

LX10 Front Panel PC Board

OVERVIEW

The LX10 Front Panel PCB lies behind the LX10 front panel, and connects the connectors accessible through that panel to the rest of the telescope, including the RA and optional DEC motor, the battery, and the hand controller. It replaces the original board in the same form factor, and performs the same functions.

Though compatible, this new board is designed to improve upon the original board's RA tracking accuracy by compensating for the temperature variation of the RA drive voltage.

FEATURES

- Tracking speed thermal stability improved by over 50X vs. original board.
- Multi-turn adjustment for tracking.
- Short-circuit and reverse-voltage protection.
- Installation requires no special tools or soldering.



APPLICATION

The board is a drop-in replacement: installation requires no soldering. Before removing original board, take note of the RA connection. Care must be taken to make sure the RA connection is made in the same orientation, which will be different for a telescope in the northern hemisphere versus one in the southern hemisphere. If reversed, the effect will be to track in the opposite direction and you will not be able to adjust it to track until you correct the RA connection.

Once installed, it will require adjustment to get the motor drive voltage matched to your RA motor's specific characteristics. This is accomplished with the multi-turn potentiometer and a small screwdriver. Turning the screwdriver clockwise will slow the tracking down, counter-clockwise will speed it up. You will need to lift the board slightly out of the base to get at the adjustment screw. The adjustment is very fine and will take some amount of trial and error to get right, but once dialed in should not vary significantly with temperature as the observing session proceeds.

DESIGN

Reference the two schematic diagrams in FIG 1 and FIG 2.

The original design (FIG 1) uses two voltage regulators. Both are low-drop-out regulators which can operate with an input voltage almost as low as the output voltage. Under battery power, as the battery drains its voltage drops, so a low-drop-out regulator will allow the circuit to continue to function longer as the battery drains. The second voltage regulator at 3.3V was “bumped-up” by including the two diodes in its reference path, so that the actual voltage at the regulator output is something like 4.2 volts. This lower voltage means that there is a higher voltage that can be applied from the 5v regulator, in order to speed up the RA when the West (or East) handset button is pressed.

The emitter-follower design is susceptible to voltage change over temperature. Measured over a 30 degree C temperature drop, the RA voltage rose by about 80 mV, or about 2.5%. This was enough to cause a noticeable variation in observed tracking accuracy.

In the new design, (FIG 2) the two voltage regulator approach was simplified to a single, 5v low-drop-out, low-quiescent-current regulator, since a different control circuit was used that did not require a second voltage source. This regulator is well protected from reverse-battery, short-circuit, etc. as are the regulators in the original circuit.

In this design, an op-amp is used so that output voltage can be controlled to within about 1mV over a 30-degree C temperature variation. Since the OPA-379 op-amp allows its inputs' to swing from 0 to 5v in normal operation, this means the circuit can use the same 5V supply used for the op-amp, to pull and push its output voltage, and speed up or stop the RA drive.

The DEC drive is operated by a flat 5v through the N or S buttons, as in the original circuit. The DEC drive control will move the telescope faster than the East and West buttons move the RA axis. This is as in the original board.

The adjustment of tracking speed is more fine-grained in the new circuit, due to a multi-turn potentiometer. It should be possible, over time, to adjust the tracking to be more accurate as well as more stable, than was possible with the original circuit.