# TCF-Leo Low Profile Focuser Installation

*Step-by-Step Instructions for Installing the TCF-Leo Focuser on any telescope Optical Tube Assembly (OTA).*

The TCF-Leo low profile focuser is a thin, robust focuser controlled by Optec's FocusLynx control system. FocusLynx features PC connection via serial, USB, or Ethernet with options to add a second focuser, hand controller, or 802.11 WiFi connectivity.

## Introduction

TCF-Leo measures only 1-1/4" at the full IN position with 0.35" (8.9mm) of overall focuser travel.  At the midpoint of travel, TCF-Leo consumes only 36.2mm of the telescope OTA's available back-focus.   TCF-Leo features a true 3-inch drawtube with 76.2mm of clear aperture.



In operation, the TCF-Leo delivers extremely fine resolution of 0.08 micron per step.  In the Hi-Speed mode Leo can achieve step rates of 2,400 steps per second.  Normal Hi-Torque operating speed tops out at a respectable 1,400 steps per second yielding a full IN to full OUT time just over a minute.   Like all TCF Temperature Compensating Focusers, a precision digital temperature sensor is included to mount directly on to the telescope OTA for the most precise temperature measurements available.  An RJ45 8P8C socket connector on the focuser body allows any Cat-5e Ethernet cable to connect to the FocusLynx control hub.

## Standard Optec Interfaces

The telescope side interface for the TCF-Leo is Optec's standard 3.6-inch dovetail system known as the OPTEC-3600.  The camera side interface is a 3-inch bore that allows any OPTEC-3000 adapter to be inserted.  Optional OPTEC-3000 adapters include a precision 2-inch receiver, T-thread, STL-thread and others.

Please review these instructions carefully for installation procedures.   Contact Optec Support if you have any questions or concerns when installing or configuring the TCF-Leo for your system.

## TCF-Leo Package Contents

Confirm the contents of your TCF-Leo package with FocusLynx control hub, power supply, cables, and tools. The package should contain the following items:



- TCF-Leo low profile focuser,
- FocusLynx control hub,
- Precision temperature probe,
- USB/Serial communication cable,
- Cat-5e or Cat-6 Ethernet cable x 2
- 12VDC power supply with cord,
- 5/64" T-handle hex key tool.

The second Cat-5e Ethernet cable is for a network connection using the Network port on the bottom of the FocusLynx hub. These cables are interchangeable with any Cat-5e or better cable.

## Hand Controller Option

For visual users, a special kit price is available that includes the #19695 FocusLynx Hand Controller at a discounted price. The Hand Controller provides an easy to use, vibration-free method of focusing the telescope. An embedded rotary encoder switch allows one-hand fine focus control while using an eyepiece. Additional details are available online at:
http://www.optecinc.com/astronomy/catalog/focuslynx/19695.htm

## Installation Procedure:  Step-by-Step

### Step 1 – Identify OTA mount

To install the TCF-Leo, you first need to identify the mounting surface on the telescope OTA.   For example, the Celestron EdgeHD C-11 and C-14 OTA's share a common large thread.  Celestron's thread is a coarse approximately 3.29" x 16 tpi thread.  You may need to remove the smaller 2"x 24tpi thread adapter to reveal the larger thread.

Contact Optec Sales (sales@optecinc.com) or check the Optec website (http://www.optecinc.com/astronomy/catalog/adapters/optec-3600/default.htm) for a list of suitable mounts from the OPTEC-3600 line of telescope adapters.  For the Celestron scopes, Optec stock item #17803 converts the large thread to the Optec 3.6-inch dovetail standard.

### Step 2 – Attach Telescope Mount

With a suitable 3600 telescope mount in place, slip the TCF-Leo over the mount.  You may need to loosen the three setscrews back slightly if the focuser does not fully seat against the mount.

### Step 3 – Align and Tighten

Align the focuser body for suitable clearance.  Tighten three setscrews using the 5/64" T-handle hex key tool. Be sure to tighten each setscrew securely against the dovetail on the OPTEC-3600 telescope mount.

## Step 4 – Identify Camera Mount

The TCF-Leo has a standard 3-inch receiver and can accept any of the OPTEC-3000 camera-side adapters.  Identify the required mechanical interface for your filter wheel, off-axis guider, ONAG, or camera face (whichever is first in line) and consult the Optec website or Precise Parts for a suitable mount.  (https://goo.gl/3e5JeF)

## Step 5 – Move Drawtube OUT

To gain access to the three setscrews in the focuser drawtube, you will need to move the focuser to the full OUT position, or 112,000 steps.   Skip down to FocusLynx Software Setup below if you do not see the setscrew hex heads at the end of the drawtube.

## Step 6 – Tighten Camera Adapter

With the drawtube fully extended, insert the OPTEC-3000 3-inch camera adapter into the drawtube ensuring it seats tightly.  You may need to loosen the three setscrews slightly to ensure the mount seats properly.   Rotate the camera package for best orientation and tighten each setscrew securely.

## Step 7 – Connect Temp Probe and Hub

Now you can insert the temperature probe into the 6-pin DIN socket.  Use the thermal foam to attach the temperature probe to the side of your OTA for best results.  Next, attach one end of the Cat-5e Ethernet cable into the RJ45 socket labeled FocusLynx.  The other end of this cable will connect to the Focuser 1 port on your Focus Lynx hub.

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## FocusLynx Software Setup

Your TCF-Leo focuser is now installed.  Consult the ***FocusLynx Quick Start Guide*** to install the FocusLynx Commander software.   Visit http://www.optecinc.com/astronomy/downloads/focuslynx.htm for the latest version of FocusLynx Commander and ASCOM driver. You will need to download version 2.0.6 or later.   Once installed, you should configure FocusLynx Commander for your new **TCF-Leo**.  Configuration within FocusLynx Commander will also configure the ASCOM driver so that the same settings will apply when using auto-focusing software such as Maxim D/L, TheSky X, SGP or FocusMax.

## FocusLynx Commander Focuser Type selection

Open the Focuser Hub Setup dialog for Focuser 1 (or Focuser 2 if you have installed the optional second stepper board) and choose the **TCF-Leo Hi-Torque** Focuser Type option.  Your FocusLynx Hub firmware must be v2.2.1 or higher for this option to function properly.
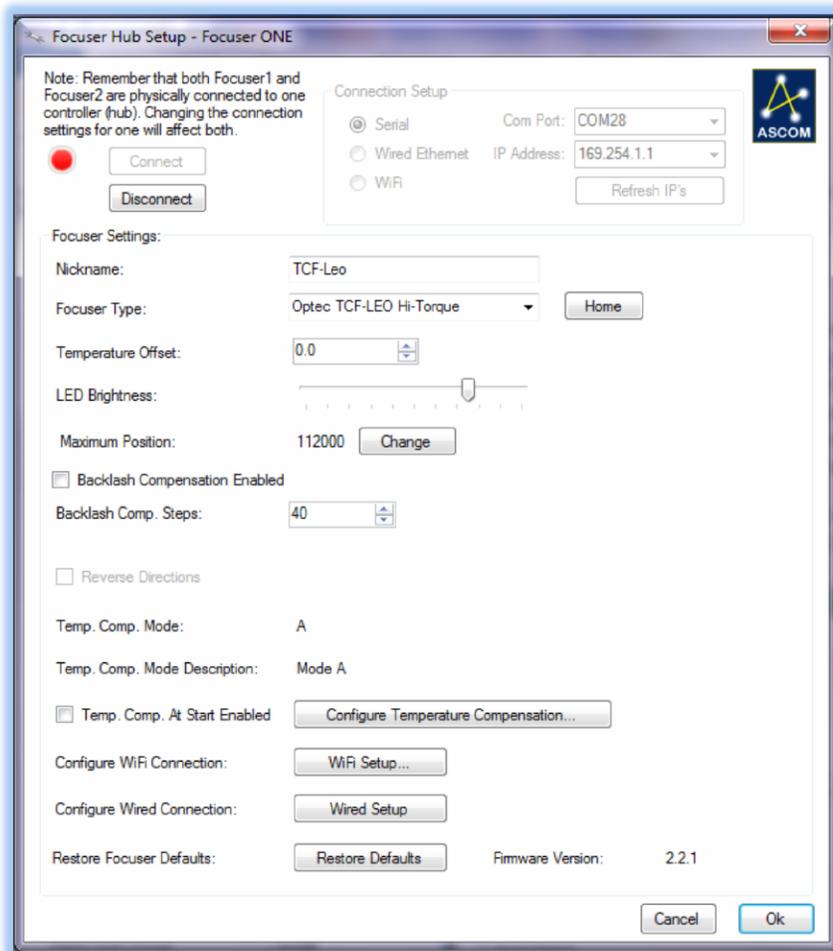
With stepper motors, speed and torque typically work inversely.  That is, higher speeds will usually result in lower torque.  The **TCF-Leo Hi-Torque**  Focuser Type option can reliably handle payloads up to 9 kg or about 20 lbs.

If you prefer faster movement from your focuser, select the **TCF-Leo Hi-Speed** focuser device type instead.  There will be a reduction of available torque but the focuser will typically home under a minute.  The recommended maximum payload for the **TCF-Leo Hi-Speed** device type is approximately 11-lbs or 5 kg.

*TCF-Leo Low Profile Focuser Installation Instructions - Revision 1*

## Set the Position Units

In the main form of the FocusLynx Commander window, you may left-click directly on the red Position digital read-out to toggle units between Steps, Microns, and Millimeters.   Note that only the step count is passed through to the ASCOM driver.  The iFocuserV2 standard for ASCOM absolute focusers relates all focuser movements to actual step counts with the higher level client responsible for making the conversions to real-world measurements.  The FocusLynx Commander client extends the property to easily convert the units to mm and microns.

## Set the Temperature Units

Like the Position units, you can left-click directly on the red Temperature display at any time to toggle through degrees Celsius, Fahrenheit, and Kelvin.

## Step Range

The TCF-Leo has a fixed number of total steps.  Full IN is at step position 0 while full OUT is at step position 112,000.  Upon initial power up the focuser will move to position 0 and then outward to the last position before last power down.  We recommend you begin the session by moving to the center position (click the Center button) of 56,000.  Once at center, adjust your telescope's coarse focus knob (if available) or use spacer rings to achieve best focus.  This ensures your normal focal travel is within the available travel range for the TCF-Leo drawtube which is about 8.9mm.

## Homing Procedure

Upon power up, the FocusLynx controller will automatically home the focuser by moving all the way in to position 0.  A limit switch will be triggered which immediately begins an outward travel to the last parked position.

At any time you may wish to re-home the focuser and move to Center for coarse focus adjustment.  If you do not have enough travel, you will need to add or remove spacers between the focuser and camera package.

## Temperature Compensation

TCF-Leo includes a precision temperature probe for temperature compensation.  Within FocusLynx Commander click File – Temp Comp Wizard to automatically determine the "TC" or Temperature Coefficient for your particular telescope configuration.  After completing the wizard, turn on temperature compensation by selecting "On" just above the Sync button.  The FocusLynx controller will automatically adjust the telescope focus for changing temperatures.

## Third-Party Software

Visit the Optec website for the additional information describing FocusLynx configurations for ASCOM clients such as **FocusMax** and **Maxim D/L**, as well as non-ASCOM software such as Software Bisque's **TheSky X** native X2 drivers for FocusLynx. Our FocusLynx Resource page is currently under development: http://www.optecinc.com/astronomy/catalog/focuslynx/resources.htm.

## Optec User Group

The Optec User Group on Yahoo! can also provide answers to specific configuration questions and provides a forum to communicate with other users.  Click the banner below to subscribe.
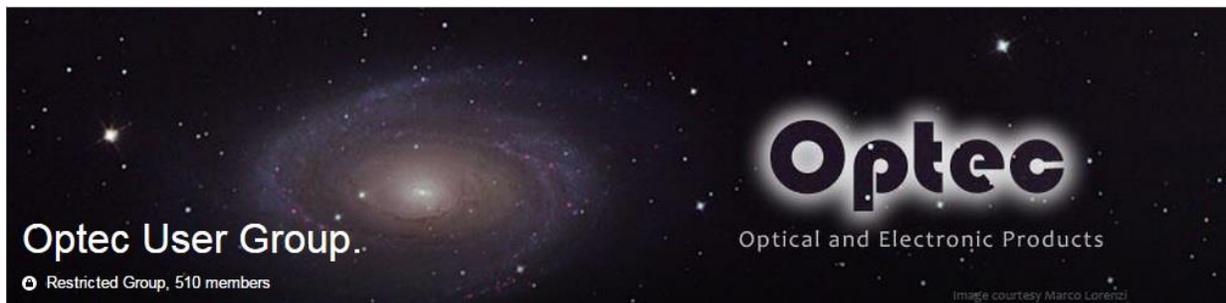


Or visit the Yahoo! site here:  https://groups.yahoo.com/neo/groups/Optec/info.

199 Smith Street  ·  Lowell, Michigan  49331  ·  U.S.A.
Telephone: 616-897-9351  ·  Fax: (616) 897-8229 · Toll Free: 888-488-0381
sales@optecinc.com  ·  http://www.optecinc.com · www.optec.us