June 25th, 2015

FOCUS 30/FOCUS 35 Field Calibration with Survey Pro Field Software

Summary:

This support note outlines the procedure which should be followed to calibrate the instrument in the field using Spectra Precision FOCUS 35 / 30 total stations with Spectra Precision Survey Pro field software.

Application note provided for total station firmware version 1.5.1 and Survey Pro 5.5.2 software release.

Issue(s) Addressed: Proper Field Calibration Routine for the FOCUS 35/30 Robotic Total Station

Solution:

Step 1. Preparations

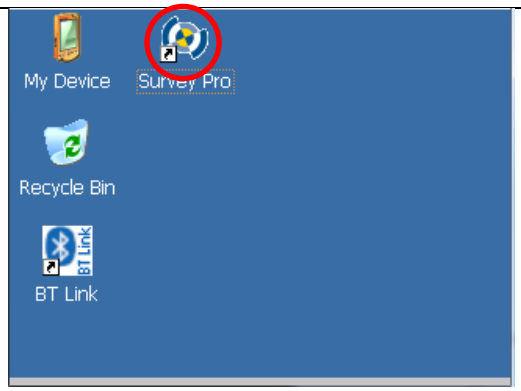
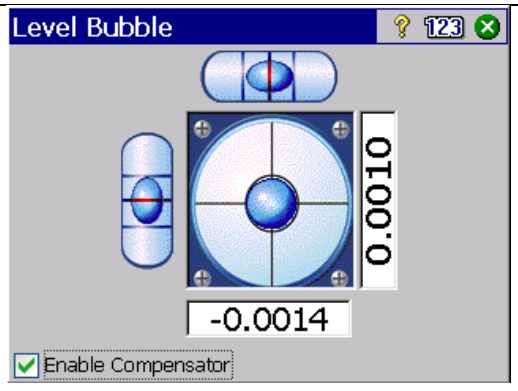
a. To get the best possible results it is recommended that the procedure be done with good field visibility conditions: moderate temperature, low water vapor content and low winds.
b. Make sure that a stable tripod is used. Spectra Precision recommends the Tri-Max heavy duty tripod (part number 88401-02-SPN).
c. Use a minimum 50 mm standard surveying prism fixed to a tripod for the tracker collimation process. Never use a 360° prism for the calibration.
d. For the Optical & Trunnion Axis Tilt Collimation process it is not necessary to use a prism as the target for this calibration. Good recognizable terrain detail is satisfactory enough as long as the pointing can be repeated.
e. Before starting the procedure, put the prism and total station on the tripods and let them set to get acclimatized to the surrounding temperature.
It is recommended to use 2 minutes for every °C/°F difference between the storage and operation temperatures, but not less than 15 minutes.
f. To get the best possible calibration results, please complete all the steps in order as described below.

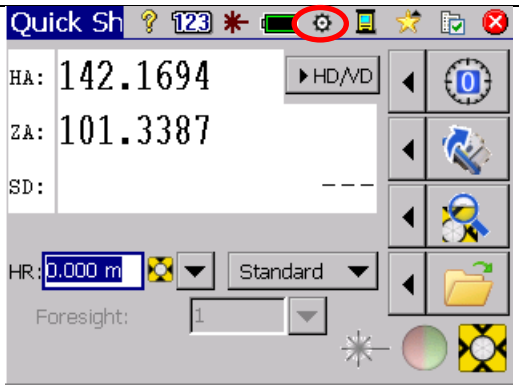
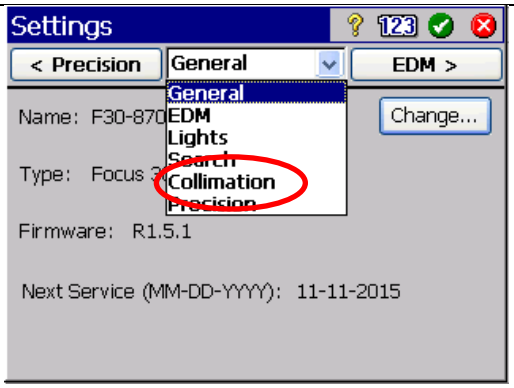
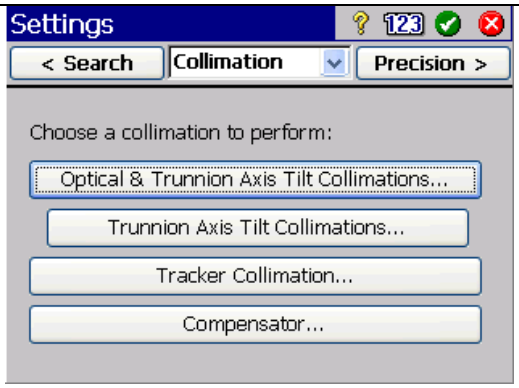
Step 2. Detect and eliminate parallax error.

a. Detection of parallax:
   i. Aim the telescope at the target.
   ii. Rotate the focusing ring until the target image is in sharp focus on the reticle crosshairs.
   iii. Move your eye vertically and laterally to check whether the target image moves relative to the reticle crosshairs.
   iv. If the target image does not move, there is no parallax.
   v. If the target image does move, move to step "b".

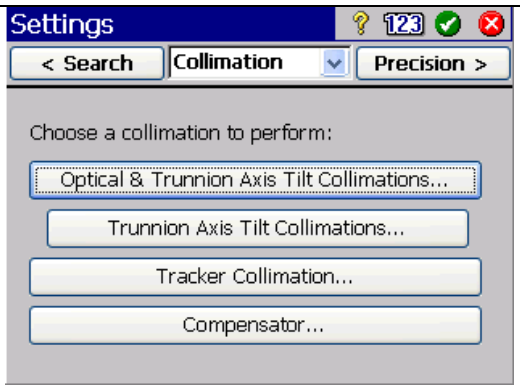
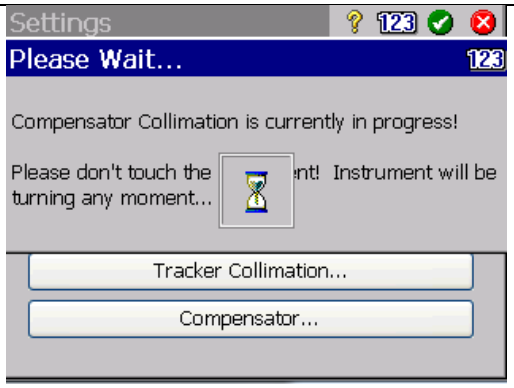
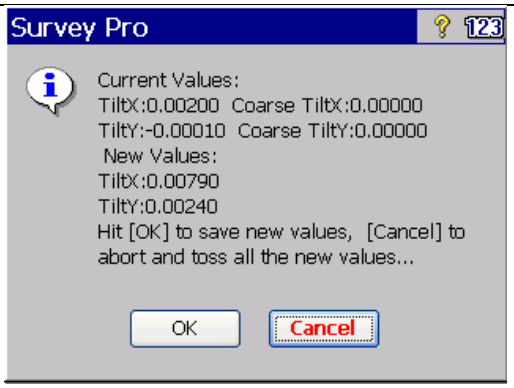
b. Elimination of parallax:
   i. Aim the telescope at a blank area like a wall, the sky or a sheet of paper.
   WARNING – Never look at the sun through the telescope. If you do, you may damage or lose your eyesight.
   ii. While sighting through the eyepiece, rotate the diopter ring until the reticle crosshairs are brought into sharp, clear focus.
   iii. Proceed to step "a" to detect if the parallax error is eliminated.

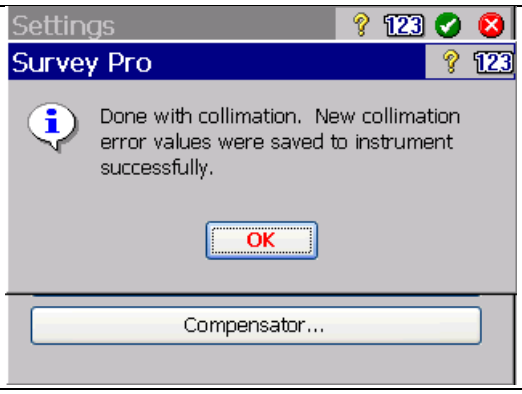
Step 3. Access to the calibration menu of Survey Pro.

1	**Starting the Survey Pro application onboard the FOCUS 30/35**. Double tap the Survey Pro icon. *Note – Collimation Routines and Adjustment settings can also be performed remotely using an external data collector and a communication link.*	
2	**Level Bubble** Level the instrument, make sure it is not 'Out of tilt!' and select the 'Close' icon to continue. Make sure that the "Enable Compensator" function is checked.	

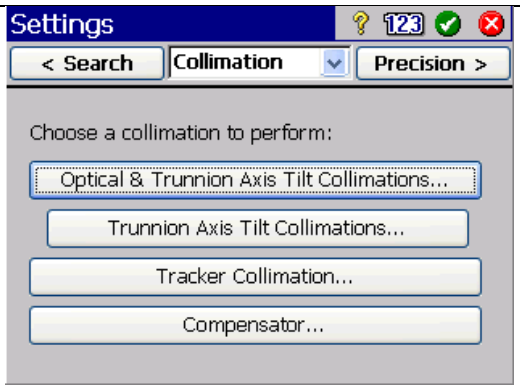
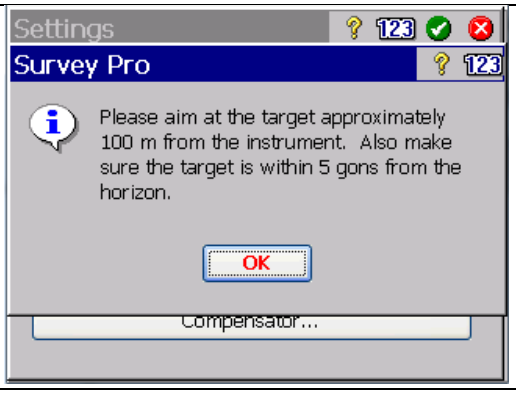
3	**Locate the Settings Icon**. Tap the Settings icon 	
4	**Settings Menu.** From the General Settings select the Collimation option. Tap Collimation.	
5	**Collimation Menu.**	

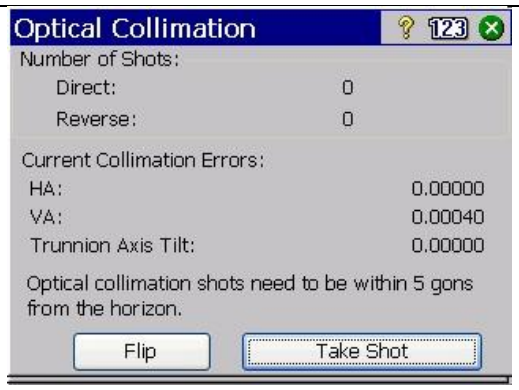
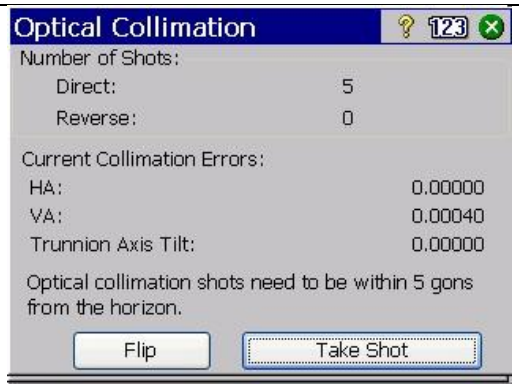
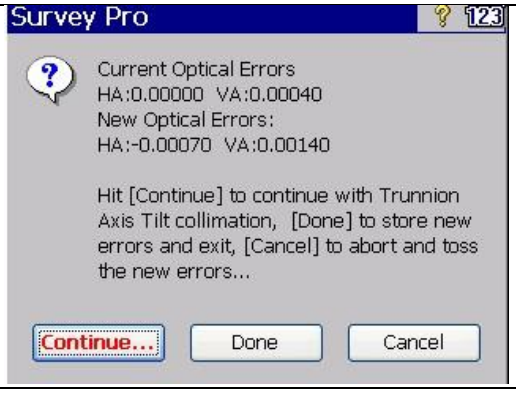
Step 4. Compensator calibration.

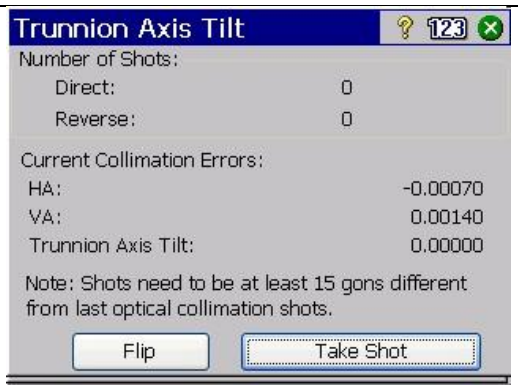
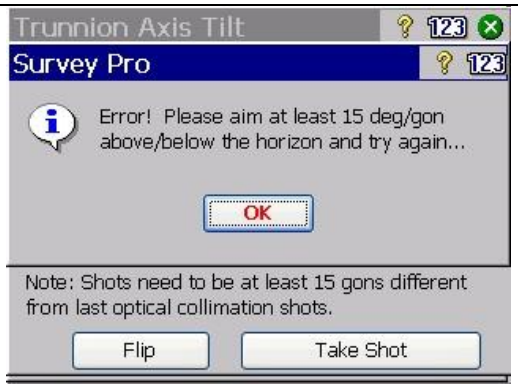
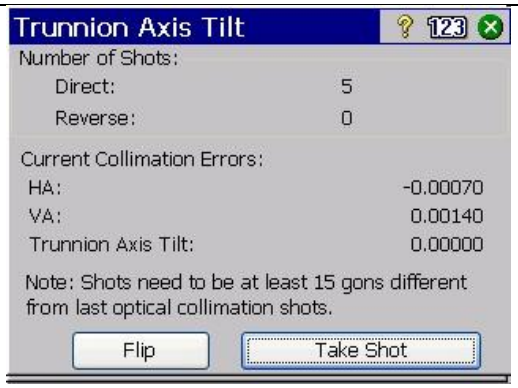
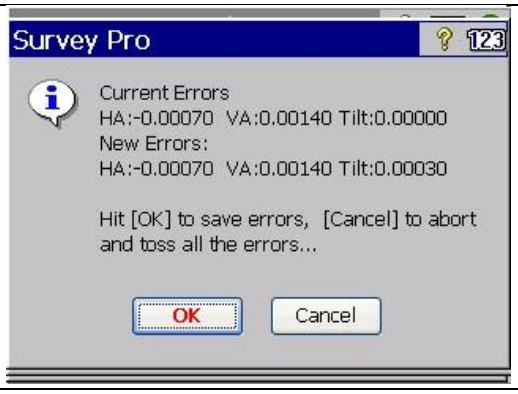
1	Make sure that the tripod is firmly setup and the instrument is properly leveled. Tap the Compensator... button.	
2	Follow the guidelines displayed on the screen. During this procedure the instrument will be rotating around its vertical axis. Make sure that nothing will disturb this motion. Instrument will rotate 180° and stop for a few seconds in this position and then turn back to its original position. Do not touch the instrument during this procedure. Hit OK to start the process.	
3	Following message will be displayed during the process.	
4	When finished a summary screen will be displayed. Press OK to save the new calculated values. *Note – If the Compensator calibration results continue to display large errors it is recommended sending the instrument to a service provider for a careful inspection and possible readjustment.*	

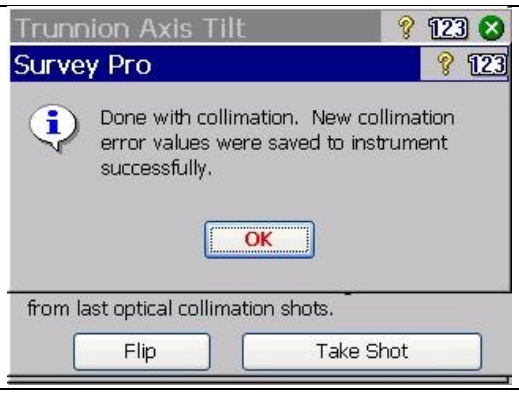
5	Tap OK to return to the Calibration screen.	

Step 5. Optical and trunnion axis tilt collimations calibration (Hz collimation and V index error).

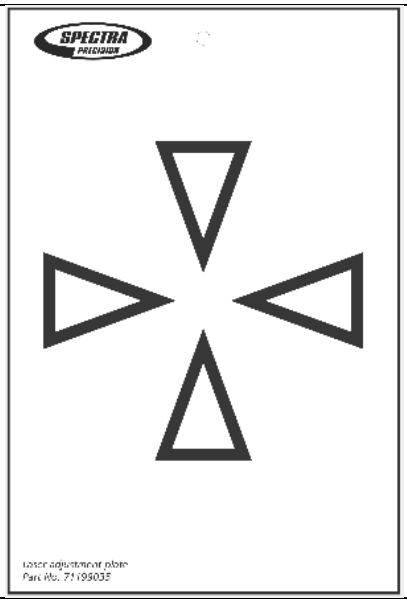
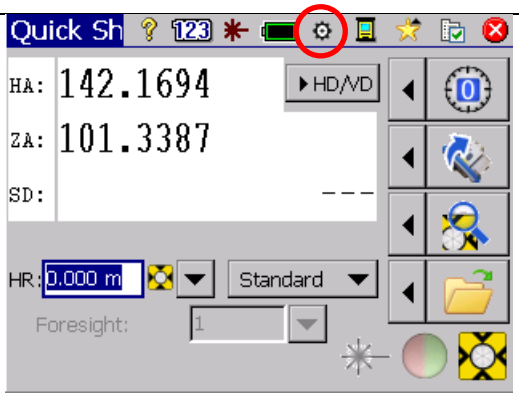
1	Make sure that the tripod is firmly setup and the instrument properly leveled. Tap the Optical & Trunnion Axis Tilt Collimations... button. *Note – it is not needed to use a prism as the target for this calibration. A recognizable terrain detail is satisfactory enough as long as the pointing can be repeated.*	
2	Follow the displayed instructions. Press OK when ready. *Note – depending on your job settings the angular values will be displayed either in Grads (gons) or in degrees.*	

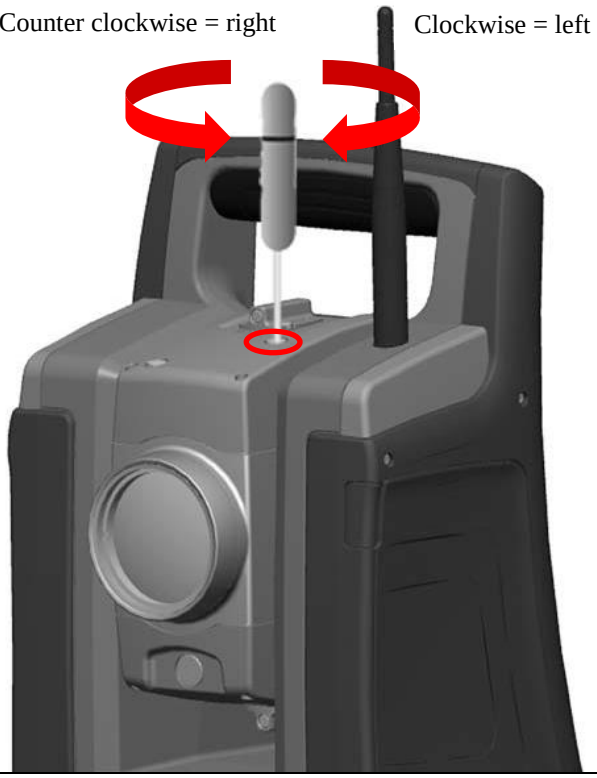
3	**Face 1** Orient the telescope to the target within 5° / 5G from horizontal and perform at least 5 'Direct' measurements on Face 1 using the [Take Shot] button. *Note - between each shot turn the telescope away from the target horizontally and vertically.* *Aim at the target again, preferably in different directions each time.* When the last measurement is taken press the [Flip] button to turn to Face 2.	
4	**Face 2** Repeat aiming the target in Face 2 manually and perform the same number of observations in Face 2 as measured on Face 1. *Note - between each shot turn the telescope away from the target horizontally and vertically.* *Aim the target again, preferably in different directions each time.* When the number of measurements taken in Face 2 matches the number of measurements taken in Face 1, the instrument will turn automatically to Face 1.	
5	After completing the last measurement using Face 2, the instrument will automatically flip to Face 1 and display the set of calculated errors. Review the computed optical errors and choose the [Continue...] button to go forward with the Trunnion Axis Tilt calibration.	

6	**Face 1** Orient the telescope to a target having a minimum 15° (G) difference in vertical from the target used for the collimation calibration before and perform at least 5 measurements in Face 1 using the [Take Shot] button. *Note - between each shot turn the telescope away from the target horizontally and vertically.* *Aim at the target again, preferably in different directions each time.* When the last measurement is taken press the [Flip] button to turn to Face 2.	
7	In case the target is less than the 15° (G) difference from the previous target, the following error will be displayed. *Note – in some environments it might be difficult to find such a steep observation point at longer distances. In this case a target closer to the instrument may be selected.*	
8	**Face 2** Perform the same number of observations in Face 2 as measured in Face 1.	
9	When the last measurement in Face 2 is completed the instrument will rotate automatically to Face 1 and will display the errors. Tap [OK] to save new values.	

10	The optical calibration is finished now. *Note – If the Collimation test results continue to display errors higher than 3' or 0,0200G it is recommended to send the instrument to a Service provider for a careful inspection and possible readjustment .*	

Step 6. EDM laser and cross-hair adjustment.

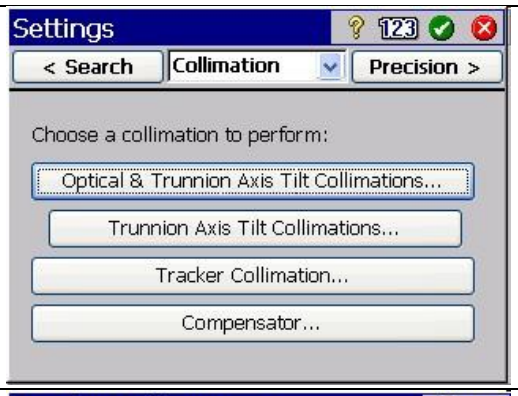
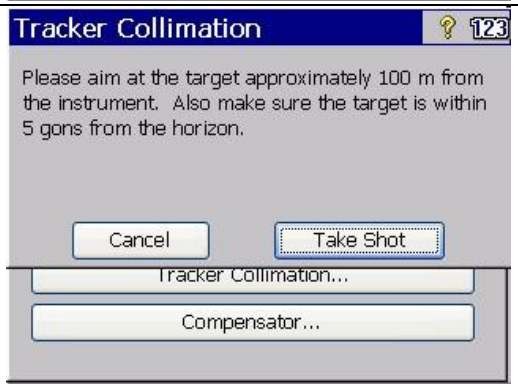
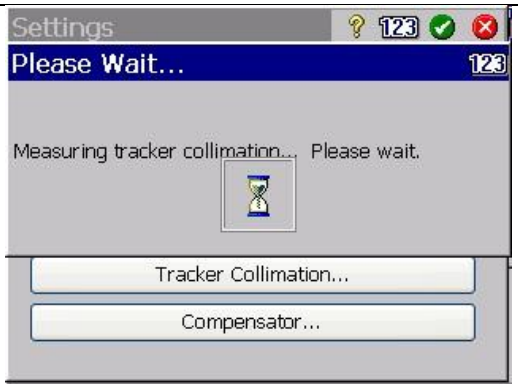
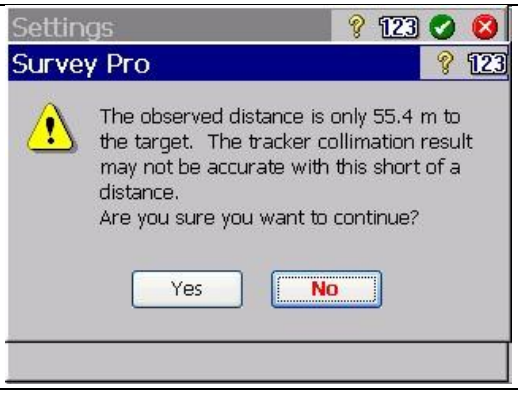
1	It is important to make the EDM laser and cross-hair adjustment prior to performing the tracker calibration. The purpose of this procedure is to ensure the cross-hair axis (line of sight) is coaxial to the EDM laser beam. Place the calibration plate (included with the FOCUS 30 /35 system) or reflective foil about 30m away from the instrument.	
2	Aim optically to the center of the plate with the telescope. (Do not use the laser pointer here.)	
3	Tap the laser pointer icon on the Quick Shot Survey Pro screen now.	

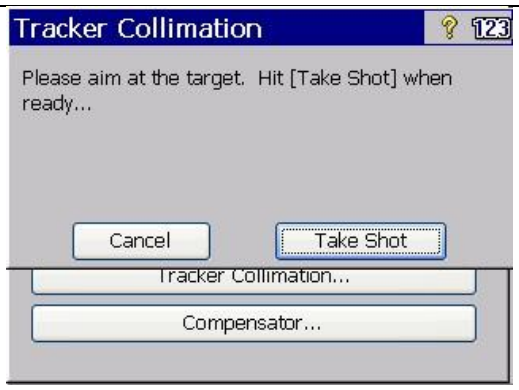
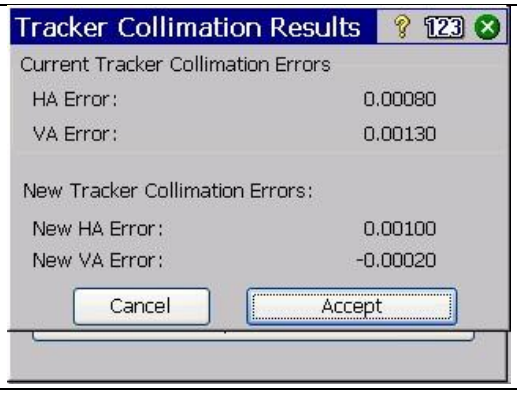
4	Verify that the laser pointer spot can be seen while looking through the eyepiece. *Note – when the laser pointer is not visible through the telescope, come closer with the plate (down to 20 m – but not less) or position the plate in the shadow.* *Try to avoid ambient light.*	
5	If the laser pointer and optical crosshair axis are not aligned, use the 2 screws on the top of the telescope to align them as described in the pictures below. Use the screwdriver included with your FOCUS 35 instrument kit. *Note – the EDM adjustment screws are very easy to move, pay attention and apply only a slight rotation to them.*	
6	Horizontal direction of the laser axis.	Counter clockwise = right Clockwise = left 

7	Vertical direction of the laser axis	
8	Aim optically to the center of the plate with the telescope again and verify that the laser beam dot is in the center of the plate. If not, repeat steps “2” to “8”.	
9	After adjustment as described above, turn off the laser pointer by tapping the icon in Survey Pro.	

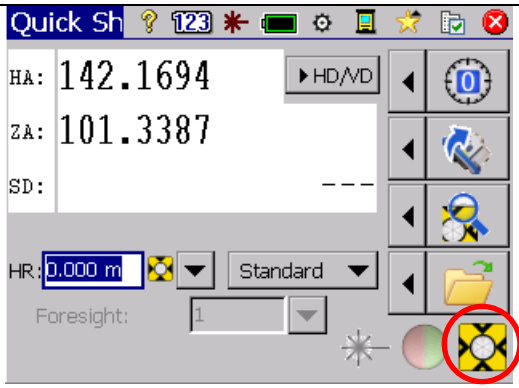
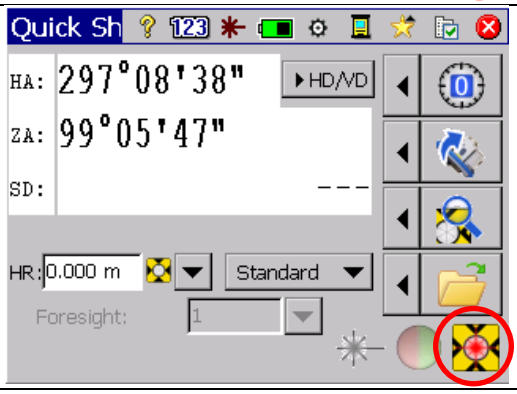
Step 7. Lock NGO tracker collimation

1	The LockNGo 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 LockNGo collimation check needs to be carried out on a regular basis to ensure that any slight misalignment is corrected for.	

2	Choose from the main 'Collimation menu' the Tracker Collimation... button. *Note – for this procedure, a standard 50mm surveying prism is needed. Do not use the 360° prism here.*	
3	Follow the instructions as displayed on the screen, set up the 50 mm single prism target at a range between 50m to 100m and choose Take Shot . *Note – it is very important to precisely aim to the center of the prism here.*	
4	The instrument will begin the tracker calibration procedure. Instrument will prompt to wait while the internal diagnostics check the target. *Note – do not move the instrument now.*	
5	If the target is not set at the specified distance an error message will be displayed. *Note – if it is not possible to meet the distance requirement it is still possible to continue with the Tracker Collimation.*	

6	Aim at the prism in Face 1 and press the Take Shot button. *Note – it is very important to aim precisely to the center of the prism here.* *Note – it will take the instrument about 15 seconds until the measurement is completed. Do not touch the instrument while taking the measurement.* Instrument will read the values in Face 1 and automatically rotate to Face 2. Aim at the prism in Face 2 and press the Take Shot button again. *Note – it will take the instrument about 15 seconds until the measurement is completed. Do not touch the instrument while taking the measurement.* After reading the values in Face 2, the instrument will rotate back to Face 1 and display the calculated values.	
7	Press Accept to save the values in the instrument. *Note – If the Tracker Collimation test results continue to display errors higher than 3' or 0,0200G it is recommended sending the instrument to a Service provider for a careful inspection and possible readjustment.*	

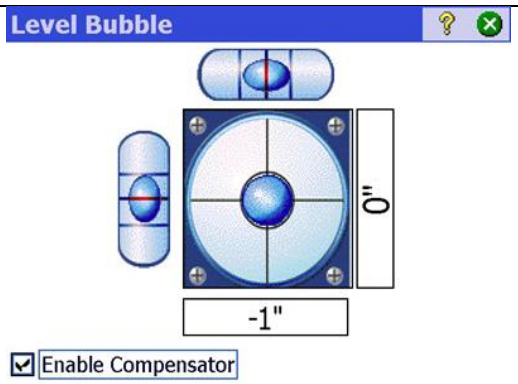
Step 8. Quick inspection of the calibration

1	Place the instrument 50 m to 100 m away from a fixed, standard 50 mm surveying prism. The same distance as in the tracker calibration procedure can be used (Step 7). *Note – do not use the 360° prism here.*	
2	Start Survey Pro, level the instrument and enter Quick Shot. Coarse sight to the prism. Press the LockNGo icon  . Instrument will lock into the prism.	
3	When locked, the LockNGo icon will change from  to  . *Note – when the LockNGo option is turned on it is expected to see maximum 30" (0,0090G) difference from the prism centre.*	

4	Press the LockNGo icon again in order to make the instrument stop tracking the prism. The icon shape will change back to . Notice a slight instrument movement to the center of the prism. Look through the telescope to make sure that the instrument is pointing exactly to the center of the prism. If the instrument is not pointing exactly to the center of the prism redo "*Step 5.: Optical and trunnion axis tilt collimations calibration (Hz collimation and V index error"* and then *"Step 7.: Tracker Collimation".* Repeat *"Step.8: Quick inspection of the calibration"* again. If the instrument is not pointing exactly to the center of the prism send it back to the Spectra Precision authorized service center for inspection.	

Step 9. Verification of the Calibration results of the compensator.

1	Start the electronic bubble in Survey Pro using the + key combination.	

2	Level the instrument correctly. Rotate the instrument 180° (200G). If the electronic bubble is in the same location and values in the position 1 and 2 are close to the same but with different signs, it means that the compensator calibration was performed correctly.	

Step 10. Collimation and trunnion axis inspection

1	Use the Quick Shot in Survey Pro. Aim at the target and write down the Face 1 Hz and V values. Flip to Face 2 and write down the Hz and V values again. If both values are within 20” (0,0060G) difference it means that the calibration was performed correctly. *Note – always perform this calibration using manual aiming and never use LockNGo or Smart Aiming.*	$$Hz\ collimation = \frac{HZ_{Face2} - HZ_{Face1} \pm 180°}{2}$$ $$V_{index} = \frac{360° - (V_{Face2} + V_{Face1})}{2}$$