CHAPTER

4

Setup

In this chapter:

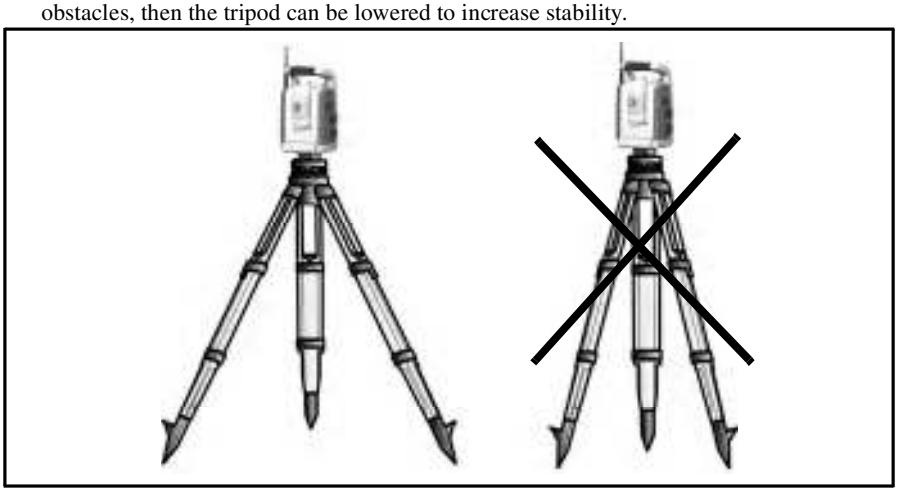
Setup

An instrument setup with good measuring stability will increase the precision in the measurement result and allow you to utilize the measurement precision of the Trimble S Series Total Station to its full extent.

Setup stability

When an optical total station is setup it is important to consider the following:

1. Set 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 survey quality tripod and tribrach can be used. However, Trimble strongly recommends the use of tripod heads made of steel, aluminium or similar material. Tripod heads of fiberglass or other composite materials are not recommended.

See Servo Technology on page 85 for more information.

Measurement stability

Take into account that optical total stations 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 irradiation by sun light, e.g. at noon.

Starting the Instrument

When there is no Control Unit attached, you can start the instrument with the trigger key.

Levelling

Once you start the instrument, the face 2 display appears with the electronic bubble for levelling. If there is a Control Unit attached, the CU software controls the face 2 display. figure4.25 shows the levelling process.

To toggle between a graphical or numerical display press .

To change the graphical displays sensitivity (zoom) press .

To accept press .

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

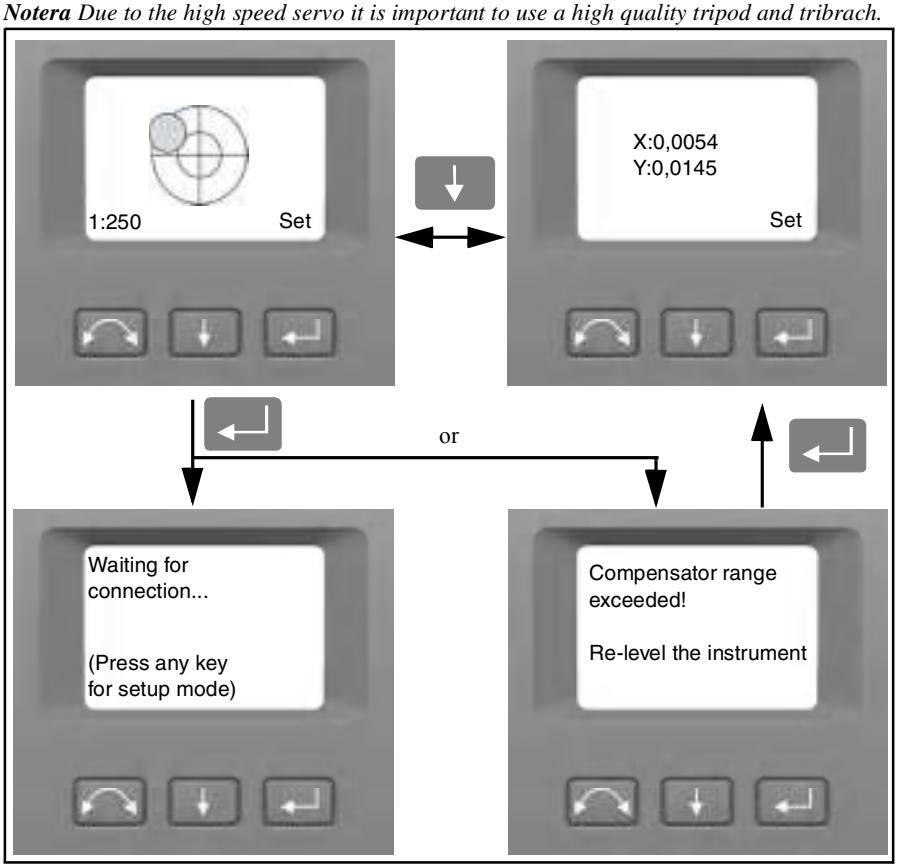


Figure 4.28 The levelling process

If there is no Control Unit attached, press any key to enter the Instrument setup menu.

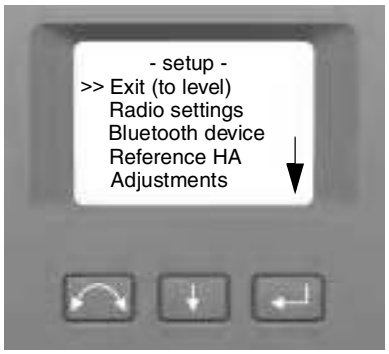
Note – *If the instrument is inactive for longer than 300 seconds (5 minutes) it will go to suspend mode. See Power management on page 89.*

Instrument Setup

With the face 2 display, you can access a number of instrument functions and routines without a CU attached:

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

Note – *It is possible to access the instrument setup menu without levelling the instrument.*



The instrument *Setup* menu is structured as follows:

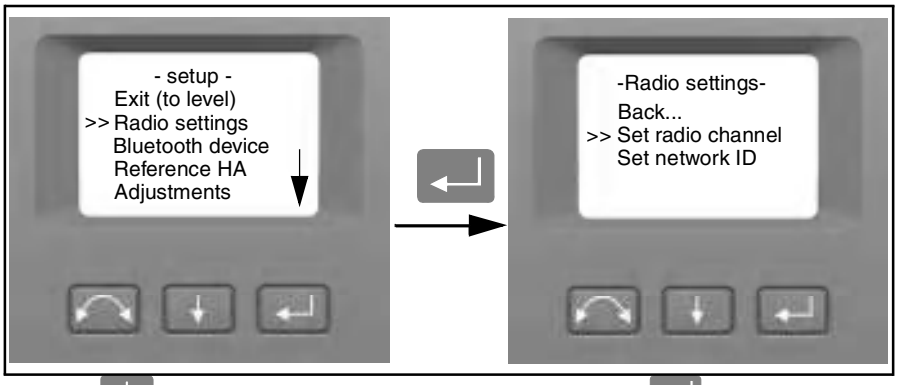
- Exit (to level)
- Radio settings. See page 43.
- Bluetooth® device
- Reference Horizontal Angle. See page 46.
- Adjustments. See page 46.
  - Back
  - Compensator calibration. Seepage 47.
  - HA/VA and trunnion axis collimation. See page 49.
  - Autolock® collimation. See page 53.
  - Laser pointer on/off. See page 55.
- Firmware version information. See page 56.
- Language Menu

Radio settings

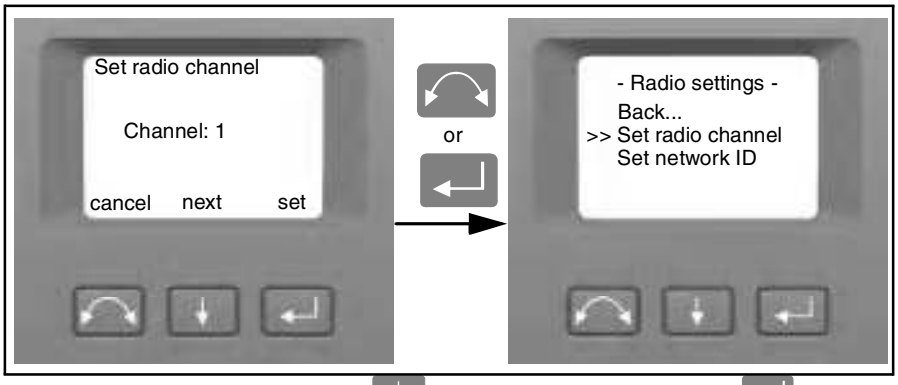
In the *Radio settings* menu it is possible to set the radio channel and network ID number.

Set radio channel

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



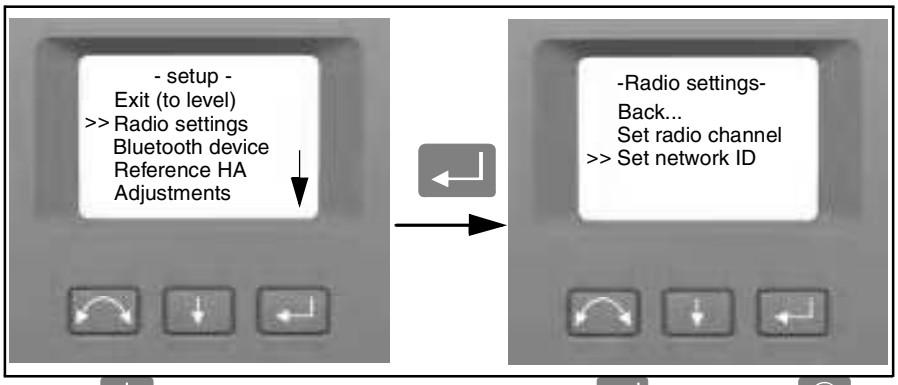
3. Press ↓ to select the radio Channel number and then press ↵ to set or press ↶ to cancel and return to the *Radio settings* menu.



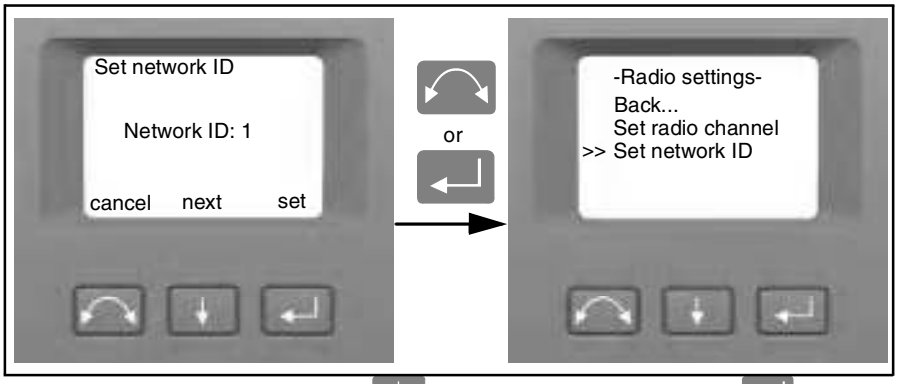
4. To return to the *Setup* menu Press ↓ to scroll to Back and then press ↵.

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. Press ↓ to select the radio Network ID and then press ↵ to set or press ↶ to cancel and return to the *Radio settings* menu.



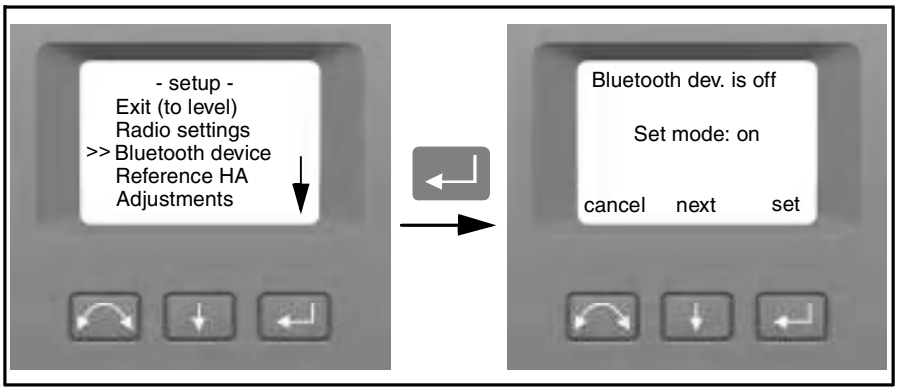
4. To return to the *Setup* menu Press ↓ to scroll to Back and then press ↵.

Bluetooth® device

In the Bluetooth device menu it is possible to set the Bluetooth device On or Off.

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.

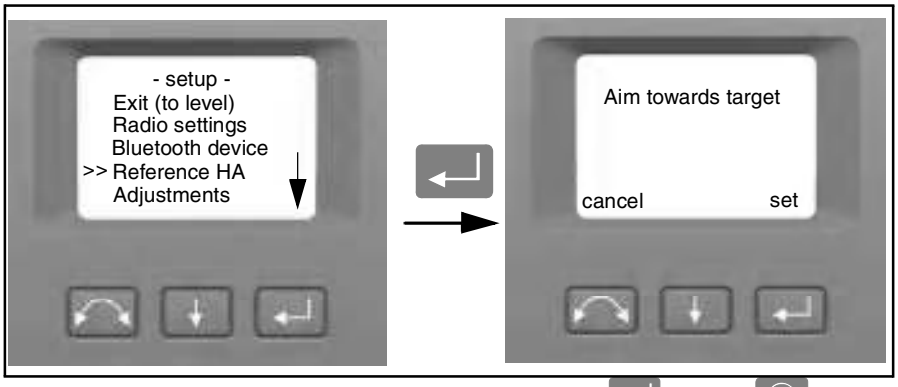
1. Press ↓ to scroll to Bluetooth then press ↵.
2. Press ↓ to select Bluetooth device on or off.
3. Press ↵ to set, the *Setup* menu appears.



Note – *At delivery the Bluetooth device is by default in off mode. The setting then made by the operator will be the default mode until a new setting is made.*

Reference HA

1. Press ↓ to scroll to Reference HA and then press ↵.



2. Aim the instrument towards the target and then press enter ↵ to set or ↶ to cancel.

On pressing enter the instrument will register the horizontal angle to the location as if the instrument had been aimed in Face 1.

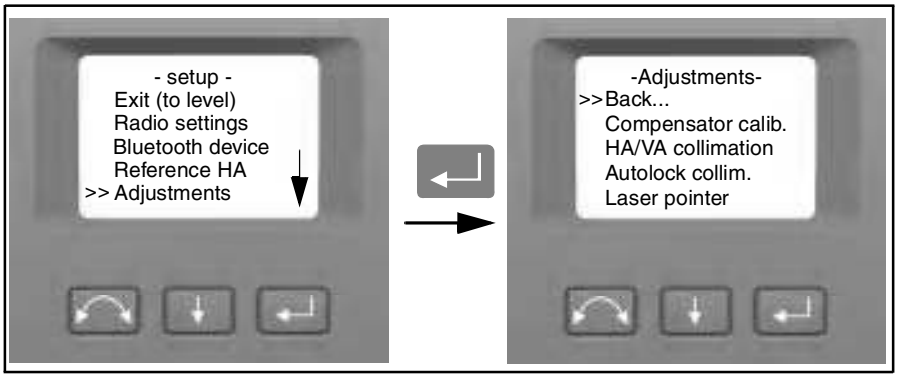
(i.e. 180 degrees or 200 grads from the Face 2 angle the instrument is actually aimed).

The *Setup* menu appears.

Adjustments menu

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

- Press ↓ to scroll to Adjustments and then press ↵.



Compensator calibration

The compensator is calibrated when the instrument is in perfect balance, then the compensator sensor will compensate for any imbalance caused by e.g. the CU on the instrument introduced later. For this reason the instrument has to have low imbalance i.e. CU is detached from the instrument during the compensator calibration process.

To minimize unbalance in the instrument:

- Do not have the Control Unit mounted on the instrument.
- Internal battery must be fitted.
- Handle must be mounted.
- The instrument will automatically position the distance unit 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.
2. Press ↓ to scroll to Compensator calib. and then press ↵.
3. Follow the instructions in the display. figure 4.29.

Note – *Trimble recommends that you regularly carry out a compensator calibration, particularly when measuring during high temperature variations and where high accuracy is demanded.*

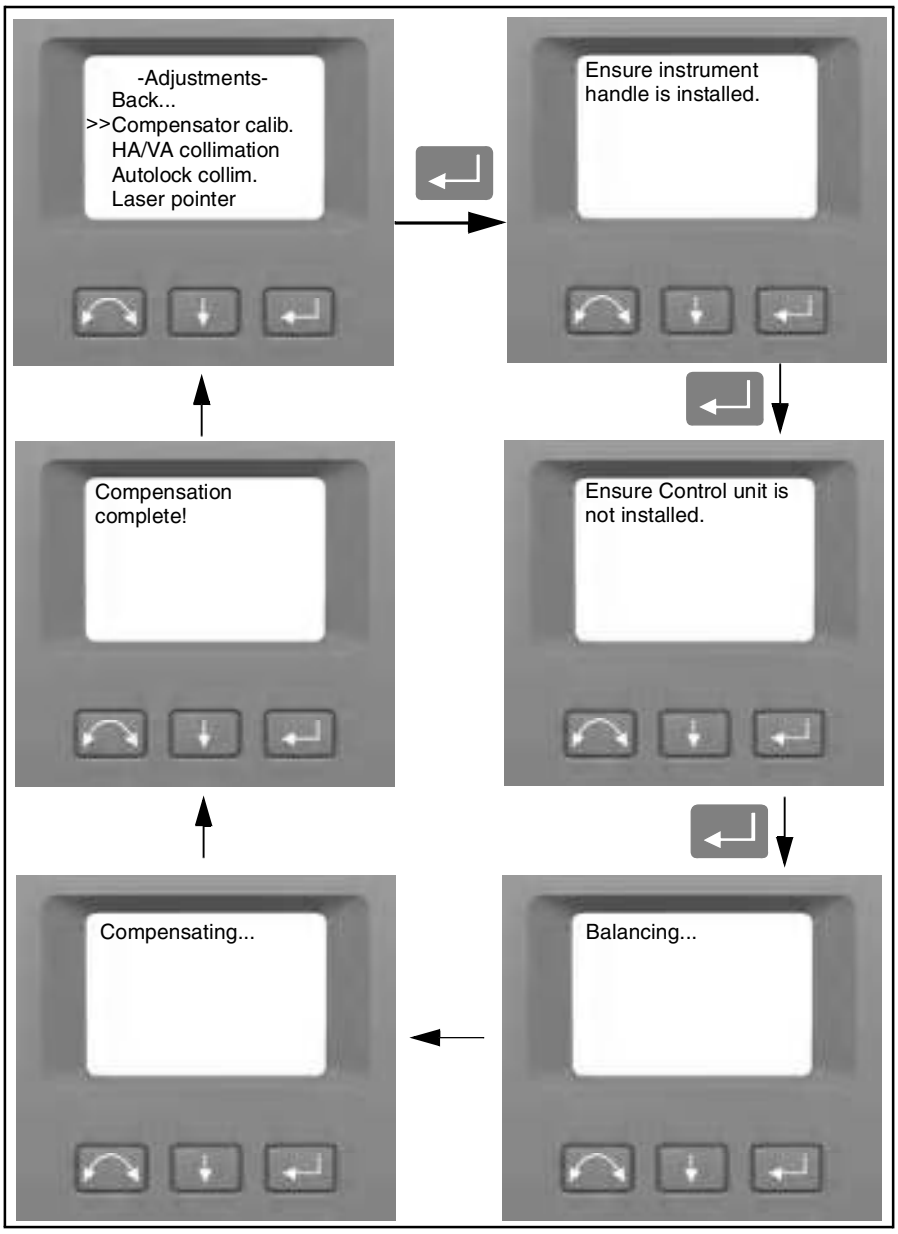


Figure 4.29 Compensator calibration routine

HA/VA Collimation and trunnion axis tilt

The collimation routine consists of the HA/VA collimation and then the trunnion axis tilt.

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

The S Series Total Station 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 I 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 S Series Total Station will always provide accurate measurements.

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

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

Trimble recommends that a collimation check and tiltaxis check be carried out routinely as follows

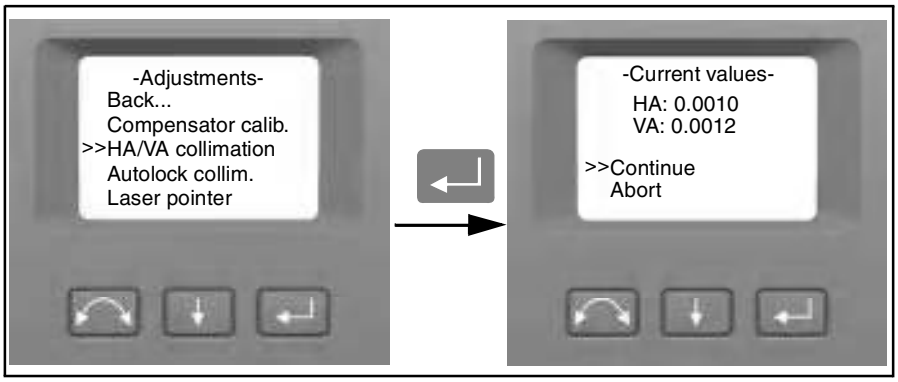
- After any long uncontrolled transport of the instrument (e.g. after service or shipment to a new location)
- After any accidental knock or drop
- At any time when the operating temperature changes by more than 10 •C (18 •F)
- At any time when the instrument changes the height above sea level by more than 500m (1640 Feet)
- At any time when the highest precision positions are required
- Routinely on a periodic basis (Monthly, weekly etc.)

Trimble 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.

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.

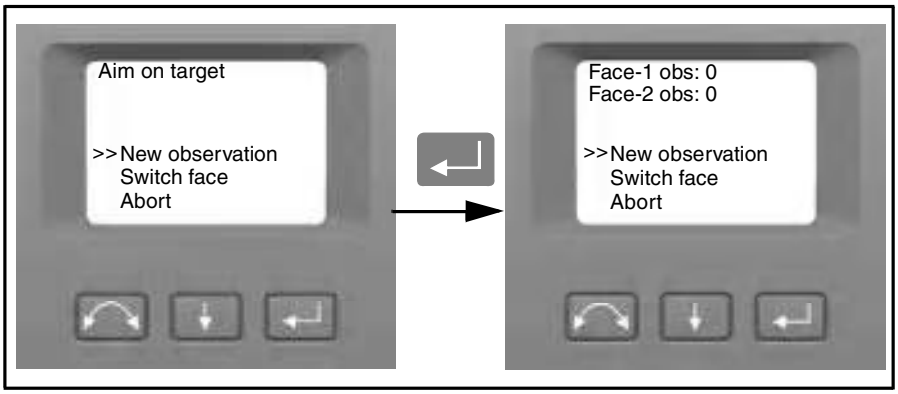
In a new instrument the values should be close to zero, over time these will change. The instrument allows a maximum value of 0.05 grads (0.045 degrees) in the HA, VA and Trunnion axis tilt values. If these values are exceeded, the instrument will need a service to rectify a mechanical problem.

1. Press ↓ to scroll to HA/VA collimation and then press ↵.



The current collimation values appears.

2. Press ↓ to scroll to one of the following:
   - Continue Then press ↵ to continue the HA/VA collimation test.
   - Abort. 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.
   - Switch face. Then press ↵ to change between face 1 and 2.
   - Abort. 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. ±5 grads (± 4.5 degrees) to the horizontal and at a minimum distance of 100 m (328 ft.).

b. 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 5 sightings in Face 2

d. Press ↓ to scroll to Switch face. Then press ↵ to change to face 1.

e. Aim accurately towards the same point as that used in face 2.

f. 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.

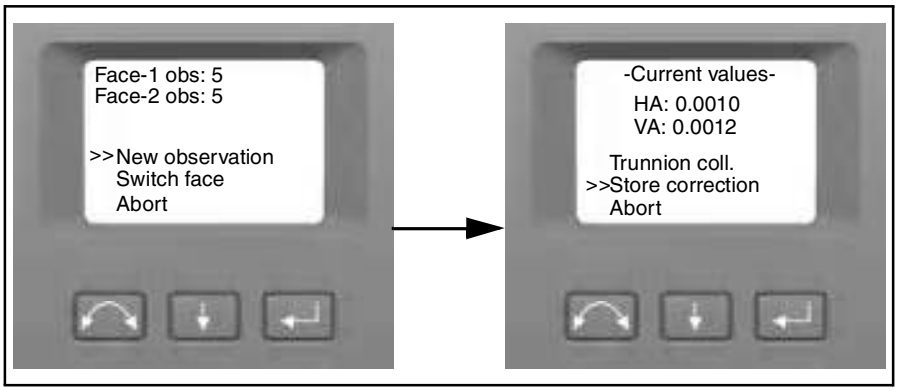
The software calculates and displays the new horizontal and vertical collimation values.

4. Press ↓ to scroll to one of the following:

– Trunnion coll. Then press ↵ to continue to Trunnion collimation.

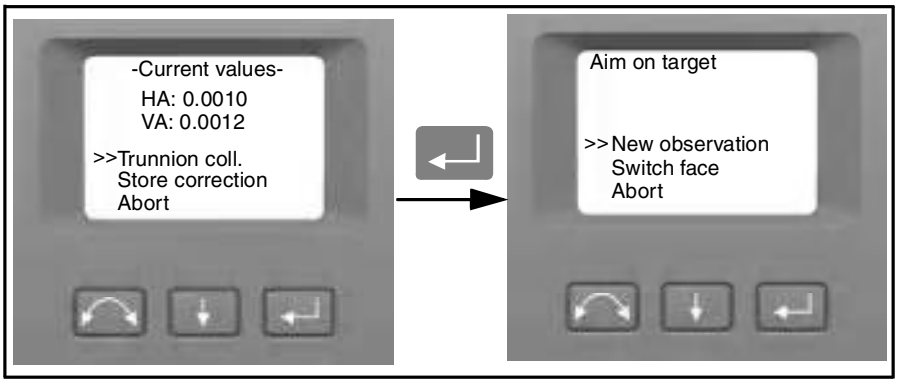
– Store correction. Then press ↵ to accept and store the new collimation values.

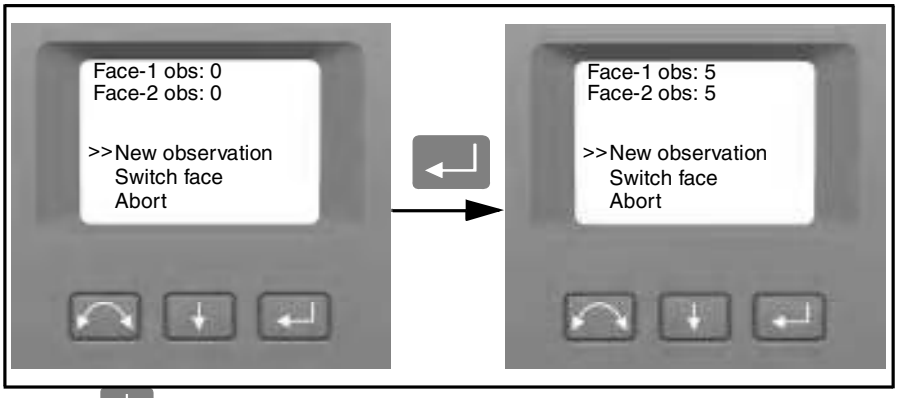
– Abort. Then press ↵ to return to the *adjustments* menu.



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 collimation test.





6. Press ↓ to scroll to one of the following:

- New observation. Then press ↵ to continue the trunnion axis tilt test.
- Switch face. Then press ↵ to change face.
- Abort. 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 II 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.).

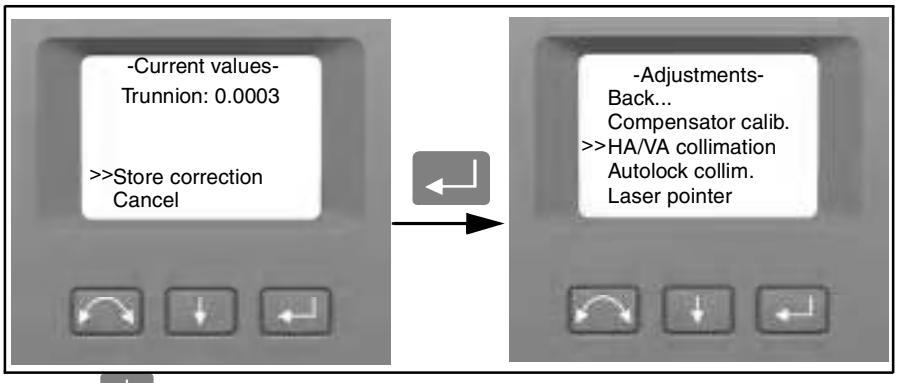
b. Press ↵ to measure and record angles.

c. Press ↓ to scroll to Switch 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 have 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 0.05grads (0.045 degrees), then the instrument must be mechanically adjusted at the nearest authorized Trimble service center.*

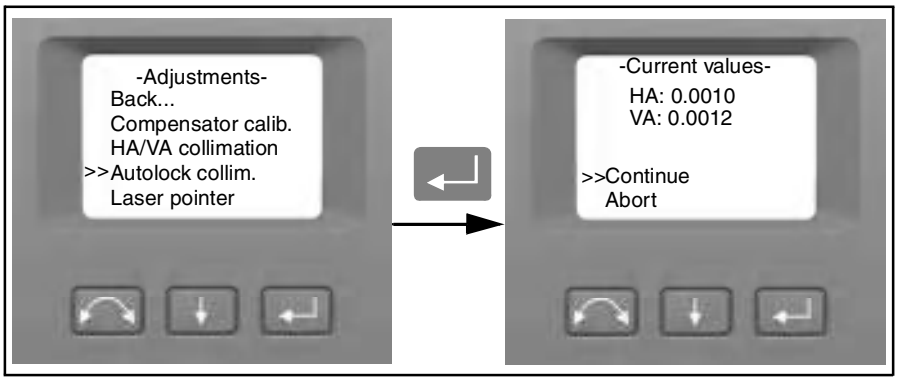
Autolock collimation (Only on instruments with Autolock capability)

The instrument tracker unit is designed to be coaxial with the instrument cross hairs. If for any reason the alignment of the tracker deviates from the line of the telescope cross hairs, then errors in position of the point being measured would result. For this reason an Autolock collimation check needs to be carried out on a regular basis (under the same conditions as the HA/VA collimation check) to ensure that any slight misalignment is corrected for.

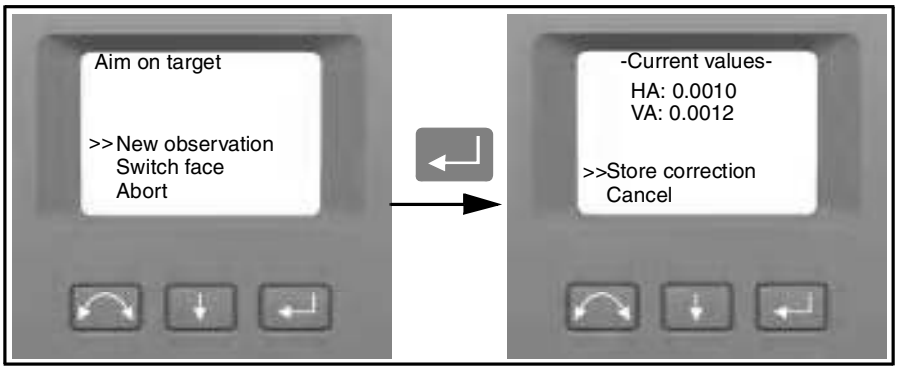
Perform the test over a similar distance as that you will be working on, but at least 100 m. The target must be very still during the test (Trimble recommends that you use a tripod or bipod mount for the target) and must be in clear line of sight without any obstructing traffic. The instrument is calibrated 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 113*

1. Press ↓ to scroll to Autolock collim then press ↵.



2. Accurately aim towards a prism.
3. Press A 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.

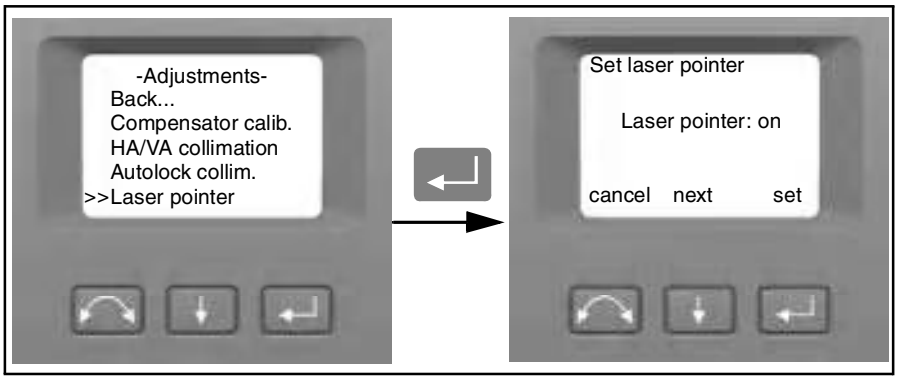
Laser pointer

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. In order to adjust the laser pointer it has to be switched On, see page 4-58

1. Press ↓ to scroll to Laser pointer then press ↵.
2. Press ↓ to select laser pointer on or off.
3. Press ↵ to set, the *Adjustments* menu appears.

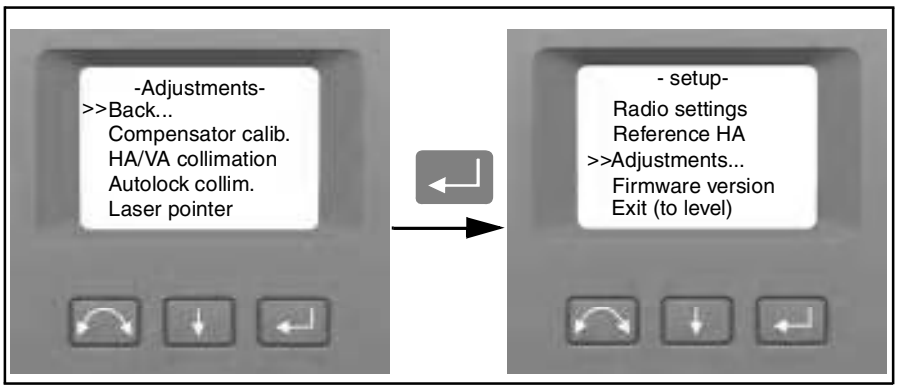


With the laser pointer on, you can adjust the beam, For more information, see The Laser Pointer, page 58.

4. To return to the *Adjustments* menu without changing the setting press ↶.

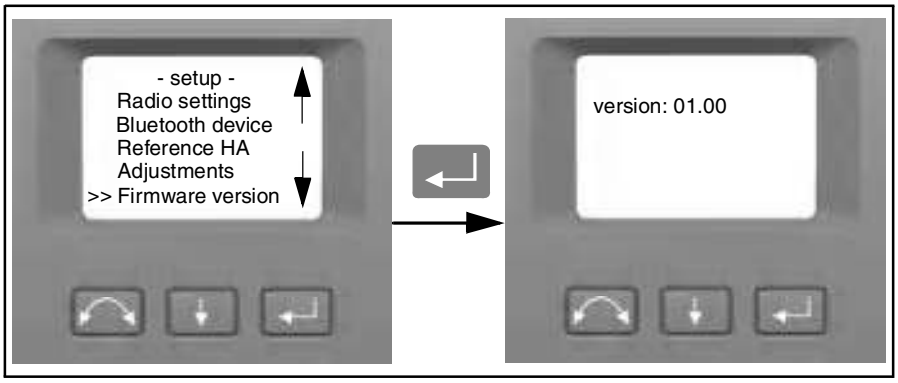
Back

1. To return to the *setup* menu, press ↓ to scroll to Back... and then press ↵.



Firmware version information

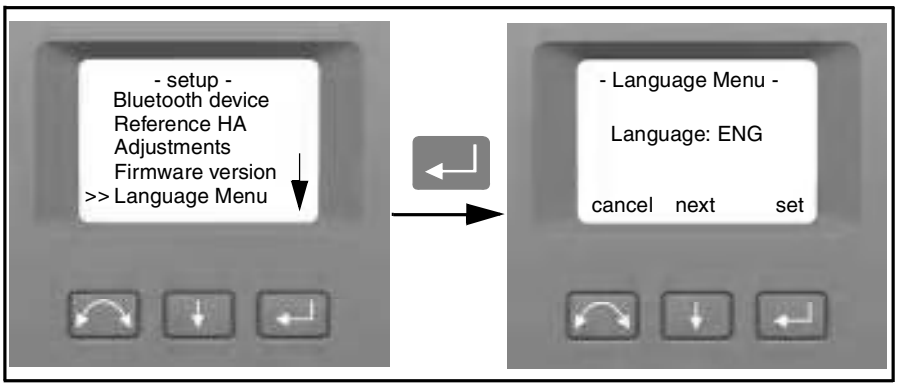
1. Press ↓ to scroll to Firmware version and then press ↵. The instrument firmware number appears on the screen. The program will return automatically to the *setup* menu.



Language Menu

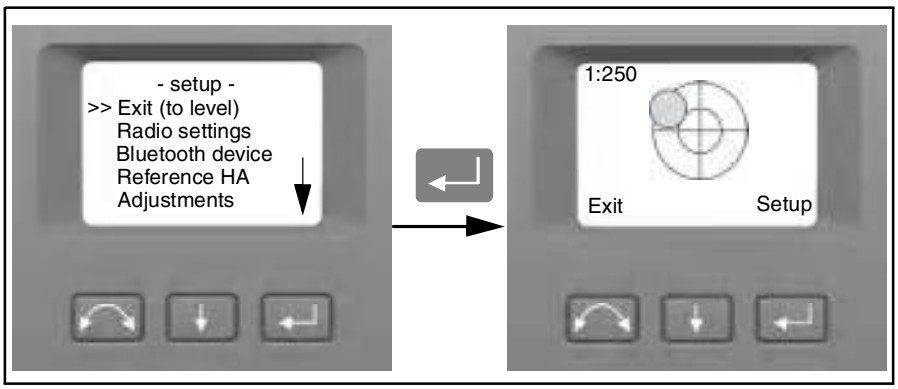
In the *language menu* it is possible to select the language for the Face 2 display.

1. Press ↓ to scroll to Language Menu and then press ↵.
2. Press ↓ to scroll through the available languages
3. Press ↵ to set 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 S series High Precision Total Station uses a red laser beam to measure and as a laser pointer.The S Series DR 300+ Total Station uses a red laser 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 using the laser pointer, use the supplied adjustment target to check the laser alignment regularly and before you attempt precise distance measurements:

1. Setup the adjustment target 25–50 metres away, facing the instrument.
2. Activate the laser pointer function to switch on the red laser beam.
3. Aim the instrument to the centre of the target plate and then inspect the position of the red laser spot in relation to the telescope cross-hairs.
4. If the red laser spot lies outside the cross-hairs, adjust the direction of the beam until it matches the cross-hairs. figure 4.30

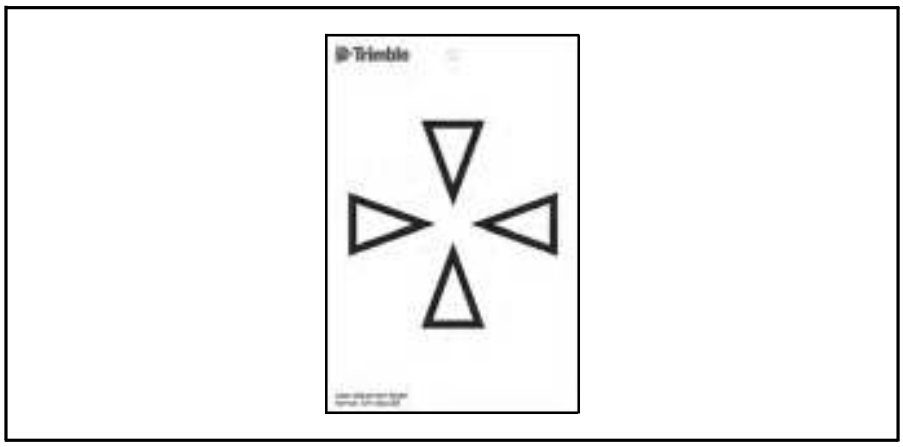


Figure 4.30 Adjustment target for DR 300+

Figure 4.31 Adjustment target with reflective foil for High Precision

Adjusting the laser beam

1. Pull out the two plugs from the adjustment ports on top of the telescope housing. figure 4.32

Figure 4.32 Laser pointer adjustment ports

2. To correct the vertical position of the laser spot, insert the allen key into the vertical adjustment port and turn it as shown in figure 4.33.

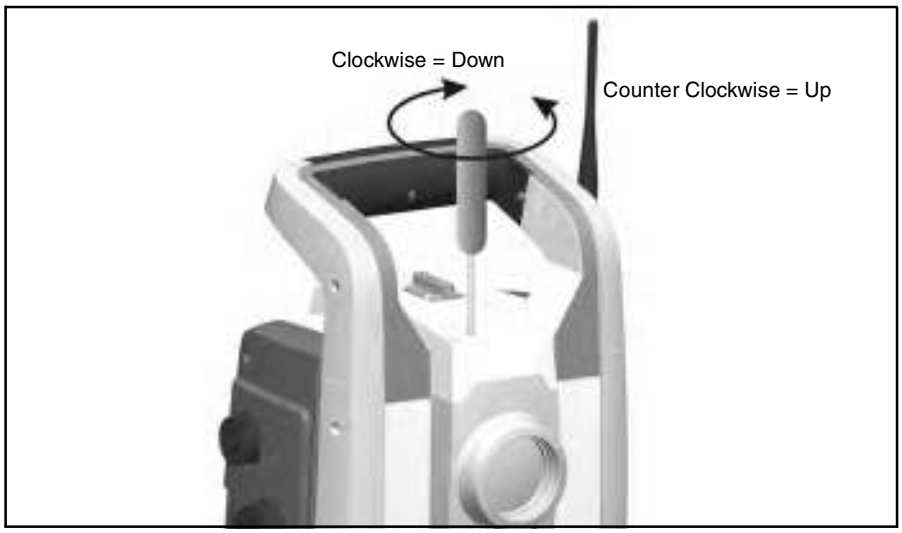


Figure 4.33 Vertical position adjustment

3. To correct the horizontal position of the laser spot, insert the allen key into the horizontal adjustment port and turn it as shown in figure 4.34.

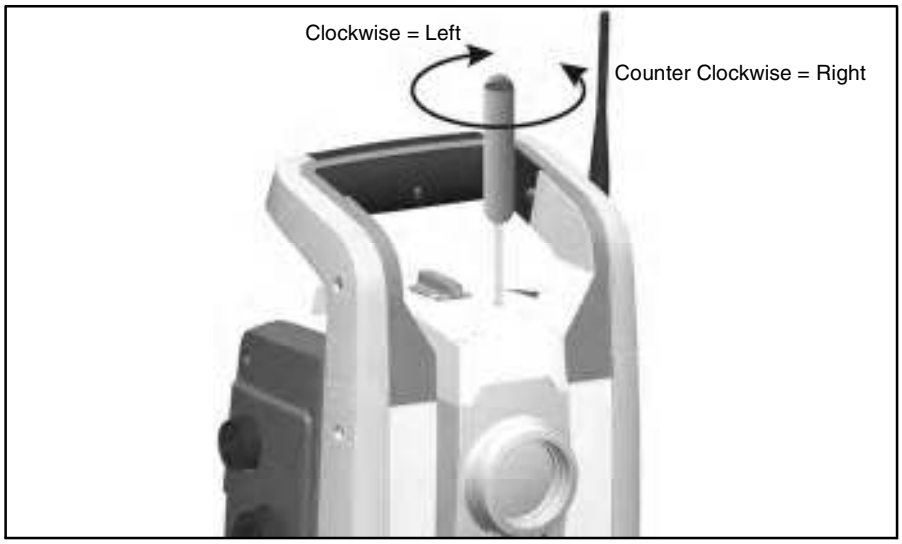
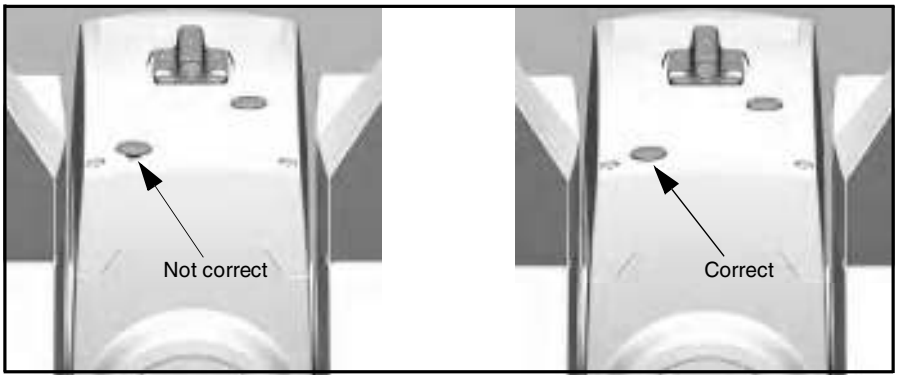


Figure 4.34 Horizontal position adjustment

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 top mark corresponds to the trunnion axis of the instrument. The bottom mark is 0.158 m (0.518 ft.) below the top mark. Measure the bottom mark to the top ridge of the mark. figure 4.35

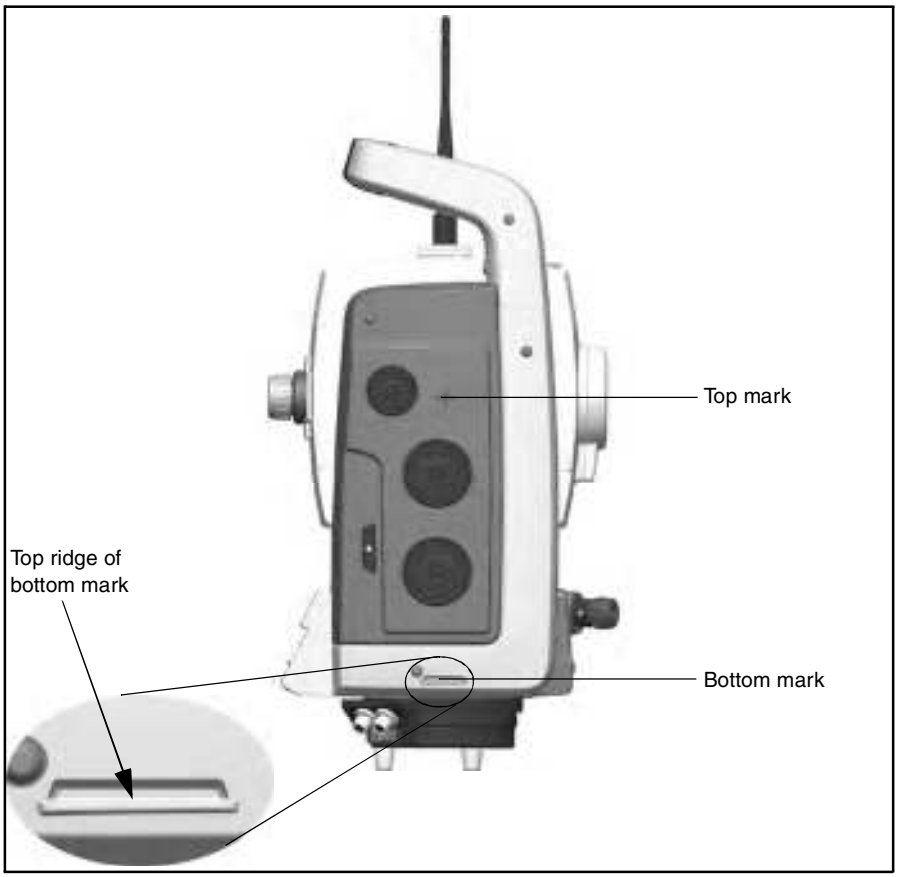


Figure 4.35 Instrument height marks

When there is a Trimble Control Unit (TCU) attached running Trimble Survey Controller or Trimble Survey Pro, the software has additional functions that reduce the bottom mark measurement to the required vertical instrument height to the trunnion axis. figure 4.36 and the following paragraph.

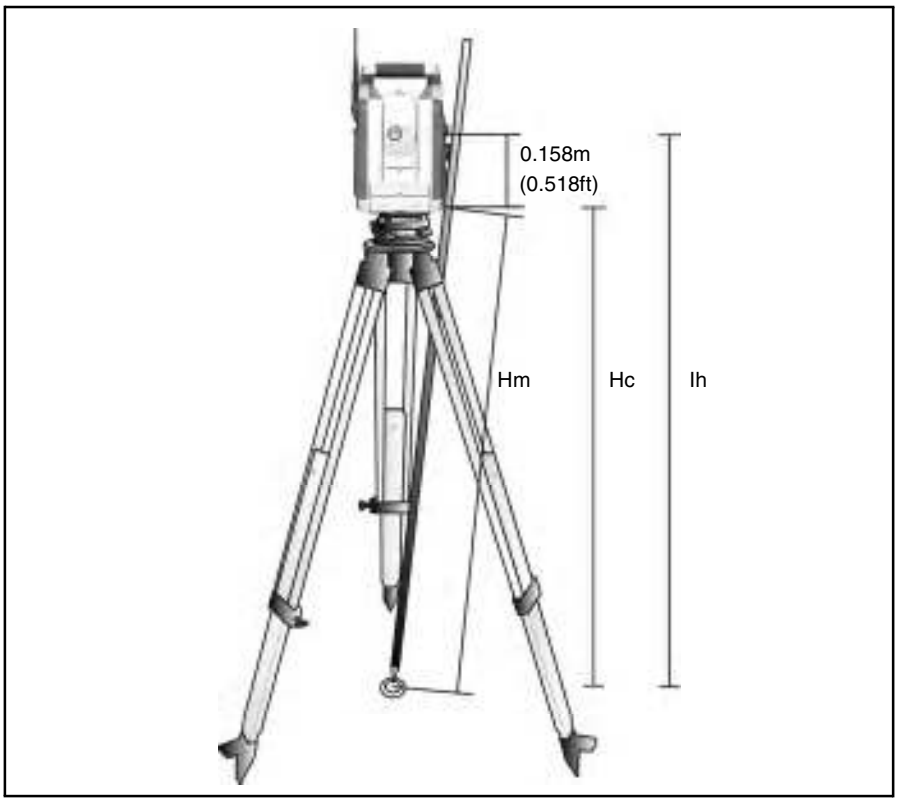


Figure 4.36 Instrument height measurement

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

Alternatively, to obtain an accurate measurements to the top mark (Ih), you can manually measure the slope distance from the ground to the bottom mark (Hm). To calculate the total instrument height (Ih), insert the measured slope distance (Hm) into the formula below:

$$Ih = 0,158 + \sqrt{Hm^2 - 0,091^2}$$

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 (±0.1 m) (4.920 ft. (±0.328 ft.)). figure 4.37
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 4x 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 reticle in relation to the ground mark, no further adjustment is needed.

Caution – When adjusting the optical plummet with the four adjustments screws it is important that the screws are correctly adjusted. When one screw is adjusted the opposite screw must be equally adjusted in the other direction, in order to keep the correct tension on the optics. Do not overtighten the screws, this might damage the optics

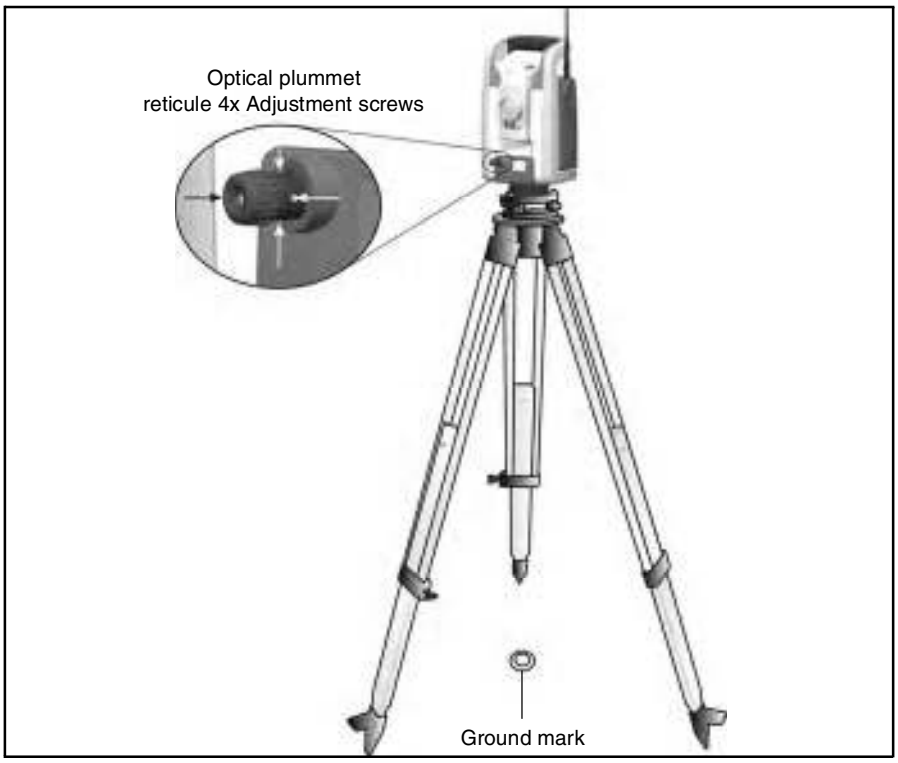


Figure 4.37 Optical plummet adjustment

Check List

Before you begin a survey, check the following items:

- Lenses are clean
- Instrument is correctly leveled
- Collimation error
- Autolock collimation error (if the instrument is equipped with Autolock capability)
- Trunnion axis tilt
- Correct radio channel is selected (robotic measurements only)
- Laser Pointer beam alignment
- Measure instrument height
- Allow sufficient time for the instrument to adjust to the ambient temperature, see page 40

Attaching a Trimble Control Unit

1. Hook the top of the Trimble Control Unit (CU) over the top edge of the panel attachment. figure 4.38

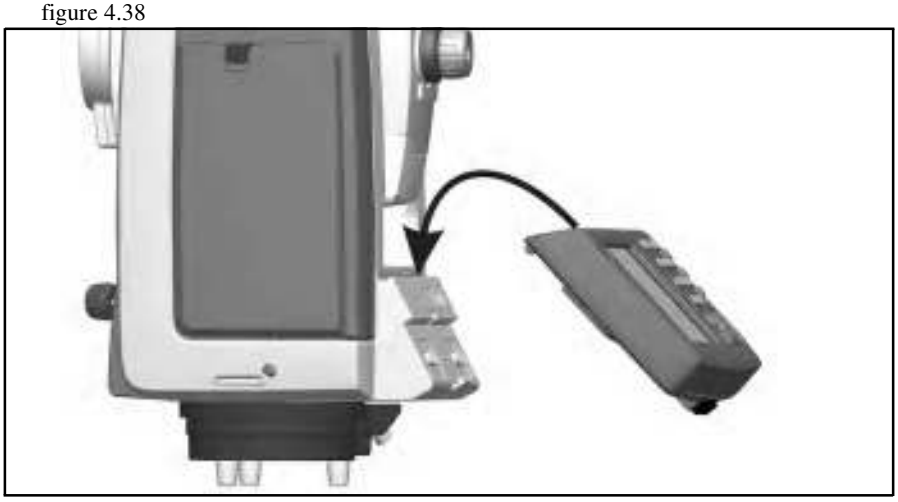


Figure 4.38 Attaching the Trimble CU to the instrument

2. Push the bottom of the CU toward the panel attachment until it clicks into place. figure 4.39

Figure 4.39 Attaching the Trimble CU

Detaching the Trimble Control Unit

Caution – When the Control Unit is removed from the instrument it is recommended to to have the Control Unit in suspend or off mode.
To remove the Control Unit from the instrument when in on mode will not damage the equipment, but files that are being saved or written to when the Control Unit is being removed might be damaged or lost.

1. Push the lock release button on the bottom of the CU. figure 4.40 (1)
2. Lift the bottom of the CU away from the instrument (2),

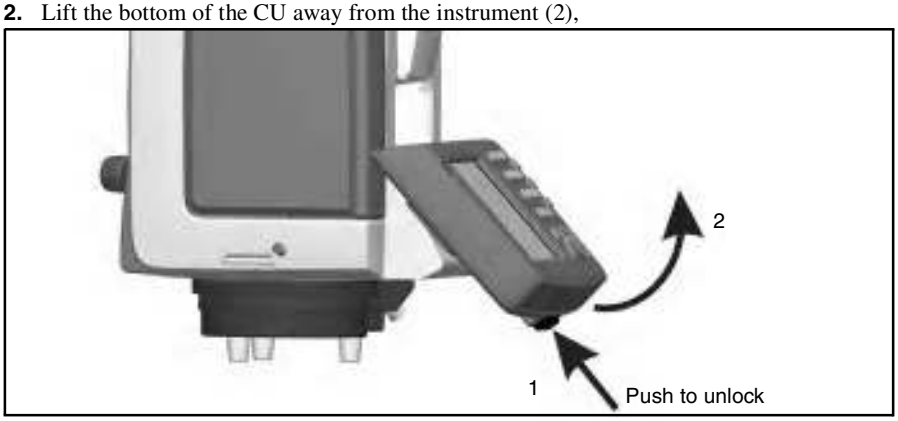


Figure 4.40 Detaching the Trimble CU

3. Unhook the top of the CU from the top edge of the panel attachment and remove the CU from the instrument. figure 4.41

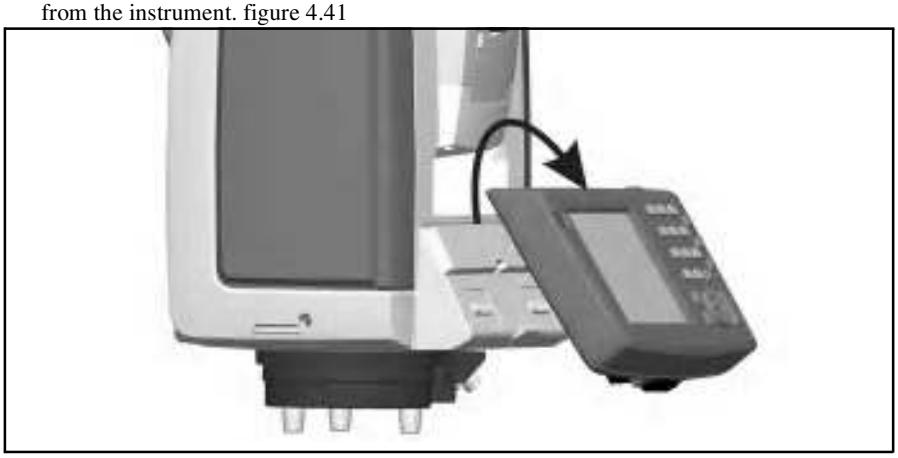


Figure 4.41 Detaching the Trimble CU

Lifting the Instrument

To lift the instrument, hold it as shown in figure 4.42.

Figure 4.42 Correct way to lift the instrument

Do not hold the CU as you lift the instrument or you may accidentally push the lock release button, causing the CU to fall off the instrument. figure 4.43

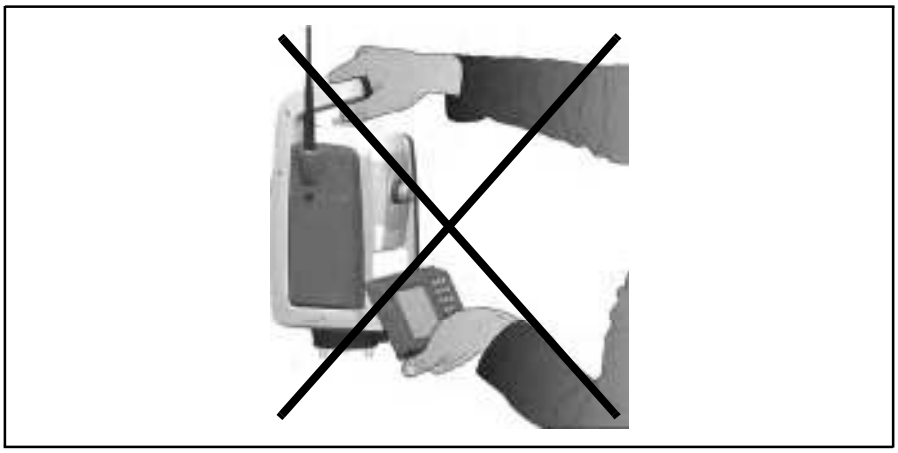


Figure 4.43 Wrong way to lift the instrument