

# Analog Theodolite Vertical Index and Horizontal Collimation Calibration Procedure

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## Overview

The analog Kern DKM2-AEC theodolite may be used in the optical alignment of the ESIS and MOSES instruments. Before the theodolite should be used for alignment, its Vertical Index and Horizontal Collimation error should be checked and corrected if not properly celebrated.

## Vertical Index Calibration

1. Level theodolite using Leveling Knobs. Make sure it is level in all directions by rotating the theodolite 120° horizontally and re-leveling multiple times.
2. Connect the battery to the wires that power the blue LED, illuminating the autocollimation attachment.
3. Set up flat mirror in a tip/tilt kinematic mount at least 4 feet from the theodolite.
4. Adjust theodolite until cross-hairs are centered on the surface of the mirror.
5. Change focus to the reflected theodolite image. Theodolite or user should be in focus.
6. Adjust tip/tilt of mirror so reflected image is directly back into the theodolite lens cavity.
7. Focus theodolite at infinity or until return cross-hairs are clearly visible.
8. Adjusting the tip tilt of the theodolite, center the return cross-hairs with the original cross-hairs.
9. Adjust the Lighting Mirror so all displays are visible in the Reading Eyepiece. Sometimes it is helpful to set up a lamp over the Lighting Mirror.
10. Look through the Reading Eyepiece, and twist the micrometer knob until the single vertical line(s) are centered between the 2 close vertical lines in the vertical display.
11. Read the vertical angle as explained in figure 13 of the theodolite user manual and enter the value into the CalibrationCalculator.xlsm excel sheet.
12. Rotate theodolite 180° in both horizontal and vertical axes and repeat steps 4-11 excluding step 6. Moving the mirror at this point will ruin the experiment.

13. Move the Micrometer Knob to the correct angle, without actually adjusting the position of the theodolite.
14. Adjust the screw shown in figure 25 of the user manual until the single vertical line(s) are centered between the 2 close vertical lines in the vertical display.
15. Repeat procedure until desired error is obtained.

## Horizontal Collimation Calibration

This is the same procedure as the Vertical Index Calibration, but dials instead of a screw is used to correct the error. This can be done at the same time as the Vertical Index Calibration if desired.

1. Level theodolite using Leveling Knobs. Make sure it is level in all directions by rotating the theodolite 120° horizontally and re-leveling multiple times.
2. Connect the battery to the wires that power the blue LED, illuminating the autocollimation attachment.
3. Set up flat mirror in a tip/tilt kinematic mount at least 4 feet from the theodolite.
4. Adjust theodolite until cross-hairs are centered on the surface of the mirror.
5. Change focus to the reflected theodolite image. Theodolite or user should be in focus.
6. Adjust tip/tilt of mirror so reflected image is directly back into the theodolite lens cavity.
7. Focus theodolite at infinity or until return cross-hairs are clearly visible.
8. Adjusting the tip tilt of the theodolite, center the return cross-hairs with the original cross-hairs.
9. Adjust the Lighting Mirror so all displays are visible in the Reading Eyepiece. Sometimes it is helpful to set up a lamp over the Lighting Mirror.
10. Look through the Reading Eyepiece, and twist the micrometer knob until the single vertical line(s) are centered between the 2 close vertical lines in the horizontal display.
11. Read the horizontal angle as explained in figure 13 of the theodolite user manual and enter the value into the CalibrationCalculator.xlsm excel sheet.
12. Rotate theodolite 180° in both horizontal and vertical axes and repeat steps 4-11 excluding step 6. Moving the mirror at this point will ruin the experiment.
13. Move the Micrometer Knob to the correct angle, without actually adjusting the position of the theodolite.
14. Adjust the dials for the Circle Orienting gear until the single vertical line(s) are centered between the 2 close vertical lines in the horizontal display. The dial on the bottom of the theodolite is a coarse adjustment, while the dial under the cover is a fine adjustment.
15. Repeat procedure until desired error is obtained.