed by:

1. Unscrew the two Torx screws securing the handle to the instrument, use a T30 Torx key.



2. Slide the handle horizontally away from the front of the instrument.



Attaching the handle:

Attaching the handle is completed by reversing the above operations.



**CAUTION** - Make sure that the handle is firmly attached before you lift the instrument.

# Set up

---

**Setup** A stable setup is critical for high precision measurements.

## Setup Stability

When an instrument is setup it is important to consider the following:

1. Set the tripod legs wide apart to increase the stability of the setup. A setup where one leg is placed on e.g asphalt and the other two on soil will still be a stable setup provided that the tripod legs are set wide enough. If it is not possible to set the tripod legs wide apart due to obstacles, then the tripod can be lowered to increase stability.



2. Make sure that all the screws on the tripod and/or tribrach are tightened to avoid any play.
3. Any high quality tripod and tribrach can be used. However, Spectra Geospatial strongly recommends the use of tripod heads made of steel, aluminum or similar material. Tripod heads of fiberglass or other composite materials are not recommended.

See *Servo Technology* on page 71 for more information.

## Measurement Stability

Take into account that instruments require sufficient time to adjust to the ambient temperature. The following rule-of-thumb for a high precision measurement applies:  
Temperature difference in degree Celsius (°C) x 2 = duration in minutes required for the instrument to adjust to the new temperature.

Avoid sighting across fields with intense heat shimmer by sun light, e.g. at noon.

## Starting the Instrument

**Note** - Before following any of the instructions below, put the instrument in the face 2 position, i.e. the telescope eyepiece and face 2 keyboard and display are pointing towards you.

The face 2 display menus described in this chapter can only be accessed when there is no Spectra Geospatial data collector connected, please disconnect the Spectra Geospatial data collector before starting the instrument.



**WARNING** - Do not touch or look into coaxial optics while the instrument is running.

Start the instrument by pressing the trigger key.



Angle accuracy of instrument

Instrument model

Once you start the instrument, the **Select Mode** menu appears in the face 2 display.

To go to **Setup/Level** press .



**Note** - If no selection is made within 10 seconds the instrument will go to suspend mode. To return to the select mode menu press the trigger key.

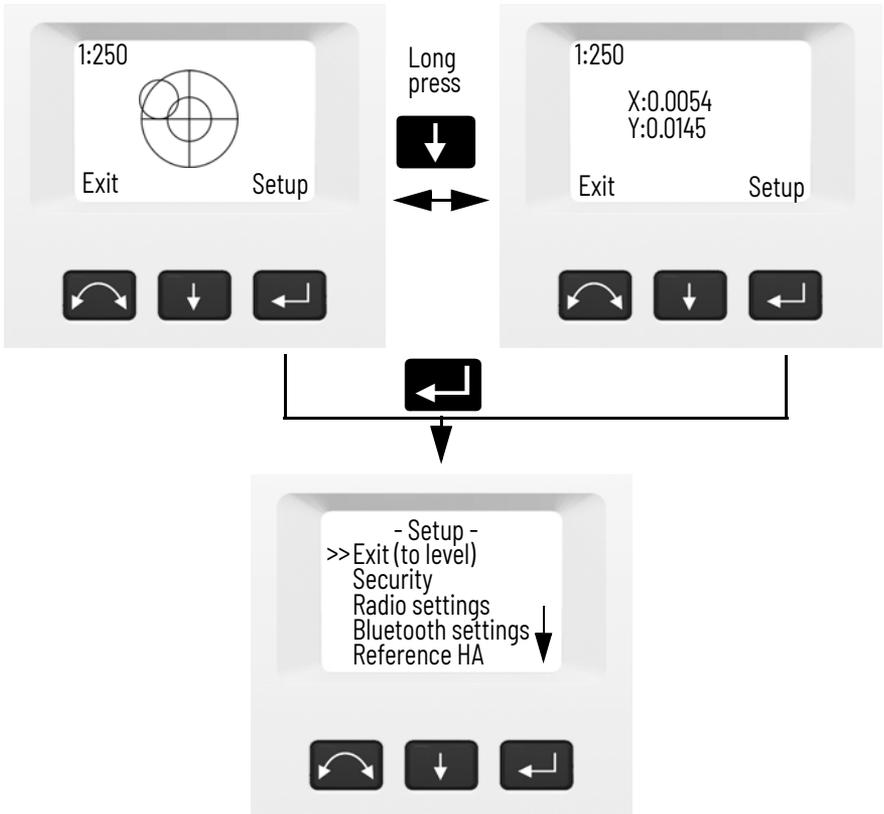
## Leveling

Once you have selected Setup/Level, the face 2 display appears with the electronic bubble for leveling. If there is a Spectra Geospatial data collector connected, the Spectra Geospatial data collector software controls the face 2 display. To toggle between a graphical or numerical display make a long press on .

To change the graphical displays sensitivity (zoom) make a short press on .

To accept and enter the **setup** menu press .

**Note** - Due to the high speed servo it is important to use a high quality tripod and tribrach.



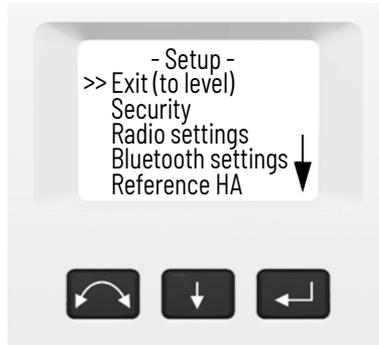
**Note** - If the instrument is inactive for longer than 300 seconds (5 minutes) it will go to suspend mode. See *Power Management* on page 73

## Instrument Setup

With the face 2 display, you can access a number of instrument functions and routines without a Spectra Geospatial data collector connected:

In the leveling display select **Setup** by pressing , the **Setup** Menu appears:

**Note** - It is possible to access the instrument setup menu without leveling the instrument.



The instrument **Setup** menu is structured as follows:

- Exit (to level)
- Security settings. See *Security* on page 25.
- Radio settings. See *page 31*.
- Bluetooth<sup>®</sup> wireless technology settings. See *Bluetooth Device Settings* on page 35.
- Reference Horizontal Angle. See *page 37*.
- Adjustments. See *page 37*.
  - Back
  - Compensator calibration. See *page 38*.
  - HA/VA and trunnion axis collimation. See *page 40*.
  - Tracker collimation. See *page 46*.
  - Laser pointer on/off. See *page 47*.
  - Autofocus calibration. See *page 49*.
- Firmware version and instrument configuration information. See *page 50*.
- Service info. See *Service Info* on page 51.
- Language settings. See *Select Language* on page 51.

## Security

To avoid unauthorized use of the instrument a PIN/PUK security code can be activated by the user.

## PIN Code

The PIN Code is a four digit code where each digit can be set between 0-9 e.g. "1234". The PIN Code can be activated and changed by the user.

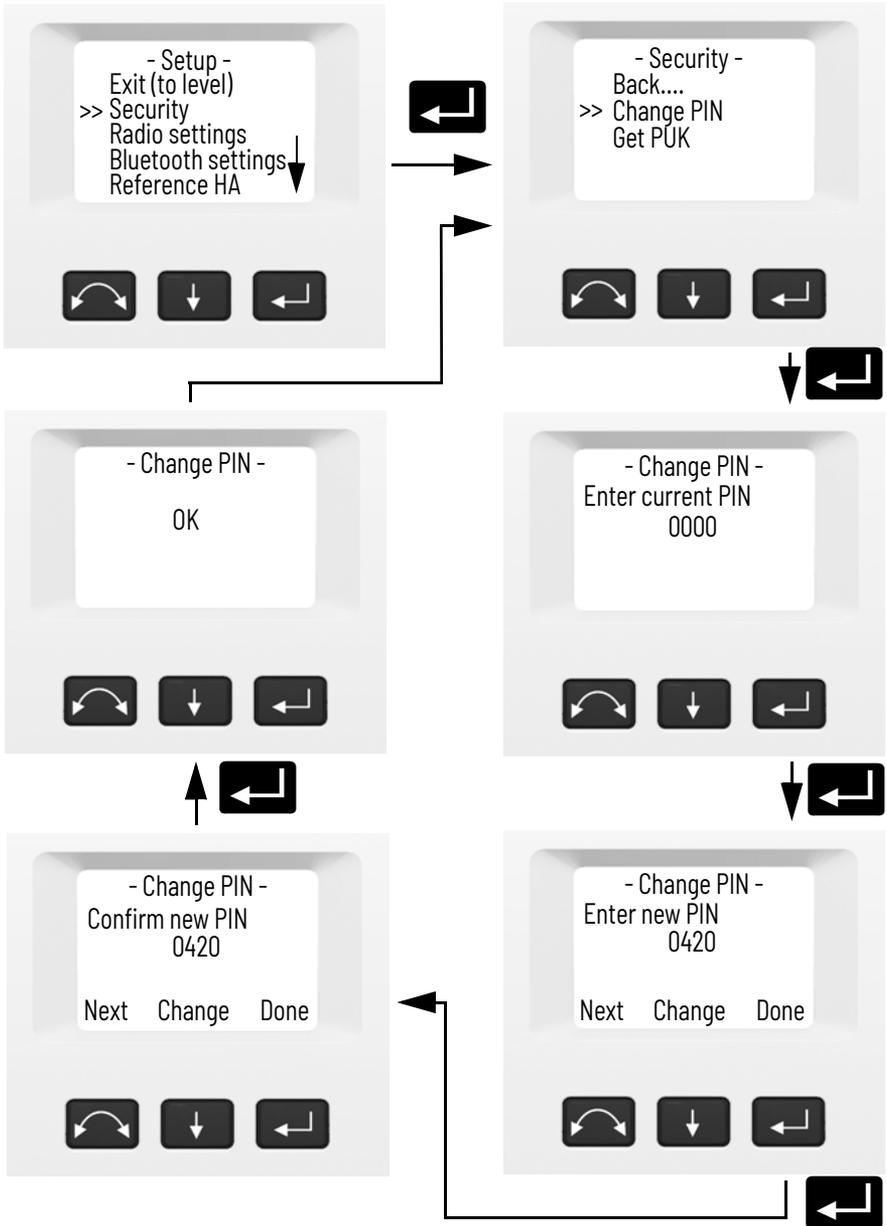
As default the PIN Code is set to "0000". With this code set the security is not activated and the user will not be prompted to enter PIN Code at start up.

**Note** - If the wrong code is entered more than 10 times, the instrument will be locked and the PUK Code needs to be entered.

### Activate or Change PIN Code

To activate the security PIN Code or change the PIN Code:

1. Press  to scroll to **Security** and then press .
2. Press  to scroll to **Change PIN** and then press .
3. Enter the current PIN Code. The underlined digit is selected for change.
4. Press  to change the digit to the correct number.
5. Press  to select the next digit.
6. When all four digits have been set to the correct PIN code press .
7. Enter the new PIN Code of your choice and press , follow the instructions 3a, 3b and 3c
8. To confirm the PIN Code press .

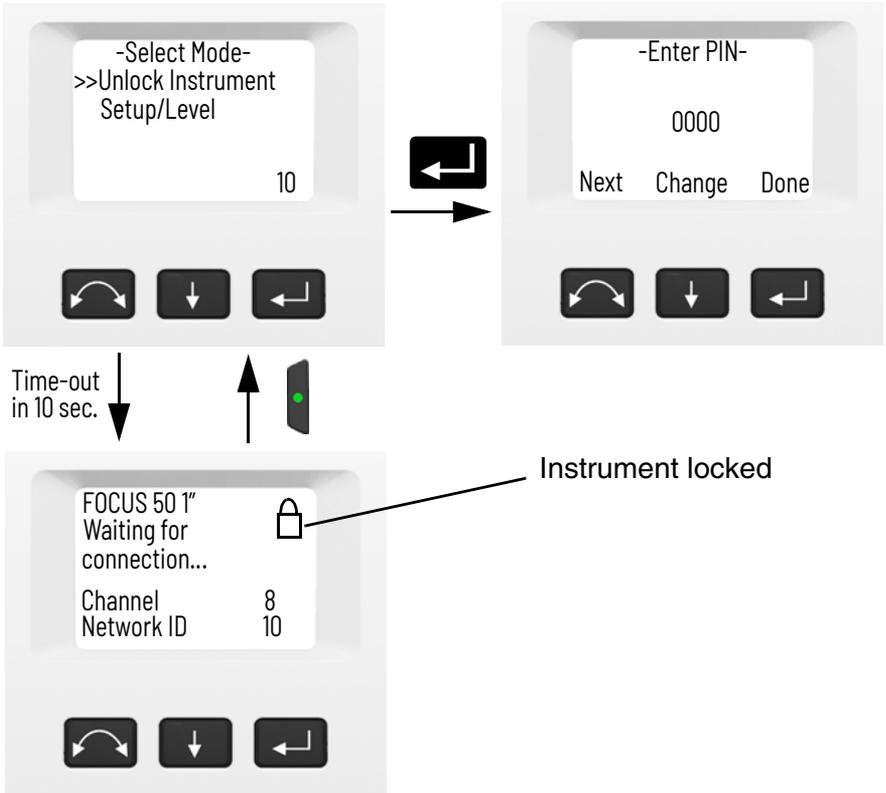


9. Press  to scroll to **Back....** and then press  to return to the **Setup** menu.

## Unlock Instrument With PIN Code

When the security PIN Code has been activated, the PIN Code needs to be entered at start up.

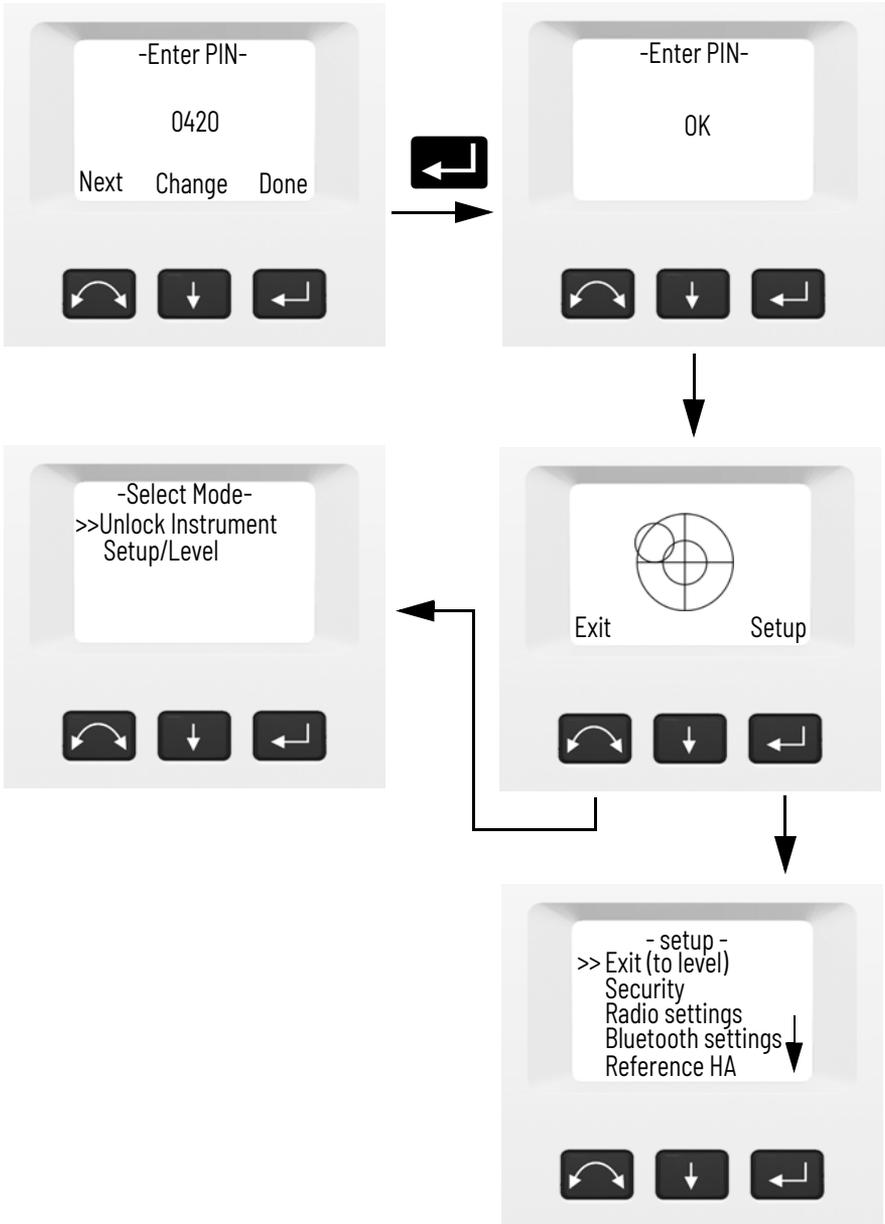
To unlock the instrument select **Unlock Instrument** and press



**Note -** If no selection is made within 10 seconds the instrument will go to suspend mode. To return to the select mode menu press the trigger key.

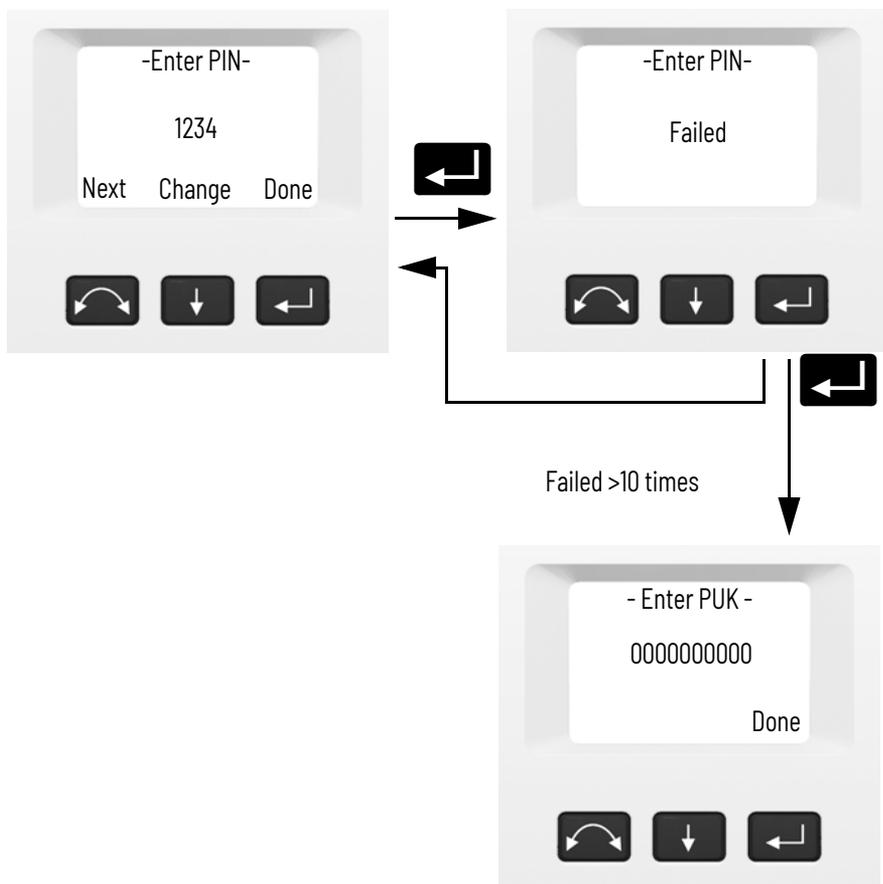
The PIN code is a four digit number. The underlined digit is selected for change.

1. Press to change the digit to the correct number
2. Press to select the next digit.
3. When all four digits have been set to the correct PIN code press .



If the wrong PIN Code is entered more than ten times, you will be prompted to enter the PUK Code.

When the correct PUK Code has been entered, the PIN Code will be reset to "0000". This means that the PIN Code security will be inactivated.



### **PUK Code**

The PUK Code is a ten digit code where each digit is set between 0-9 e.g. "0123456789". The PUK Code can not be changed by the user.

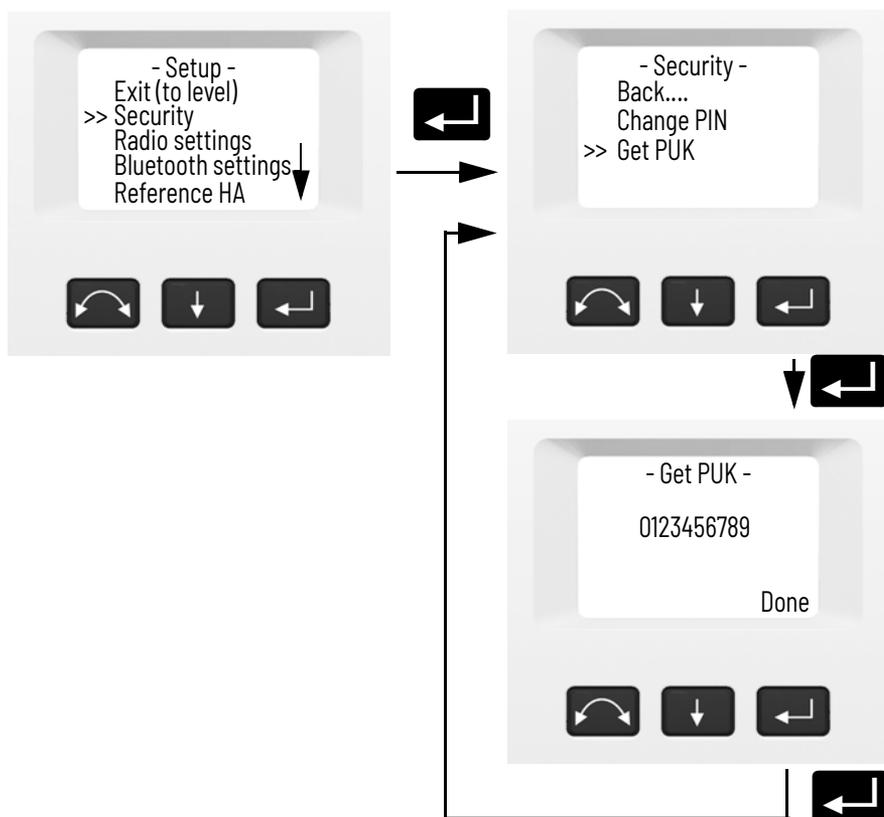
The PUK Code is set at the factory. A document with the PUK Code is supplied to the user when the instrument is delivered. Please save this document in a safe place.

**Note** - If the PUK code has been lost, please contact your authorized Spectra Geospatial distributor to retrieve the PUK code.

**Note** - The PUK Code is needed to unlock the instrument if wrong PIN Code has been entered more than ten times.

You can read out the PUK Code from the instrument:

1. Press  to scroll to **Security** and then press .
2. Press  to scroll to **Get PUK** and then press .
3. Press  to return to the **Security** menu.

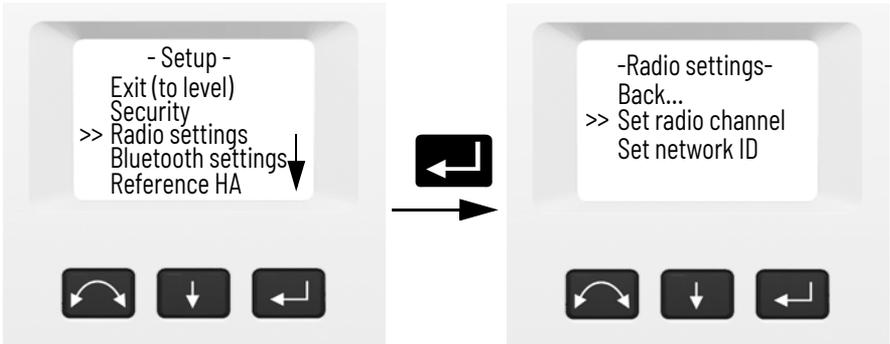


### Radio Settings

In the **Radio settings** menu it is possible to set the radio channel and network ID number.

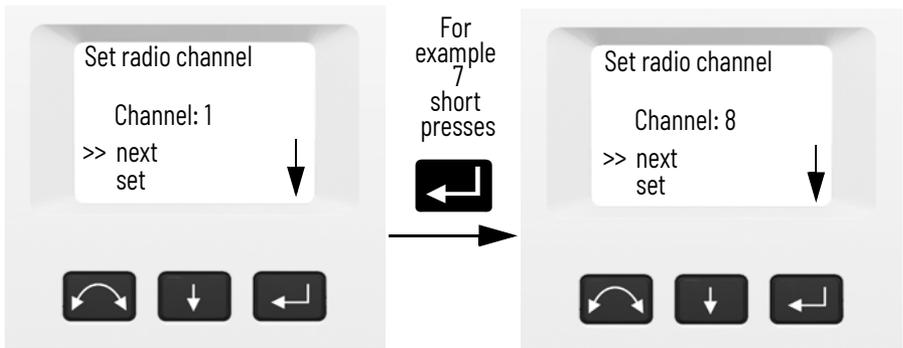
### Set Radio Channel

1. Press  to scroll to **Radio settings** and then press .
2. Press  to scroll to **Set radio channel** and then press .

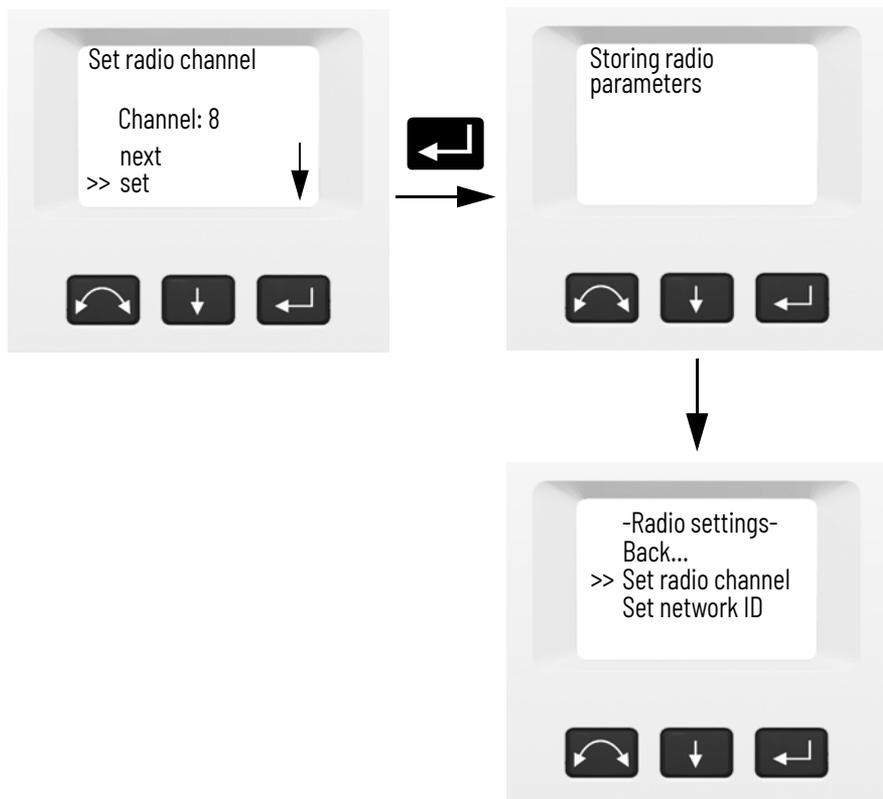


3. To change the radio channel number press  to select **Next** and then press  to change the channel number in the display.

**Note** - A short press on the enter key will increment the radio channel in increments of 1. Pressing and holding the enter key, will increment the radio channel in steps of 10.



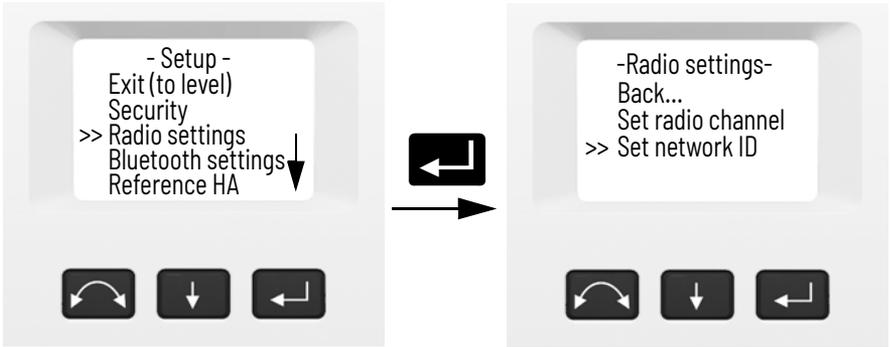
4. When you have found the channel number of your choice press  to select **Set** and then press  to store this channel number. You will then be returned to the **Radio Settings** menu.



5. If you want to cancel Press to select **Cancel** and then press to return to the **Radio Settings** menu.
6. To return to the **Setup** menu Press to scroll to **Back** and then press .

#### **Set Network ID**

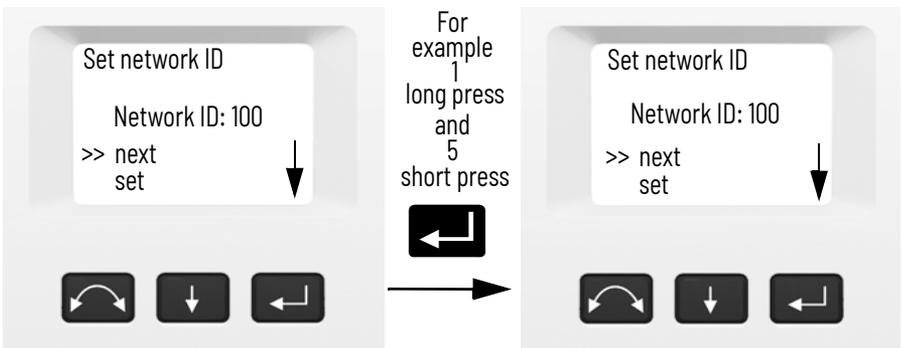
1. Press to scroll to **Radio settings** and then press .
2. Press to scroll to **Set network ID** and then press .



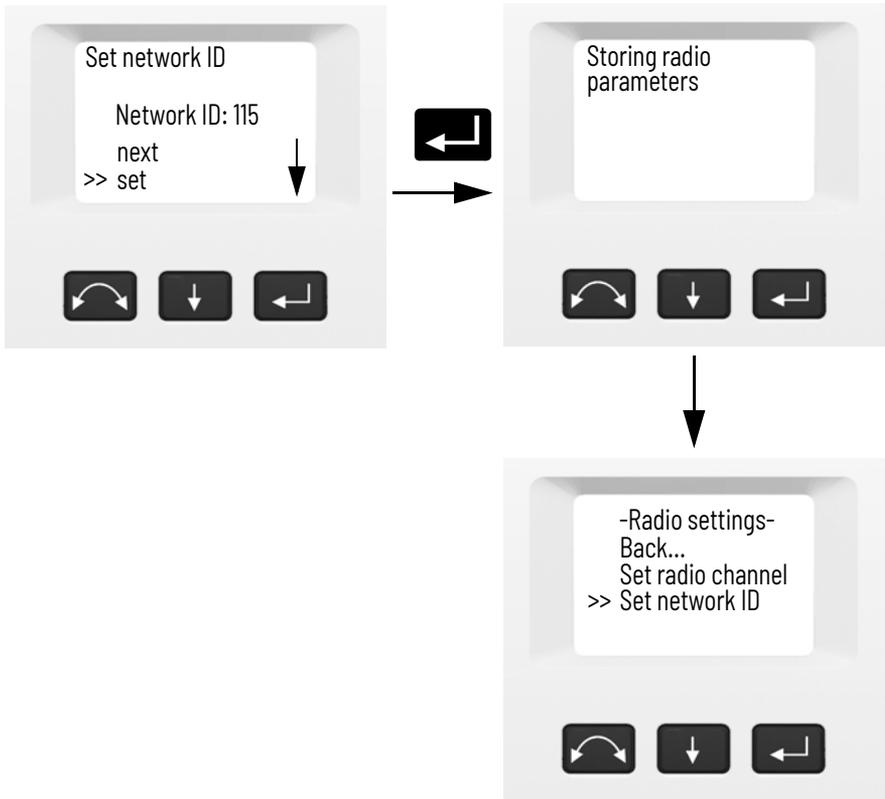
3. To change the network ID number press to select **Next** and then press to change the channel number in the display.

**Note** - A short press on the enter key will increment the network ID in increments of 1. Pressing and holding the enter key, will increment the network ID in steps of 10.

Network ID range 0-255



4. When you have found the network ID number of your choice press to select **Set** and then press to store this network ID number. You will then be returned to the **Radio Settings** menu.



5. If you want to cancel Press to select **Cancel** and then press to return to the **Radio Settings** menu.
6. To return to the **Setup** menu Press to scroll to **Back** and then press .

### Bluetooth Device Settings

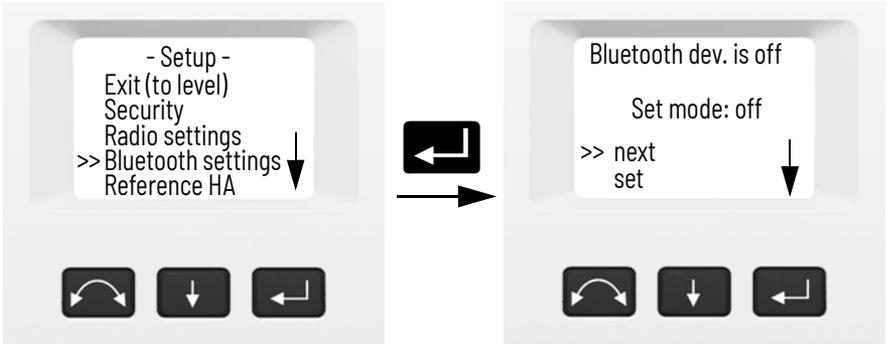
To establish Bluetooth® wireless technology communication between a Spectra Geospatial data collector and the instrument, first enable the Bluetooth wireless technology option in the instrument. This is carried out as follows.

**Note** - Bluetooth wireless technology is not available on the Autolock model.

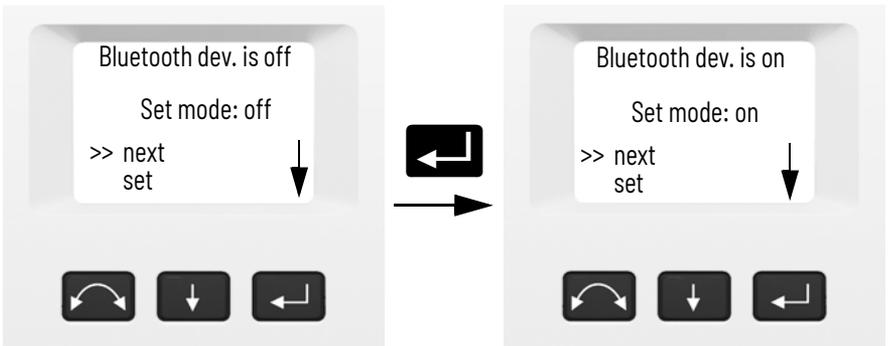


**CAUTION** - Before starting the Bluetooth device, make sure that the regulations of the country that you are working in allows the use of Bluetooth wireless technology.

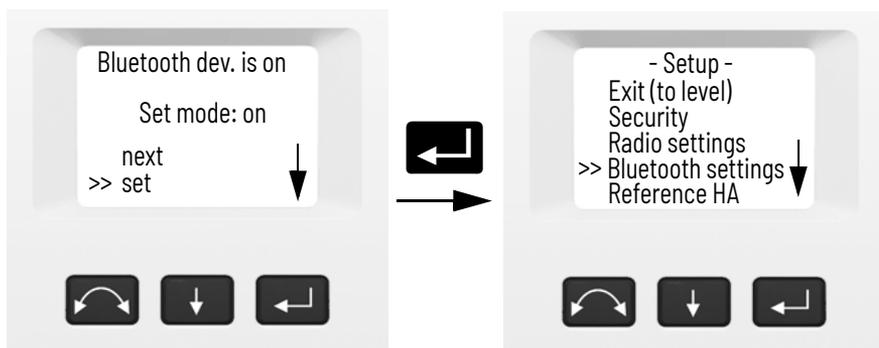
1. Press  to scroll to **Bluetooth settings** then press .



2. To change the Bluetooth device setting press  to select **Next** and then press  to select **on** or **off**.



3. When you have found the setting of your choice press  to select **Set** and then press  to store this setting. You will then be returned to the **setup** menu.



4. If you want to cancel Press  to select **Cancel** and then press  to return to the **setup** menu.

**Note** - By default, the Bluetooth device is turned off. Any change to this setting becomes the default setting until it is changed again.

**Note** - To reduce power consumption and extend operation time, Spectra Geospatial recommends that the Bluetooth device is switched off when not in use.

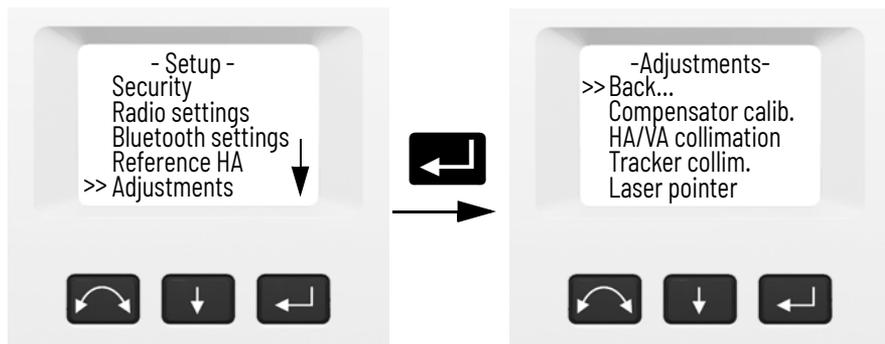
### Reference HA

Depending on the application software to support this function.

### Adjustments Menu

The **adjustments** menu contains all the instrument collimation and calibration routines.

- Press  to scroll to **Adjustments** and then press .



## Compensator Calibration

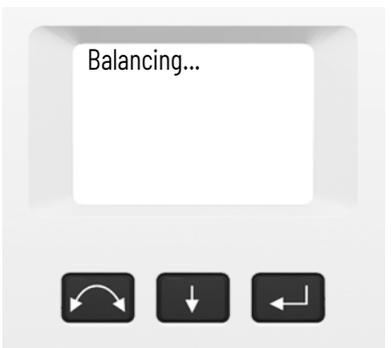
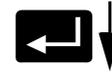
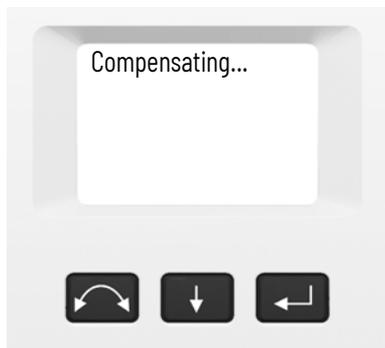
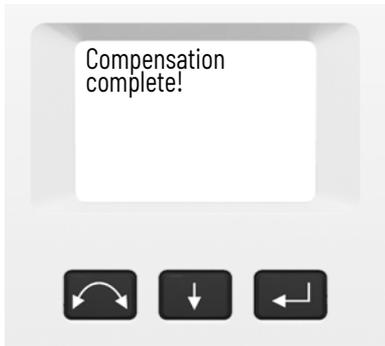
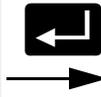
To calibrate the compensator, the instrument needs to be in perfect balance. After calibration, the compensator sensor will automatically adjust and allow for changes in that balance caused by the presence or the absence of an internal battery.

To minimize imbalance in the instrument:

- An internal battery must be present in the battery compartment.
- The instrument handle must be attached.
- The instrument will automatically position the telescope for best balance.

To start the compensator calibration:

1. Level the instrument. The instrument will automatically check if the compensator is within range before the calibration is started.
1. Press  to scroll to **Compensator calib.** and then press .
2. Follow the instructions in the display.  
**Note** - Spectra Geospatial recommends that you regularly carry out a compensator calibration, particularly when measuring during high temperature variations and where the highest measurement accuracy is required.
3. The calibration process involves the instrument automatically reading the compensator value at a series of predetermined positions through the full rotation of the instrument. The process takes approximately one minute to complete. During the process the instrument should be on a stable platform, free from vibration and untouched by the user.



## **HA/VA Collimation and Trunnion Axis Tilt**

The instrument utilizes precise angle and distance measurements to determine the position of the point being measured. The instruments design facilitates the ability to measure all points with a single pointing to the target in the face 1 position. All electronic total stations are subject to collimation errors in both the horizontal and vertical angle measuring systems, and also errors caused by the axis of the telescope not being truly perpendicular to the vertical of the instrument.

In order to compensate for these errors, the collimation routine allows the operator to accurately determine the current errors in the instrument, and store the errors as corrections to be applied to all measurements made in a single pointing to a target. In this way the instrument will always provide accurate measurements:

The Collimation errors and Trunnion axis tilt will change over time, the most common changes being caused by

- Wear and tear with use
- Bumps and knocks during transit
- Large changes in operating temperature

Spectra Geospatial recommends that a collimation check and tilt axis check be carried out routinely as follows:

- After any long uncontrolled transport of the instrument (e.g. after service or shipment to a new location)
- After any accidental knock or drop
- At any time when the operating temperature changes by more than 10 °C (18 °F)
- At any time when the instrument changes it's height above sea level by more than 500 m (1,640 ft)
- At any time when the highest accuracy positions are required for single pointing to a target (not two face measurements)
- Routinely on a periodic basis (monthly, weekly etc.)

Spectra Geospatial also recommends that the operator keep a record of the dates and values measured so that any gross changes can easily be detected. Gross changes can indicate the need for a check by an approved service center.

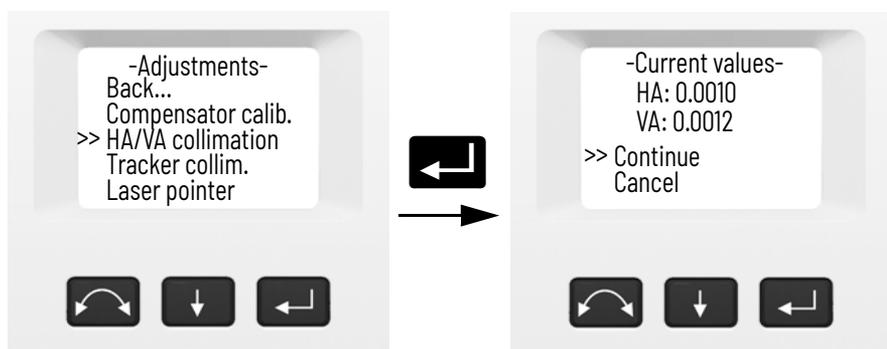
The adjustment of the instrument for HA/VA collimation and Trunnion Axis tilt is a two-stage process.

The Horizontal and Vertical collimation and the trunnion axis tilt correction have been measured and stored in the instrument at the factory.

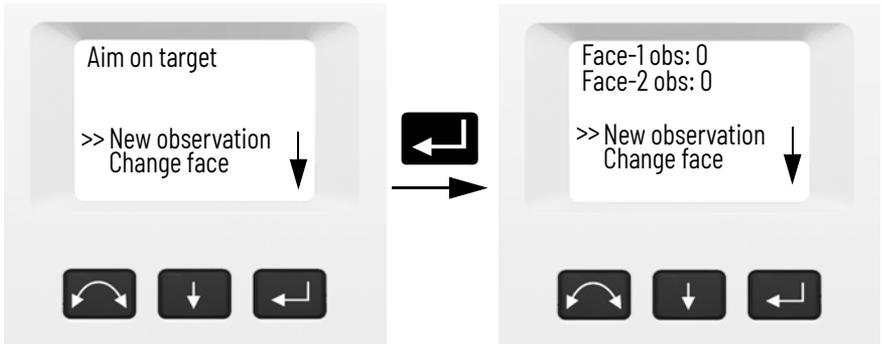
In all calibrations, multiple sightings will be made in both faces to ensure that any minor pointing errors can be eliminated in the accurate determination of current collimation error values.

In a new instrument the values should be close to zero, over time these will change. The instrument allows a maximum value of 0.05 grads (0.045 degrees) in the HA, VA and Trunnion axis tilt values. If these values are exceeded, the instrument will need service to rectify a mechanical problem.

1. Press  to scroll to **HA/VA collimation** and then press . The current collimation values appear.



2. Press  to scroll to one of the following:
  - **Continue** Then press  to continue the HA/VA collimation test.
  - **Cancel**. Then press  to return to the **Adjustments** menu.



If you select Continue:

3. Press to scroll to one of the following:
  - **New observation.** Then press to continue the HA/VA collimation test.
  - **Change face.** Then press to change between face 1 and 2.
  - **Cancel.** Then press to return to the **Adjustments** menu.

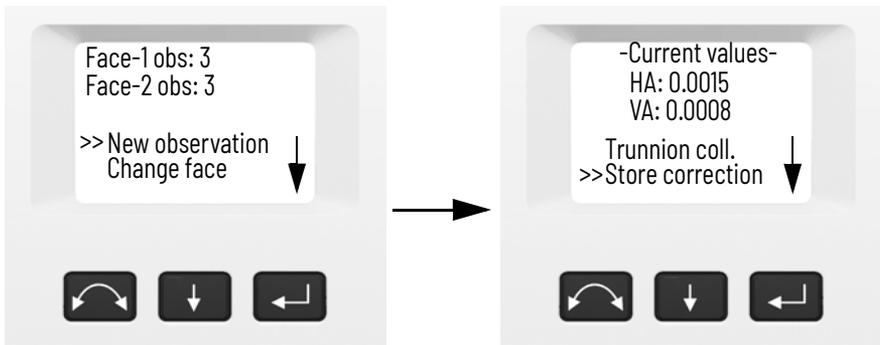
If you select New observation:

- a. Aim accurately in face 2 towards a point near the horizon at max.  $\pm 5$  grads ( $\pm 4.5$  degrees) to the horizontal and at a minimum distance of 100 m (328 ft.).
- b. Press to scroll to **New observation**. Press to measure and record angles
- c. Re sight the instrument at the same point and press the enter key again. Repeat this process for a minimum of five sightings in face 2.
- d. Press to scroll to **Change face**. Then press to change to face 1.
- e. Aim accurately towards the same point as that used in face 2.

- f. Press **↓** to scroll to **New observation**. Then Press **↵** to measure and record angles
- g. Re sight the instrument at the same point and press the enter key again. Repeat this process for the same number of times as in face 2.

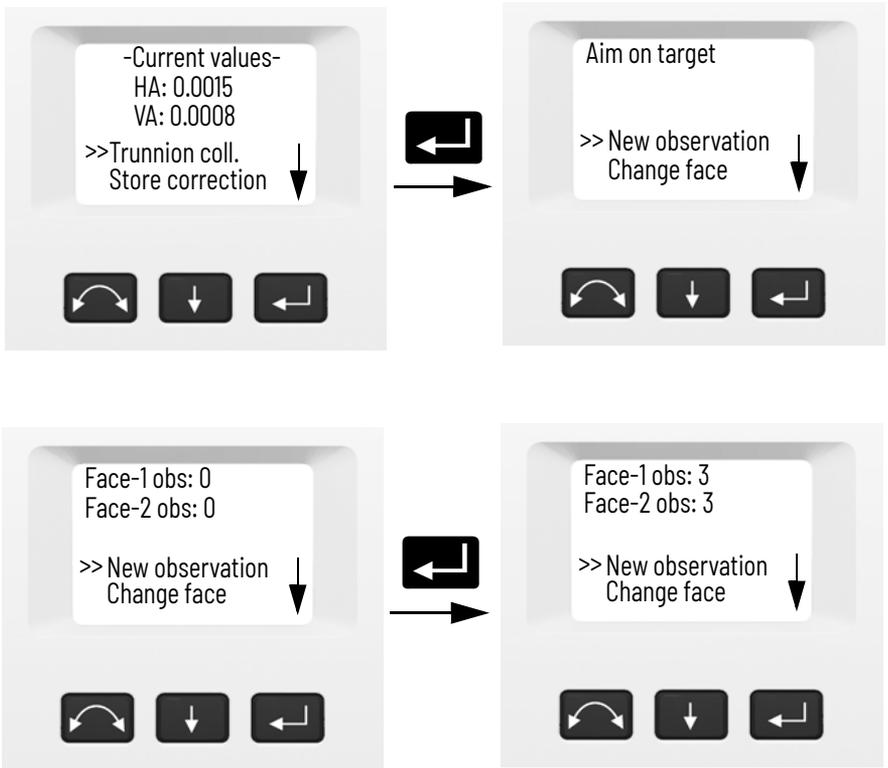
As observations are made on the first face (either face 1 or face 2), the angle values are stored and the counter increases. When one or more observations have been taken on each face, and the number of observations on each face are the same, the software calculates and displays the new horizontal and vertical collimation values.

4. Press **↓** to scroll to one of the following:
  - **Trunnion coll.** Then press **↵** to continue to Trunnion collimation.
  - **Store correction.** Then press **↵** to accept and store the new collimation values.
  - **Cancel.** Then press **↵** to return to the **adjustments** menu.



Select **Trunnion coll.** to continue with trunnion axis tilt collimation.

5. Press **↓** to scroll to **Trunnion coll.** Then press **↵** to continue the Trunnion axis tilt test.



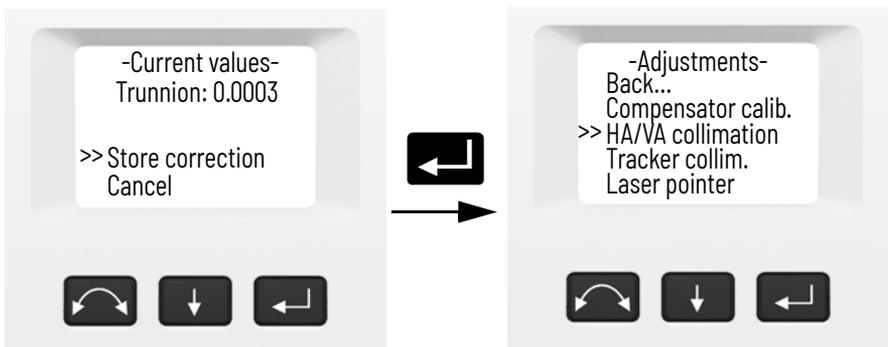
6. Press to scroll to one of the following:
- **New observation.** Then press to continue the trunnion axis tilt test.
  - **Change face.** Then press to change face.
  - **Cancel.** Then press to return to the adjustments menu.

If you select **New observation** the number of observations in both faces appears:

- a. Aim accurately in face 2 towards a point at least 15 grads (13.5 degrees) above or below the point where the collimation test was made at a minimum distance of 30 m (66 ft.).
- b. Press to measure and record angles.

- c. Press  to scroll to **Change face**. Then press  to change face.
- d. Aim accurately towards the point.
- e. Press  to measure and record angles.

As observations are made on the first face (either face 1 or face 2), the angle values are stored and the observation counter increases. When one or more observations has been taken on each face, and the number of observations on each face are the same, the software calculates and displays the new trunnion axis tilt value.



7. Press  to scroll to one of the following:
  - **Store correction**. Then press  to accept the new trunnion axis tilt value. The **Adjustments** menu appears.
  - **Cancel**. Then press  to return to the **Adjustments** menu.

**Note** - The instrument will prohibit a trunnion axis tilt test if it is made towards a point with an angle less than 15 grads (13.5 degrees) from the point where the collimation test was made. The trunnion axis tilt determination accuracy will improve with a steeper angle towards the measured point. The minimum distance for the trunnion axis tilt measurement is 30 m (66 ft.).

**Note** - If the trunnion axis tilt correction value is greater than 0.05 grads (0.045 degrees), the message **Fail Remeasure?** appears. Press Yes and then repeat the

measurement procedure. If the value is greater than 0.05 grads (0.045 degrees) and you answer No to the re measurement message, the instrument uses the correction value previously stored in the instrument. If the value is greater than 0.05 grads (0.045 degrees), then the instrument must be mechanically adjusted at the nearest authorized Spectra Geospatial service center.

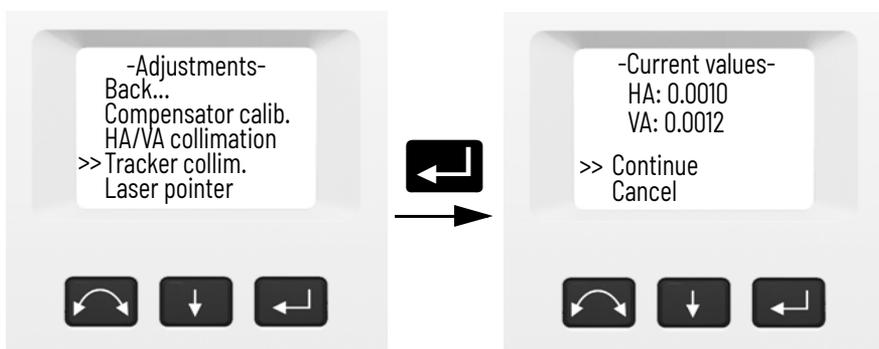
### Autolock Collimation

Autolock® technology collimation check needs to be carried out on a regular basis (under the same conditions as the HA/VA collimation check).

Perform the test over a similar distance as that you will be working on, but at least 100 m. The prism target must be very still during the test (Spectra Geospatial recommends that you use a tripod or bi-pod mount for the target) and must be in clear line of sight without any obstructing traffic. The instrument is calibrated to accurately point at the center of the target in both horizontal and vertical axes. The calibration is used to correct the positions of all points measured using the Autolock function. The measured calibration values are stored and used until a new set of calibration values are determined.

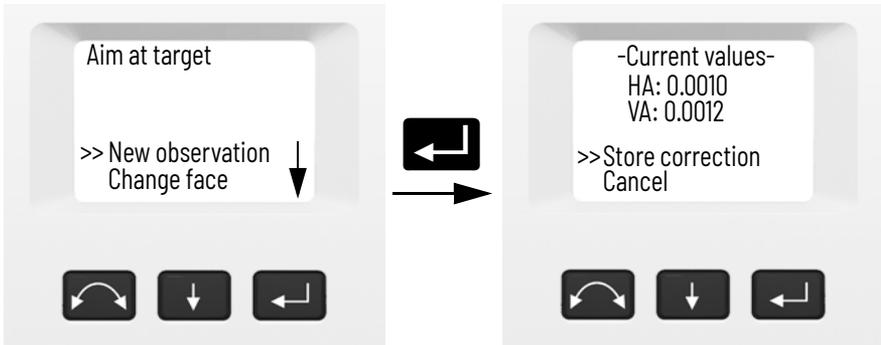
**Note** - The adjustment between the two optical axes, i.e. the Telescope and the Tracker, may differ. See *Aiming* on page 69.

1. Press  to scroll to **Tracker collim** then press .



2. Accurately aim towards a prism.

3. Press  to scroll to **New observation** and then press .



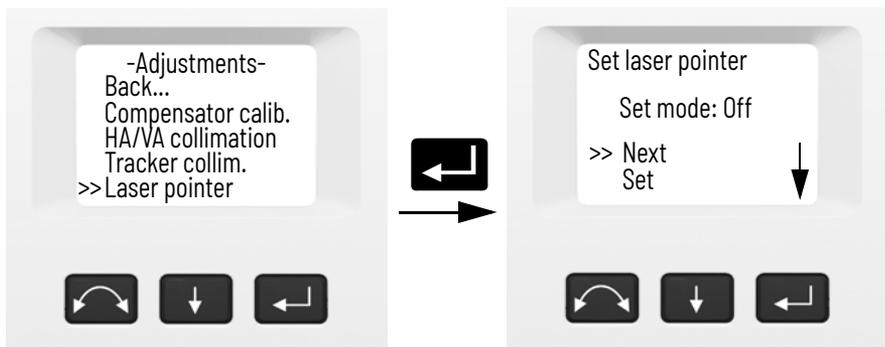
4. The instrument will measure to the target in both faces automatically and then display the current values.
5. Press  to scroll to one of the following:
  - **Store correction.** Then press  to save the correction values.
  - **Cancel.** Then press  to return to the **Adjustments** menu.
6. Once the instrument has stored the correction values, the **Adjustments** menu appears.

### Laser Pointer

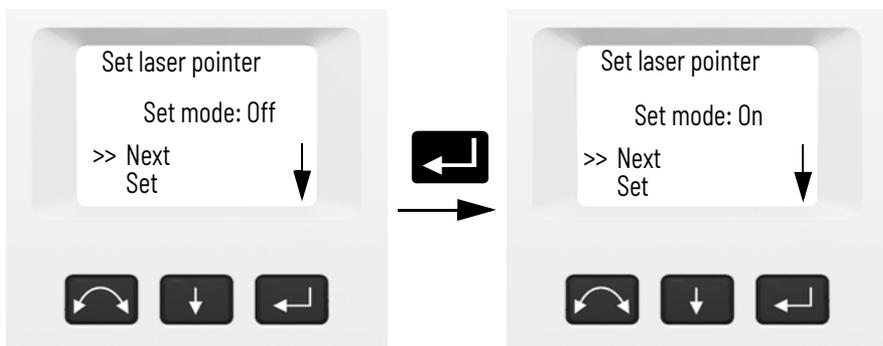
The laser pointer is a visible laser that is emitted from the telescope along the line of sight. The laser is used to visibly indicate the point being measured, and is especially useful when employing the DR reflectorless EDM for measurement. The laser pointer is clearly visible in areas of shadow, inside buildings and tunnels and also at night, however in bright sunshine it is generally not readily visible with the human eye. The following controls allow the laser pointer to be switched on and off.

**Note** - The laser pointer is mechanically aligned to the telescope cross hairs. The laser may require periodic adjustment to keep it perfectly aligned for measurement. To adjust the laser pointer, it must be switched on. See *The Laser Pointer* on page 52.

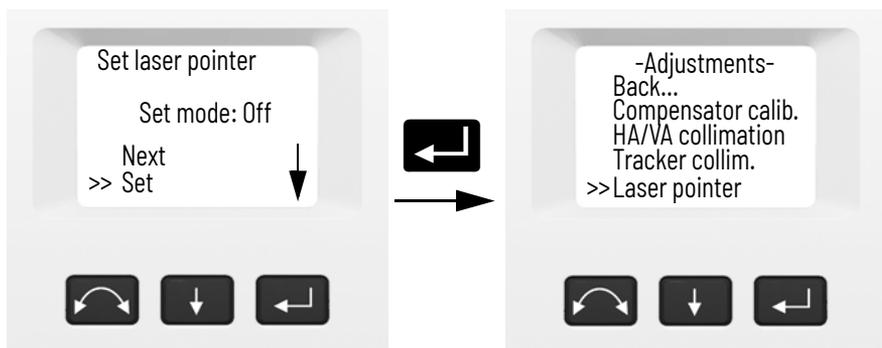
1. Press  to scroll to **Laser pointer** then press .



2. To change the laser pointer setting, press  to select **Next** and then press  to select **On** or **Off**.



3. When you have found the setting of your choice, press  to select **Set** and then press  to store this setting. You will then be returned to the **Adjustments** menu.



4. If you want to cancel, press  to select **Cancel** and then press  to return to the **Adjustments** menu.

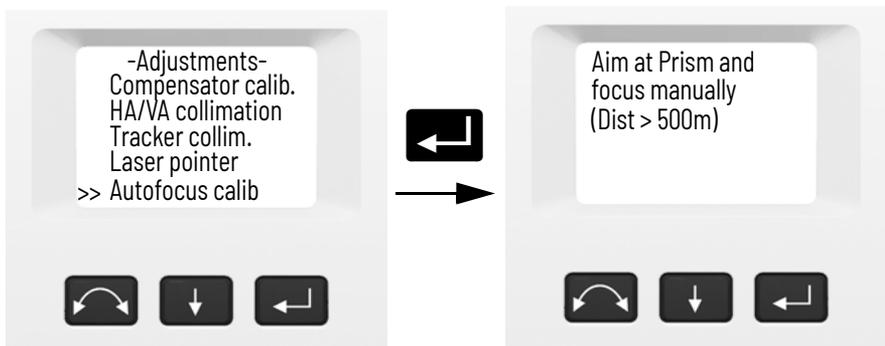
With the laser pointer on, you can adjust the beam. For more information, see *The Laser Pointer* on page 52.

### Autofocus calibration

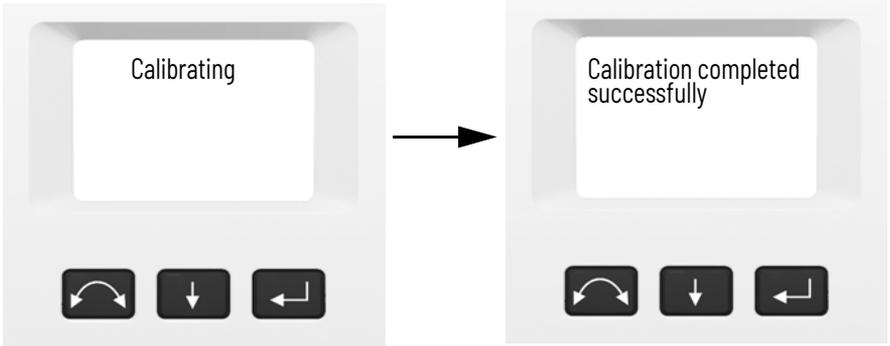
The instrument is equipped with an autofocus function. Before you can start using the autofocus, the function needs to be calibrated.

To start the calibration:

1. Level the instrument. The instrument will automatically check if the compensator is within range before the calibration is started.
2. Press  to scroll to **Autofocus calib** and press .

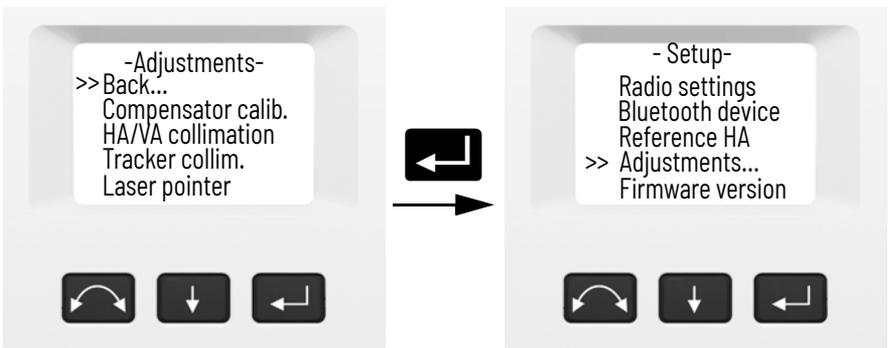


3. Aim and manually focus at a target at a distance of at least 500 meters, then press .



### Back

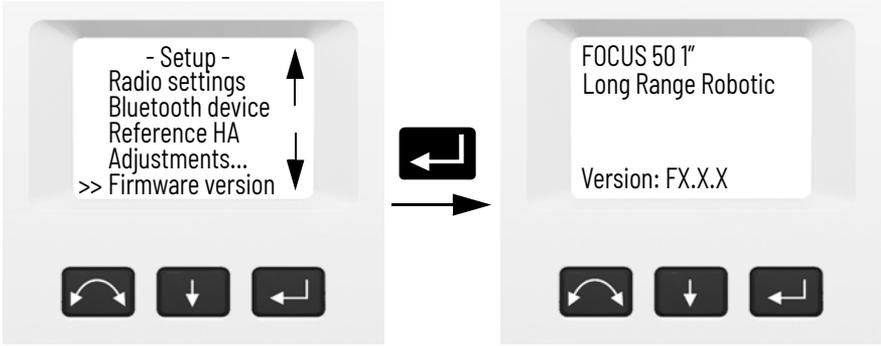
1. To return to the **Setup** menu, press  to scroll to **Back...** and then press .



### Firmware Version

Under **Firmware version** the following information is available:

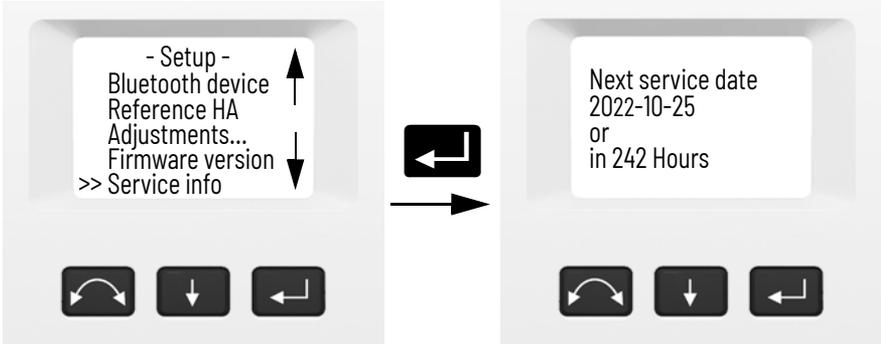
- Instrument angle accuracy
  - Instrument model
  - Installed instrument firmware version
1. Press  to scroll to **Firmware version** and then press . The instrument angle accuracy, model and firmware version appears on the screen. The program will return automatically to the **Setup** menu.



**Service Info**

In the **Service info** menu it is possible to see the date for the next recommended service occasion or how many run time hours the instrument have left before service is recommended.

1. Press to scroll to **Service info** and then press . The instrument service info appears on the screen. The program will return automatically to the **Setup** menu.

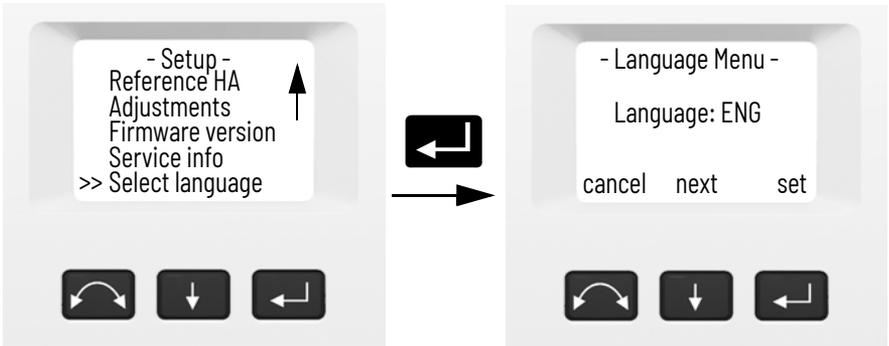


**Select Language**

In the **Select language** it is possible to select the language for the Face 2 display.

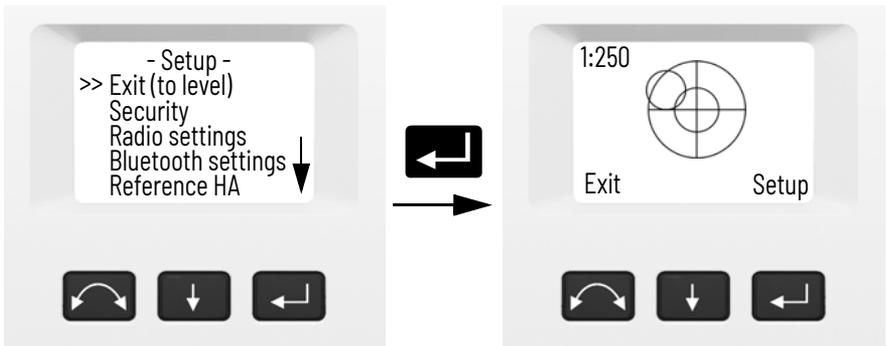
1. Press to scroll to **Select language** and then press .
2. Press to scroll through the available languages.

3. Press  to set the language.



### Exit Menu

1. To exit the **Setup** menu press  to scroll to **Exit (to level)** and then press . The electronic level appears.



**Note** - If the instrument is left idle for more than 300 seconds (5 minutes) during any of the above routines, then the instrument goes to suspend mode.

### The Laser Pointer

The FOCUS 50 total stations uses a red laser only as a laser pointer. The laser pointer is coaxial with the line of sight of the telescope. If the instrument is well adjusted, the red laser pointer coincides with the line of sight. External influences such as shock or large temperature fluctuations can displace the red laser pointer relative to the line of sight.

## Aligning the Laser Pointer



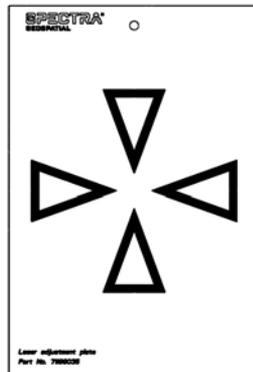
**CAUTION** - Viewing the laser spot on the adjustment target through the telescope is safe. Do not try to make the adjustment using a prism, the reflected light from a prism can be dazzling.



**CAUTION** - Do not use the laser pointer as an aid when searching for prisms, the reflected light can dazzle your eyes. The reflected light will not damage your eyes, but might be uncomfortable.

To avoid faulty measurements when using the laser pointer for aiming, use the supplied adjustment target to check the laser alignment regularly and before you attempt precise distance measurements:

1. Set up the adjustment target 25–50 meter away, facing the instrument.
2. Aim the instrument to the center of the target plate and then inspect the position of the red laser spot in relation to the telescope cross-hairs.
3. If the red laser spot lies outside the cross-hairs, adjust the direction of the beam until it matches the cross-hairs.



## Adjusting the Laser Pointer

1. Pull out the two plugs from the adjustment screw access holes on top of the telescope housing.



2. To correct the vertical position of the laser spot, insert the Allen key into the access hole for the vertical adjustment screw and turn it.

Clockwise = Down  
Counter clockwise = Up



3. To correct the horizontal position of the laser spot, insert the Allen key into the horizontal adjustment port and turn it.

Clockwise = Left  
Counter Clockwise = Right



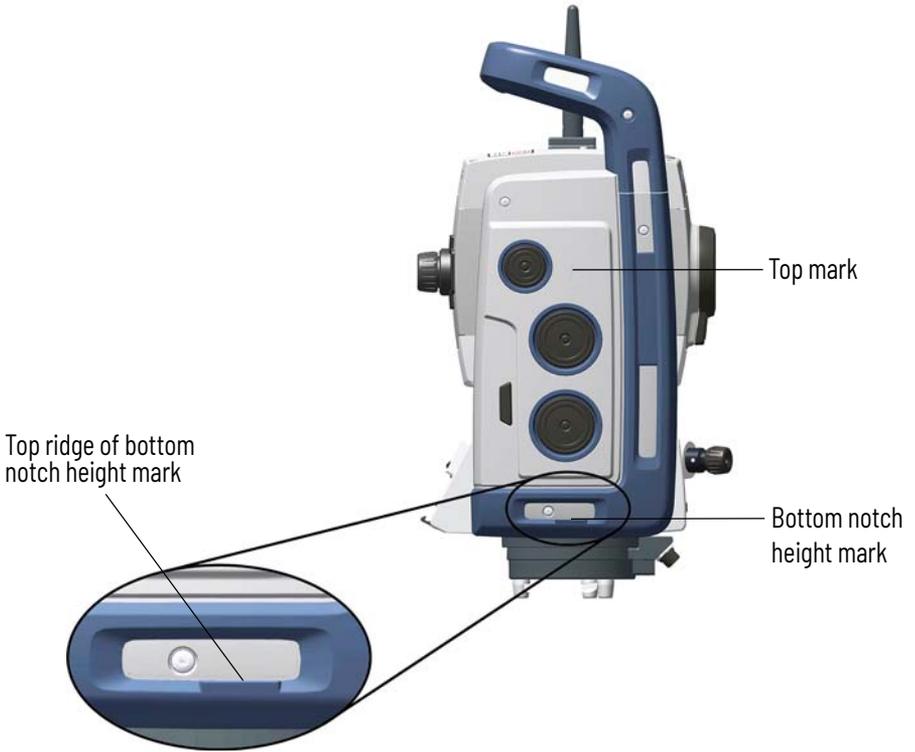
4. Check the alignment of the laser spot and the cross-hairs. Throughout the adjustment procedure, keep the telescope pointing to the adjustment target. The adjusting screws are of a high tension because they are self locking. The screws tighten automatically after you adjust them.
5. Refit the plugs in the adjustment holes. Make sure that the plugs are correctly fitted for proper sealing against the cover.



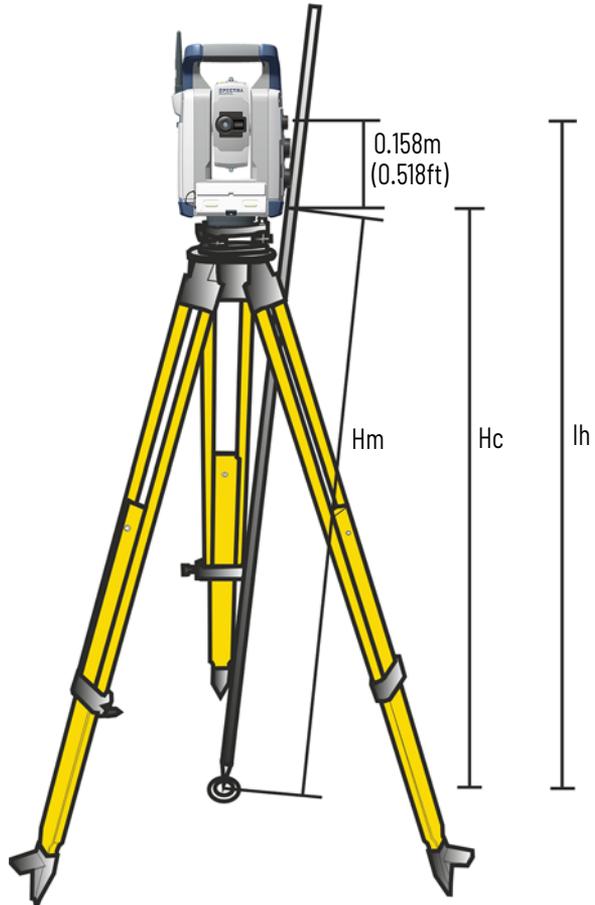
**CAUTION** - To keep out moisture and dust, make sure that the plugs are correctly fitted in the adjustment ports.

### Measuring the Instrument Height

There are two measurement marks on the side of the instrument. The true height mark corresponds to the trunnion axis of the instrument. The bottom notch height mark is 0.158 m (0.518 ft.) below the true height mark. Measure the bottom notch height mark to the top ridge of the mark.



When there is a Spectra Geospatial data collector connected running a field application software, the software has additional functions that reduce the bottom notch height mark measurement to the required vertical instrument height to the trunnion axis.



The measured distance ( $H_m$ ) is corrected for the slope of the measurement to obtain a vertical measurement to the bottom notch height mark ( $H_c$ ). The constant from the bottom notch height mark to the true height mark (0.158 m/0.518 ft.) is added to the  $H_c$  to obtain the vertical instrument height from the ground mark to the trunnion axis ( $l_h$ ). For more information, refer to the field software documentation.

Alternatively, to obtain an accurate measurement to the true height mark ( $l_h$ ), you can manually measure the slope distance from the ground to the bottom notch height mark ( $H_m$ ). To

calculate the total instrument height (Ih), insert the measured slope distance (Hm) into the formula below:

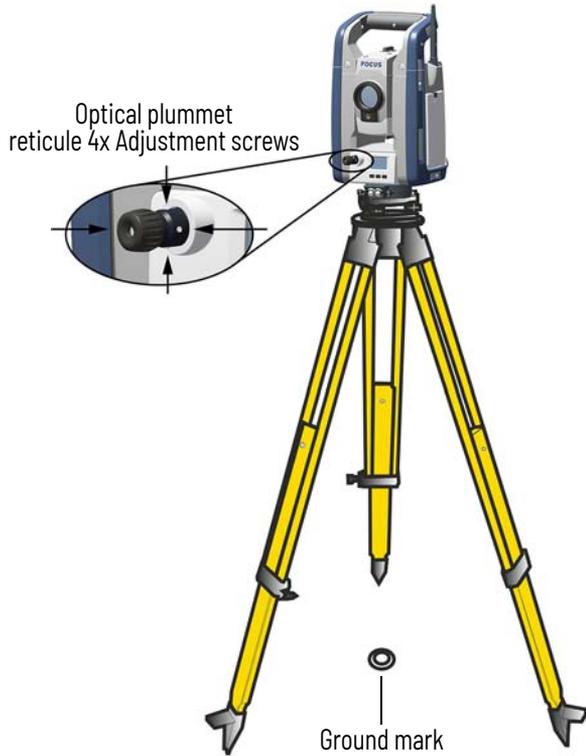
$$I_h = 0,158 + \sqrt{H_m^2 - 0,091^2}$$

### **Adjusting the Optical Plummet**

1. Set up the instrument and level it over a ground mark so that the tripod height is 1.5 m ( $\pm 0.1$  m) (4.920 ft. ( $\pm 0.328$  ft.)).
2. Note the position of the inner circle of the optical plummet in relation to the ground mark.
3. Turn the instrument 200 grads (180 degrees).
4. Note the position of the inner circle of the optical plummet in relation to the ground mark. If the inner circle of the optical plummet reticule moves in relation to the ground mark, you must adjust the plummet reticule location.
5. Adjust out half of the error with the four adjustments screws on the optical plummet.
6. Turn the instrument 200 grads (180 degrees).
7. If there is no movement between the inner circle of the optical plummet reticule in relation to the ground mark, no further adjustment is needed.



**CAUTION** - When adjusting the optical plummet with the four adjustment screws it is important that the screws are correctly adjusted. When one screw is adjusted the opposite screw must be adjusted equally in the reverse direction, in order to keep the correct tension on the optics. Do not over tighten the screws, this might damage the optics.



### **Pre Measurement Check List**

Before you begin measurement operations, check the following items:

- Lenses are clean
- Instrument is correctly leveled
- Collimation error
- Tracker collimation error
- Trunnion axis tilt
- Correct radio channel is selected (Long Range Robotic Model only)
- Laser Pointer beam alignment
- Measure instrument height
- Allow sufficient time for the instrument to adjust to the ambient temperature, see *page 22*

## **Connecting a Data Collector**

To perform surveying with the instrument a data collector must be connected to the instrument running a field software.

### **Connect with Long Range Radio**

The FOCUS 50 long range robotic model includes a long range radio (LRR). To connect to a Spectra Geospatial data collector, the channel and ID must match in both the instrument and the Spectra Geospatial data collector.

The LRR is not available on Autolock or Short Range Robotic models.

### **Connect with Bluetooth Wireless Technology**

When Bluetooth wireless technology is used to connect to a Spectra Geospatial data collector, the instrument serial number appears as a device in the Spectra Geospatial data collector with the serial number as ID. Select the device to connect to the Spectra Geospatial data collector.

**Note** - Bluetooth wireless technology is not available on the Autolock model.

### **Connect with cable**

When a cable is used to connect to a Spectra Geospatial data collector, it is automatically selected as the primary communication. If the cable is disconnected, the instrument will start to search for the Spectra Geospatial data collector using LRR or Bluetooth wireless technology.

**Note** - Use only a communication cable approved by Spectra Geospatial.

## Angle Measuring Technology

The principles of angle measurement are based on reading an integrated signal over two opposite areas of the angle sensor and producing a mean angular value. This eliminates inaccuracies caused by eccentricity and graduation.

In addition, the angle measurement system compensates for the following automatic corrections:

- Instrument mislevelment (deviation of the plumb axis).
- Horizontal and vertical collimation error.
- Trunnion axis tilt. See *Correction for Trunnion Axis Tilt* on page 62.

### Correction for Mislevelment

The instrument automatically corrects for mislevelments up to  $\pm 6'$ . The instrument warns the operator immediately of any mislevelments in excess of  $\pm 6'$  ( $\pm 0.11$  grads).

The instrument also utilizes SurePoint™ accuracy assurance technology to automatically correct the pointing of the telescope for all mislevelment and trunnion axis errors in real time during operation.

Corrections for the horizontal angle, vertical angle, and slope distance are calculated in the field application software and applied to all measurements.

### Correction for Collimation Errors

The horizontal collimation error is the deviation of the sighting axis from its required position at right angles to trunnion axis.

The vertical collimation error is the difference between the vertical circle zero and the plumb axis of the instrument.

Traditionally, collimation errors were eliminated by observing angles in both instrument faces. In the FOCUS 50 total station, a pre-measurement collimation test is performed to determine the collimation errors. Angular measurements are observed in both instrument faces, the collimation errors are calculated, and the respective correction values are stored in the instrument. The collimation correction values are then applied to all subsequent angle measurements. Angles observed in a single face are corrected for collimation errors,

which eliminates the need to measure in both instrument faces.

Carry out a collimation test in the following situations:

- Whenever the instrument may have been roughly handled during transport.
- When the ambient temperature differs by more than 10 °C (18 °F) from the previous collimation test.
- Immediately prior to high precision angle measurements in one face.

### **FOCUS 50 Total Station With Autolock technology**

A FOCUS 50 total station with Autolock technology can automatically lock on to and track a prism. Pointing errors caused by slight misalignment of the instrument's tracker have a similar effect to the HA and VA Collimation errors detailed above.

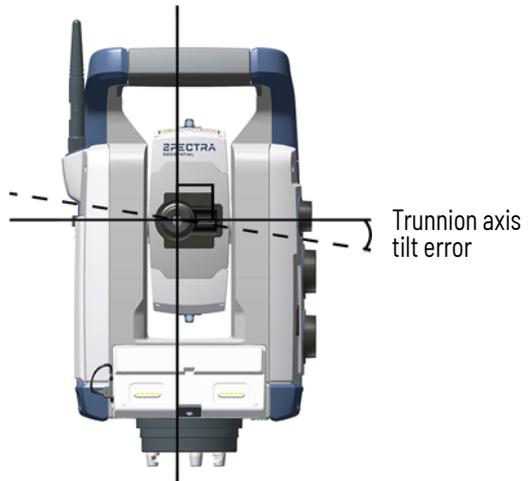
To correct for the tracker collimation errors, carry out an Autolock collimation test. The Autolock collimation test automatically observes angular measurements to a target in both faces, the tracker collimation errors are calculated and the respective correction values are stored in the instrument. The Autolock collimation correction values are then applied to all subsequent angle measurements observed when Autolock is enabled. Angles observed in a single face are corrected for collimation errors, which removes the need to measure in both instrument faces.

Carry out an Autolock collimation test in the following situations:

- Whenever the instrument may have been roughly handled during transport.
- When the ambient temperature differs by more than 10 °C (18 °F) from the previous collimation test.
- Immediately prior to high precision angle measurements using Autolock in a single face.

### **Correction for Trunnion Axis Tilt**

The trunnion axis tilt error is the deviation of the trunnion axis of the telescope from its required position at right angles to the plumb axis of the instrument.



In the instrument, perform a pre-measurement trunnion axis tilt test to determine the trunnion axis tilt error. Angular measurements are observed in both instrument faces, the trunnion axis tilt error is calculated, and the respective correction value is stored in the instrument. The trunnion axis tilt correction value is then applied to a correction to the horizontal angle value and an automatic repointing of the telescope using SurePoint technology.

Carry out a trunnion axis tilt test in the following situations:

- Whenever the instrument may have been roughly handled during transport.
- When the ambient temperature differs by more than 10 °C (18 °F) from the previous collimation test.
- Immediately prior to high precision angle measurements in one face, especially where the vertical angles significantly deviate from the horizontal plane.

## **Averaging Measurements to Reduce Sighting Errors**

The instrument automatically reduces sighting errors caused by the misalignment of the instrument to the target or by pole movement during measurement. The following techniques can be used:

- Use Autolock. When Autolock is enabled, the instrument automatically locks onto and tracks the target. Manual sighting errors are reduced.
- Automatically average angles during distance measurement. When measuring in Standard mode, the instrument takes approximately 1.2 seconds to measure the distance. Angles returned to the instrument at 1000 Hz, are averaged over the 1.2-second period to obtain an averaged angle measurement. The resultant angle measurement is an average of over 1200 observations.
- Use average measurement methods in the field software.

### **Distance Measuring Technology**

The instruments are equipped with a combined distance unit. This means that the instrument can measure to a prism or to normal surfaces (direct reflex (DR) mode).

### **FOCUS 50 Total Station EDM**

The FOCUS 50 total station's EDM is a pulsed laser distance unit that determines distances by precisely measuring the flight time of the transmitted light pulse. The distance unit generates many short laser pulses, which are transmitted through the telescope to the target. The pulses reflect off the target surface and return to the instrument where the unit determines the time difference between the transmitted pulses and the received pulses. The unit uses the time difference to calculate the distance to the target.

The distance unit includes additional functions that allow you to control the accuracy and precision of a DR measurement through the field application software.

Field application software includes:

- Standard Deviation. This allows you to configure the required precision of the DR measurement before the distance will be accepted. The distance measurement process will be carried out by the instrument until the

preset standard deviation value has been achieved. The default standard deviation value is 0.003m. Setting this value to a higher number gives shorter measurement time but is less accurate, especially when measuring to surfaces at greater distances or at oblique angles to the line of sight.

- **Weak Signal.** This allows you to accept a DR measurement that is below the normal instrument specification. This is useful when measuring to poor reflective surfaces, or when trying to achieve the maximum range of the instrument.
- **Min-Max Range.** This allows you to specify the DR measurement interval. For example, when you measure to a small object at 50 m with a background object at 200 m, set the min-max range from 2 m to 100 m. The distance meter is then tuned to provide a distance within the specified range and to ignore any signal from outside the defined range. By default, the min-max range is 2-300 m.

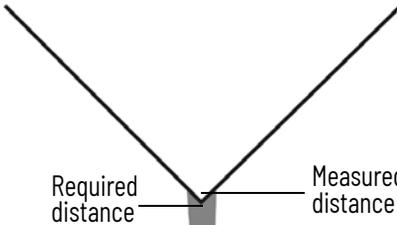
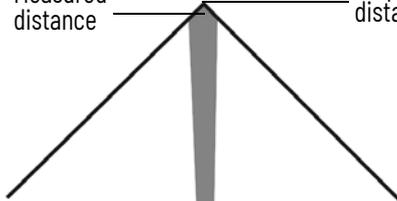
### **Beam Divergence**

All distance meter measurement beams diverge as the range from the instrument increases. The divergence of the distance meter beam relates to an increase in the size of the area being sampled, not to a degradation of the measurement precision.



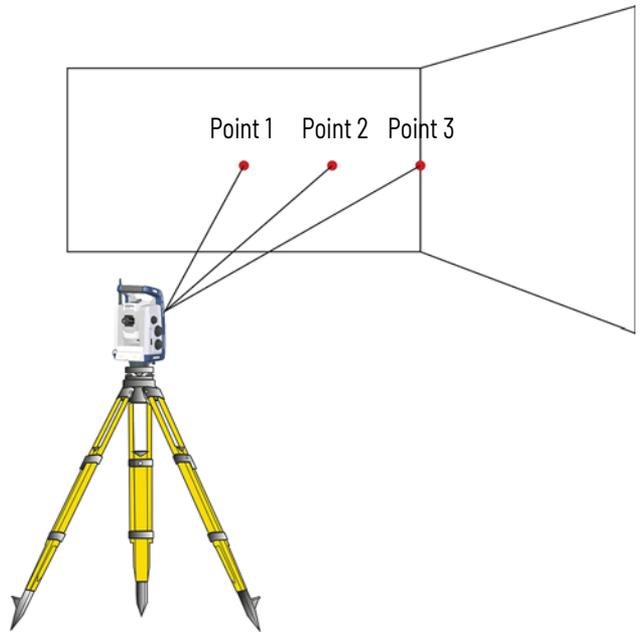
A larger measuring area at longer range is generally better because it enables smaller objects, such as power lines and antennas, to be detected and accurately measured. With a smaller measuring area, these small objects can be easily missed. A smaller measuring area has advantages when measuring tight corners and vertices at close range. When observing measurements to a tight corner, the distance meter beam divergence introduces a range error caused by the size of the sampling area.

Measured distance      Required distance



Although the problem is reduced with a beam that uses a smaller measuring area, the error can not be completely eliminated. The most accurate solution to measure to tight corners and eliminates errors caused by beam divergence, is to use an offset measurement method such as that used in the field application software:

1. Measure two points on the face of the building.
2. Aim the instrument at the corner to calculate and store the position of the third point, based on the two measured points and the horizontal and vertical angle to the third point.



With offset measurements, you can accurately measure difficult locations with DR instruments, and eliminate beam divergence errors. For more information, refer to the field application software documentation.

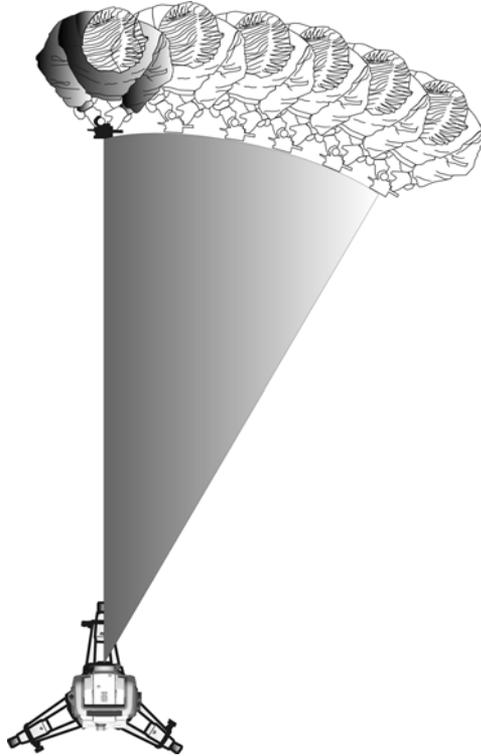
## **Autolock Technology**

The instrument is equipped with Autolock technology, which is used for a robotic or a conventional measurement with Autolock.

Autolock technology controls the instrument servos and aims the instrument correctly towards the target.



**TIP** – To assure maximum performance from the Autolock technology keep the lens clean and dry.

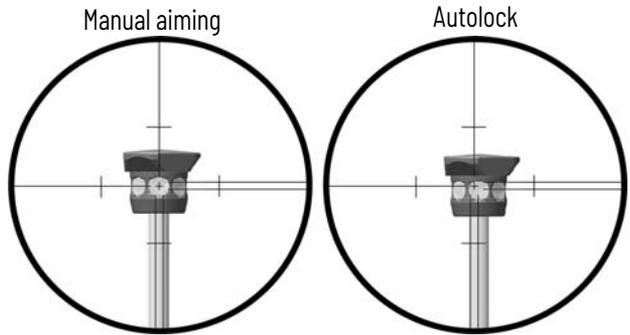


The instrument can lock onto and track a prism.

### **Aiming**

The adjustment between the two optical axes, the telescope and the tracker, may differ. The difference will make it seem like the instrument does not point towards the center of the prism, when using Autolock. This is not a problem since the

two axis have their own separate collimation data. It is however important to make collimation test for both axes.



### How to Check Aiming

You can check how well the instrument is calibrated by measuring toward the prism with and without Autolock and compare the measured angles:

1. Aim manually at a prism and read out the horizontal and vertical angles.
2. Turn on Autolock and let the instrument lock on to the same prism automatically, read out the horizontal and vertical angles.
3. Compare the angles between manual and Autolock aiming. If the difference between the read out angles is significant, you should carry out both a horizontal and vertical angle collimation adjustment, and a tracker collimation adjustment.

### Tracklight

All FOCUS 50 total station instrument models are equipped with a Tracklight<sup>®</sup> unit. Tracklight is a visible guide light that enables the rod holder to position themselves into the instruments current line of sight. The Tracklight can be used during stakeout in all operational modes, and is also of great benefit when operating in robotic mode as a means of checking that the instrument is tracking, or when trying to reacquire lock by walking into the sight line of the tracker, or using the remote joystick control in robotic mode. Tracklight consists of a flashing two-colored light, with each color lying in its own lateral projection sector. If the rod holder is to the

left of the measuring beam, they will see a red flashing light; if they are to the right, they will see a green flashing light.



**TIP** - You can use the Tracklight for clearing sight lines and as an aid to find prisms in the dark or unfavorable sighting conditions.



**CAUTION** - Do not use the laser pointer as an aid when searching for prisms, the reflected light can dazzle your eyes. The reflected light will not damage your eyes, but might be uncomfortable.

### **Servo Technology**

The instrument is equipped with servo controlled motors to position the instrument and focus the telescope. Due to the high speed position servo and the SurePoint technology used in the instrument it is important to use a high quality tripod and tribrach. It is also important to set up the tripod in a position for best stability. If the setup, tripod and/or tribrach is/are unstable the instrument servos might oscillate

slightly in an effort to compensate for that instability. An unstable setup that could negatively influence the resulting measurement precision. See *Setup* on page 21.

### Position Servo

The servo technology is an electromagnetic direct drive system, which gives high turning speeds and accuracy. The frictionless motion removes servo noise and reduces instrument wear. The system provides endless horizontal and vertical motion, including endless fine adjustment. The instrument uses servo when performing a number of different operations such as turning the horizontal and vertical motion knobs, for automatic test and calibration, or when using Autolock technology for robotic surveying.

**Note** - Due to the high speed servo it is important to use a high quality tripod and tribrach.



## Focus Servo

The instrument is equipped with a focus servo. The focus motion knob is on the side of the instrument for easy access. The focus knob is connected to a servo motor that is integrated in the telescope. When you turn the focus motion knob, the servo motor adjusts the focusing lens.



## Power Management

The power management in the instrument can set the instrument to one of three different modes.

- Off mode
- On mode
- Suspend mode

## Stand Alone

Instrument only, no Spectra Geospatial data collector connected.

## Off Mode

In the off mode the Trigger key LED and face 2 display is off.

Press the Trigger key for 1 second to turn on the instrument. The instrument will also turn on if you connect a 12 V power supply and data communication cable to the foot connector.

**Note** - During startup the Trigger key LED will flash once every second.

### **On Mode**

In the On mode, the Trigger key LED will be on solid, the face 2 display will be on.

To turn off the instrument, press the Trigger key for 3 seconds.

The instrument will go to off mode if the battery is very low (battery capacity less than 2%).

If not used for 300 seconds (5 min), the instrument will go to Suspend mode.

### **Suspend Mode**

In the Suspend mode, the Trigger key LED will flash once every other second, the face 2 display will be on.

To turn the instrument on, press the Trigger key for 1 second or turn on the instrument from a remote application.

To turn the instrument off, press the Trigger key for 3 seconds.

In Suspend mode the instrument will turn off automatically at suspend time out. The suspend time out is set in the Spectra Geospatial data collector field software.

## **Instrument with a Spectra Geospatial Data Collector Connected**

### **Off Mode**

In the Off mode, the Trigger key LED and face 2 display is off.

To turn the instrument on press the Trigger key for 1 second. The instrument will also turn on if you connect a 12 V power supply and data communication cable to the foot connector.

**Note** - During startup the Trigger key LED will flash once every second.

### **On Mode**

In the On mode, the Trigger key LED will be on solid, the face 2 display will be on. The face 2 display will be controlled by the Spectra Geospatial data collector field software. To turn off

the instrument, press the Trigger key for 3 seconds. Depending on the settings in the Spectra Geospatial data collector field software the instrument will turn off or go to suspend mode.

The instrument will go to suspend mode if the battery is very low (battery capacity less than 2%).

### **Suspend Mode**

In the Suspend mode, the Trigger key LED will flash once every other second, the face 2 display will be off. To turn the instrument on press the Trigger key for 1 second. To turn the instrument off press the Trigger key for 3 seconds.

### **Battery Low Message**

If the battery capacity drops too low, the **Bat Low** message appears in the Spectra Geospatial data collector display window and the instrument shuts down. You must then change the battery within two hours to prevent losing instrument parameters and functions such as instrument height, target height, coordinates and bearing. After that time, the system resets all parameters and functions to default values.

**Note** - This safety backup of the instrument parameters and functions will work only when **Bat low** appears on the display; it will not function if you remove the battery during operation.

## **External Communication**



### **Communication (Com) Connector**

The communication (COM) Connector on the base of the instrument can be used for external communications to a computer or Spectra Geospatial data collector.

**CAUTION** - Use only a communication cable approved by Spectra Geospatial.



# Care & Maintenance

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## Care and Maintenance



**WARNING** - Do not remove the instrument cover from the instrument. The instrument is designed to withstand normal electromagnetic disturbance from the environment but it contains circuits that are sensitive to static electricity. If an unauthorized person opens the instrument cover, the function of the instrument is not guaranteed and the warranty is invalidated.

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

1. Do not subject the equipment to rough jolts or careless treatment.
2. Keep the lenses and reflectors clean. Use only lens paper or other material that is designed for cleaning optical equipment. As a cleaner, a solution of pure water and 20-30% 2-Propanol specified with evaporation residue <5mg/l.
3. Keep the instrument protected and in an upright position, preferably in the instrument case.
4. Do not carry the instrument while the instrument is mounted on a tripod. Doing so can damage the tribrach screws.
5. Do not carry the instrument by the telescope barrel. Use the handle.
6. When you need extremely precise measurements, make sure that the instrument has adapted to the surrounding temperature. Significant variations in instrument temperature can affect precision.

### Cleaning



**CAUTION** - Never use strong detergents such as benzine or thinners on the instrument or the instrument case.

Be very careful when cleaning the instrument, especially when removing sand or dust from lenses and reflectors. Never use

coarse or dirty cloth or hard paper. Spectra Geospatial recommends that you use anti-static lens paper, a cotton wad, or a lens brush.

### **Getting Rid of Moisture**

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

### **Storage**

- Storage temperature range -40 °C to +70 °C (-40 °F to 158 °F) in a dry environment.
- Remove battery from the instrument before storage.

### **Transport**

Always transport the instrument in a locked instrument case. For longer trips, transport the instrument in the instrument case and inside the original shipping container.

Always remove the internal battery during transport.

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

### **Servicing**

**Note** - There are no user-serviceable parts on the instrument.

Spectra Geospatial recommends that you take the instrument to an authorized Spectra Geospatial service workshop for service and calibration every 2 years. This is to guarantee that the specified accuracies are maintained.

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

# Appendix

## Regulatory Symbols and Abbreviations

### Symbols

In the table are explanations to the regulatory symbols that can be found on the instrument labels.

Symbol	Description
	WEEE: Waste Electrical and Electronic Equipment
	China RoHS: Restricted Use of Hazardous Substances in Electronic and Electrical Products
	CE: Marking is the product meets the essential requirements of all relevant European directives or regulation.
	UKCA: UK Conformity Assessed
	RCM: Regulatory compliance mark for Australia and New Zealand
	GITEKI: Radio Type approval certificate for Japan.
	Laser: Indicate laser radiation warning
	Class 2: Applies to laser class 2
	Warning: Indicate a warning not to stare into beam. Class 2

## Abbreviations

In the table are explanations to the regulatory abbreviations that can be found on the instrument labels.

Abbreviations	Description
FCC	Federal Communications Commission
IC	Industry Canada Identifier, for Industry Canada Radio Equipment List.
IP65	Ingress Protection Code