

Usage Instructions

LX200 Motor Encoder board calibration using the Calibration Tool P/N 100232

Description

The motor encoder boards for the RA and DEC motors of the Meade LX200 "Classic" telescopes output two square-wave signals, representing the rotational travel of the telescope's optics. Each period represents one very small movement; the telescope's computer counts them and runs the motor until the proper number of periods have passed to move the telescope the desired amount. Two signals (vs. one) let the telescope know the direction as well as the distance. To be correctly counted by the telescope, the waveforms' duty cycle needs to be 50%, and since each telescope has some variation in components that affect this duty cycle, it must be uniquely adjusted for each telescope. If components such as those on the encoder board are replaced, the board will most likely need to be re-adjusted. Further, with age, component properties can change and cause a signal to drift away from 50% duty cycle, also necessitating adjustment.

The adjustment is affected through two variable resistors (potentiometers), which can be adjusted with a small screwdriver. An oscilloscope can be used to monitor its duty cycle as the potentiometers are adjusted.

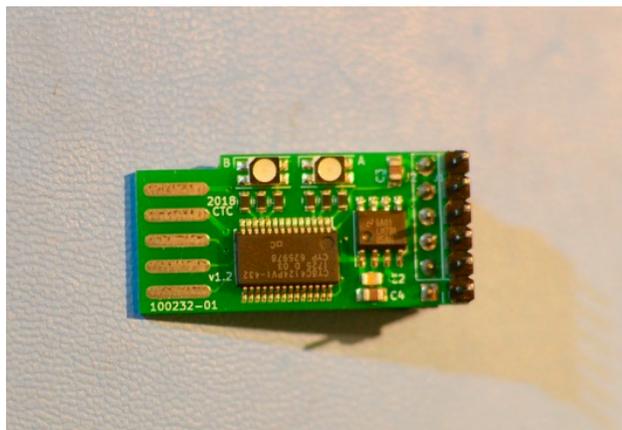


Fig. 1. Calibration Tool top view.

Calibration Tool Theory of Operation:

The 100232 Calibration Tool contains frequency counters that monitor the waveforms coming out of the motor encoder board, much like an oscilloscope would. There are two colored LEDs that align visually with the potentiometer they are reporting on. A microcontroller changes their colors depending on the frequency counter, and that color will be green when the duty cycle is between 45% and 55%. When duty cycle is outside this range, the LED color will indicate which direction to rotate the screwdriver adjusting the potentiometers below that LED.

The blue circuit board in the picture below is our new replacement encoder board, but the tool can be used on original Meade LX200 Classic (8", 10", and 12") encoder boards, as well.

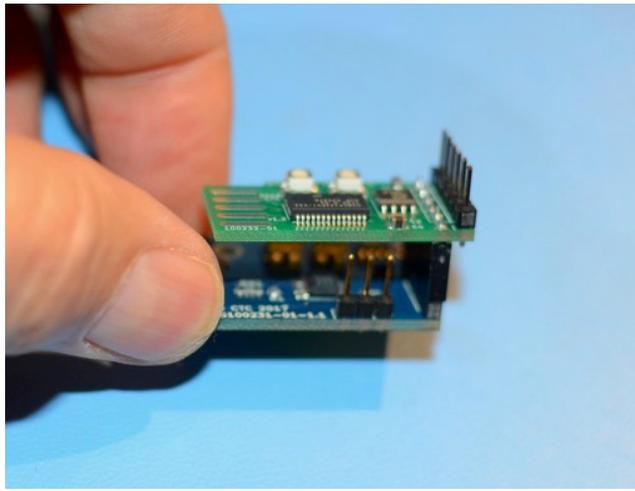


Fig. 2. Calibration Tool atop Encoder board

Usage:

With power to the scope off, remove the 6-pin header connector from the encoder board, and mount the Calibration Tool on the now-bare header. Attach the cable connector to the header on the Calibration Tool, so that the Calibration Tool is now sitting between the encoder board and the cable. The LEDs on the Calibration Tool should be above their corresponding potentiometers on the encoder board.

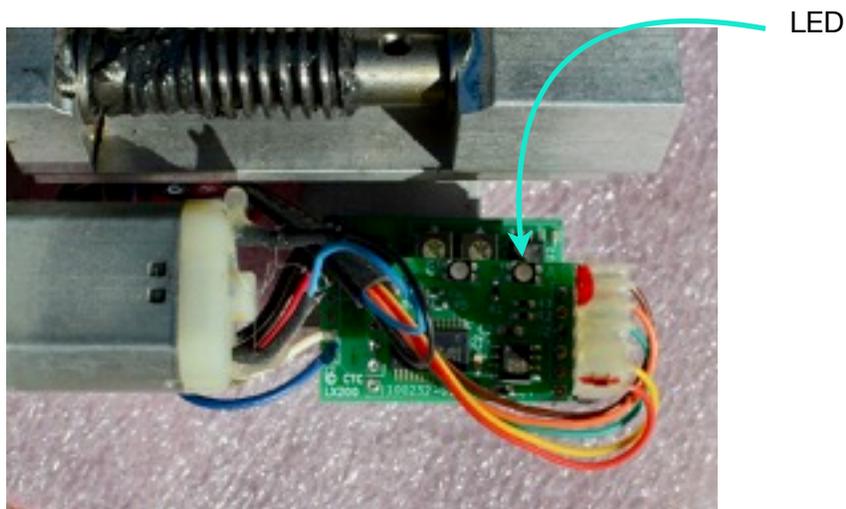


Fig. 3. Calibration Tool atop Encoder board in motor assembly with cable attached

Power the scope on, and set the handset to the "Find" speed (the "4" button on the handset). That is the only speed that the Calibration Tool is sensitive to; no other will work. Start scope movement in one of the directions that correspond to the encoder you are observing, either N and S for the DEC board, or E and W for the RA board. You should see the LEDs brighten. With the telescope still moving, adjust the potentiometers until both LEDs are green. Be careful to keep your fingers away from the gears. If the LED glows **blue**, the potentiometer directly below it should be turned clockwise (CW). If it glows **yellow**, it should be turned counter-clockwise (CCW). When you hit green, keep going until it is NOT green, and then turn about half of the way back to the point it first turned green. In other words, center it in the green zone.

When both LEDs show green, stop the scope movement and turn off the power. Remove the Calibration Tool and replace the cable onto the encoder board. Make sure the cable is completely seated, since a loose contact there can cause runaway.

You can use the Calibration Tool on both DEC and RA boards as many times as you like. A good place to keep it is in its anti-static foam envelope.

Appendix - Helpful Links

For a long and detailed explanation of the motor assemblies on the LX200 Classic:

<http://skymtn.com/mapug-astronomy/ccdastro/decfix.htm>

Some good information and photos for calibration of the board with an oscilloscope:

<http://www.b82maidbronn.de/lx200.htm>

Lots of useful information on the RA and DEC drives:

<http://skymtn.com/mapug-astronomy/MAPUG/RADrive.htm#repairURL>