



TCF-Leo kits for Takahashi Epsilon

Special Instructions for Installing the TCF-Leo Focuser onto the Takahashi Epsilon ED astrograph telescopes.

The TCF-Leo low profile focuser is a thin, robust focuser controlled by Optec's FocusLynx control system. Optec has developed special kits to replace the native focusers on the Takahashi Epsilon models listed below with the TCF-Leo while preserving the unique spacing and back-focus requirements of these fast astrographs.

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.

The low-profile nature of the TCF-Leo focuser makes it a perfect motorized replacement for the manual focuser included with the popular Takahashi Epsilon Hyperboloid Astro Camera telescopes. Optec engineers have designed replacement saddles and camera side adapters sold in kits to provide a complete system to automate the astro-imaging capabilities of the outstanding Epsilon astrographs.



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



TCF-Leo kits for Takahashi Epsilon ED scopes



Available Epsilon Kits

Currently, Optec offers TCF-Leo packages for the following Takahashi Epsilon models:

- #19740-E130 TCF-Leo package for Takahashi Epsilon 130mm ED Astrograph
- #19740-E160 TCF-Leo package for Takahashi Epsilon 160mm ED Astrograph
- #19740-E180 TCF-Leo package for Takahashi Epsilon 180mm ED Astrograph

The E-130 and E-160 Epsilon kits feature a 3-point push-pull tip-tilt leveling system and adjustable focuser height system to precisely match the native focuser position and orientation. An M60 x 0.75mm receiver for the TCF-Leo's 3-inch drawtube allows direct insertion of the Epsilon field flattener. The field flattener optimal back-focus distance of 56.2mm is unchanged for camera package configuration.

For visual use, we recommend **the FocusLynx Hand Control** option (Optec stock item [#19695](#)) be used for precise hands-free focusing.

Alternatively, the FocusLynx Alpaca driver includes a built-in webserver that allows use of any smartphone or tablet to function as a simple focus control interface as well.

Epsilon TCF-Leo Kit Contents

The Epsilon focuser replacement kits can be purchased with or without the TCF-Leo focuser. Each kit will include a telescope tube adapter assembly and a field flattener receiver. To order these components separately, specify the following stock items:

- #19814 – Epsilon 130 replacement saddle assembly,
- #19816 – Epsilon 160 replacement saddle assembly,
- #19813 – Epsilon 180 M108 thread to OPTEC-3600 dovetail adapter,

Note the #19813 adapter for the Epsilon 180 does not replace the native saddle. Instead, this solution replaces the Captain's Wheel holding the native focuser in place with an adapter that presents the OPTEC-3600 3.6-inch circular dovetail to the TCF-Leo replacement focuser. We also recommend adding



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



TCF-Leo kits for Takahashi Epsilon ED scopes



the #17798 OPTEC-3600 12.5mm extension to ensure proper spacing as there have been some spacing variations reported within the Epsilon 180 user community.

Each of the Takahashi Epsilon telescopes include a field flattener housed in a lens cell having a male M60x0.75mm male thread facing the focuser and an M54x0.75mm female thread for the camera. Each kit should also include one camera-side adapter to receive the Takahashi field flattener.

- #17833 – OPTEC-3000 to M60x0.75mm adapter.

Epsilon Kit Diagrams

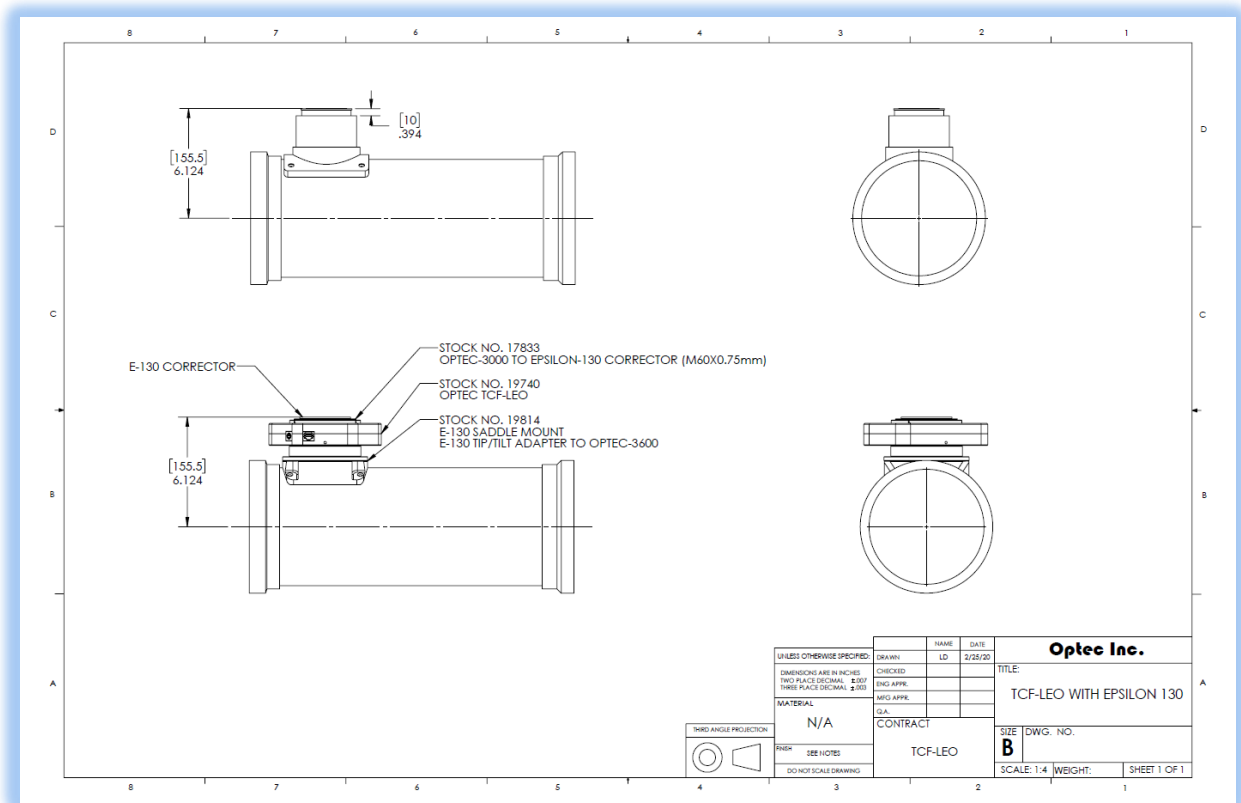


Figure 1 - Epsilon 130 Kit Diagram



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



TCF-Leo kits for Takahashi Epsilon ED scopes

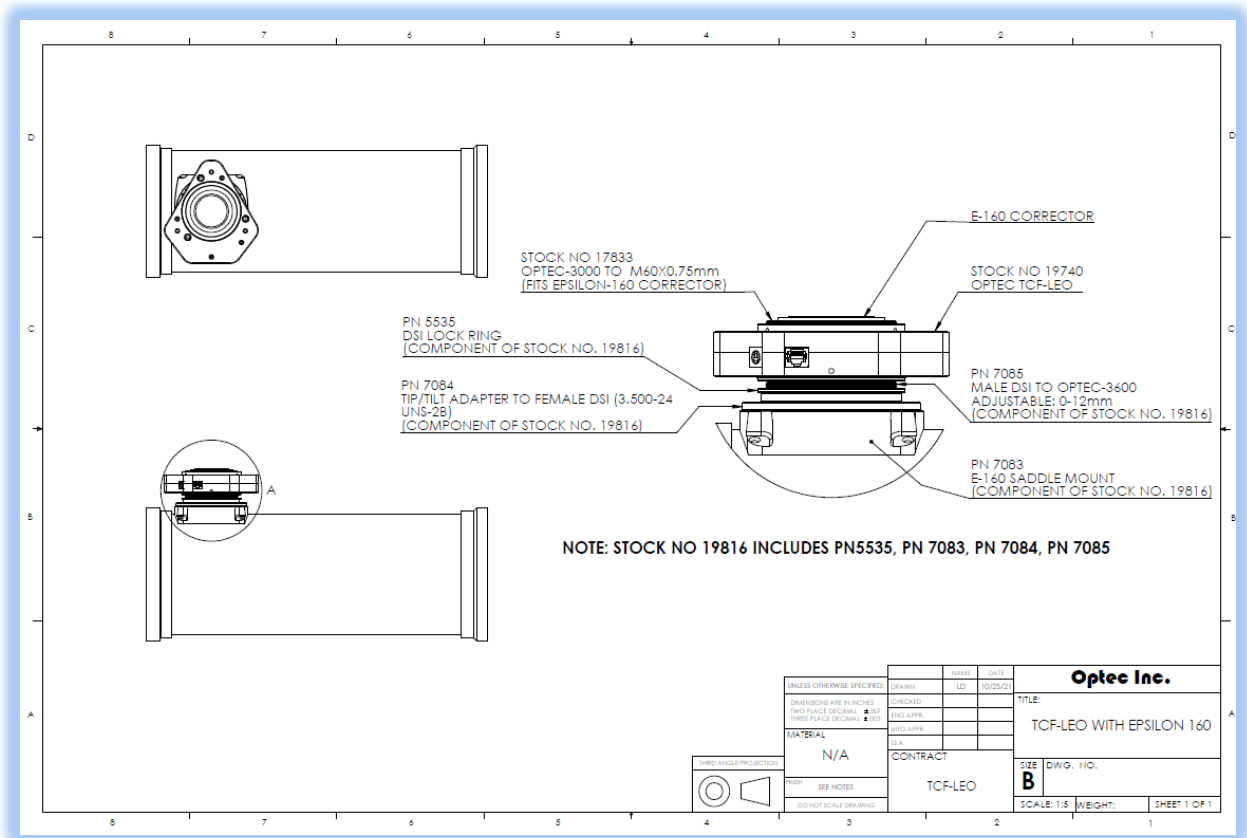


Figure 2 - Epsilon 160 Kit Diagram



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



TCF-Leo kits for Takahashi Epsilon ED scopes

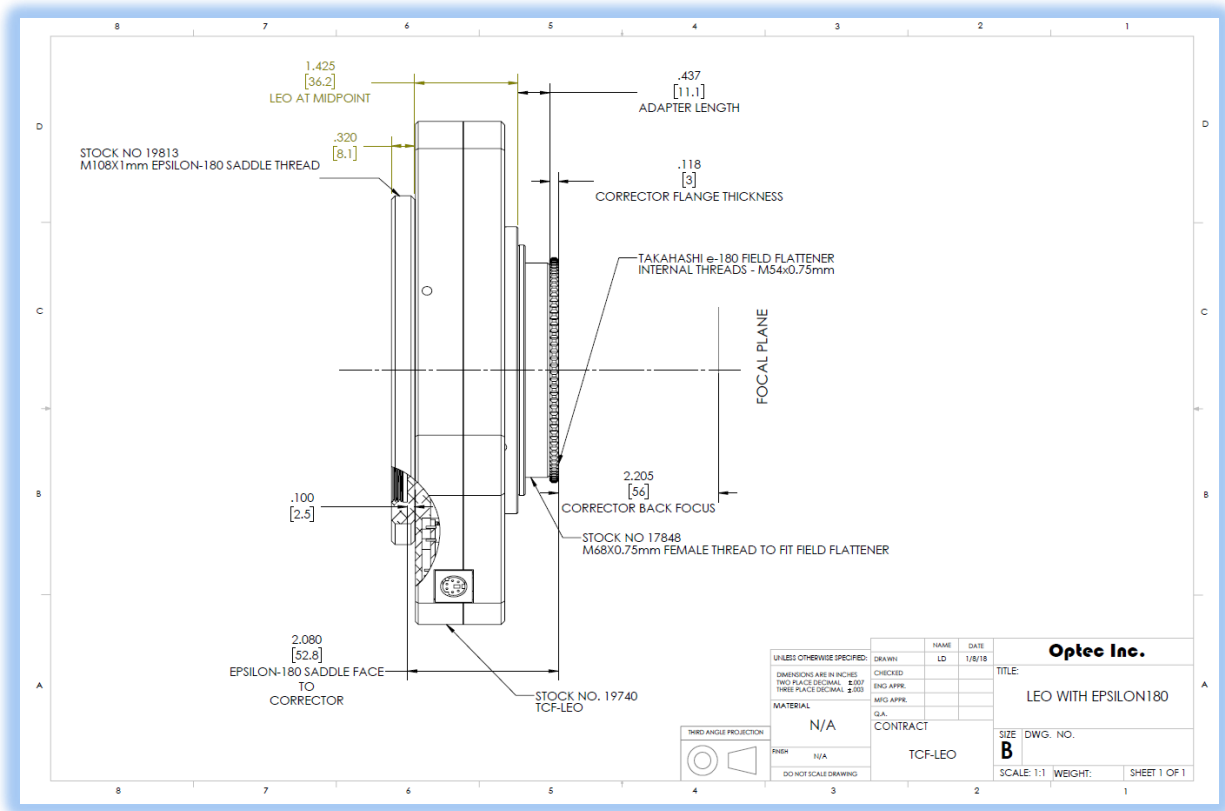


Figure 3 - Epsilon 180 Kit Diagram

Installation Procedures

The Epsilon 180 package uses the native Takahashi saddle plate while the Epsilon 160 and 130 packages require replacement of the native saddle with the adjustable assembly included as part of the kit. These replacement saddle assemblies include a push-pull tilt adjustment system as well as the height adjustment option. Each assembly is preset to match the original focuser location so that the primary/secondary mirror position relative to the field flattener will be maintained.

Step 1 - Remove Native Focuser

For the Epsilon 180 OTA, only the focuser needs to be removed while the saddle plate remains fixed to the telescope tube. Unscrew the Captain's Wheel until the native focuser can be lifted straight off to reveal an M108x1mm thread on the top of the saddle plate. Attach Optec's adapter #19813 which will present the OPTEC-3600 dovetail mount for attachment of the TCF-Leo in [Step 4](#) below.



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



TCF-Leo kits for Takahashi Epsilon ED scopes



Step 2 - Remove E-130/E-160 Saddle Plate

The Epsilon 130 and 160 installations each require removal of the native focuser saddle plate. To accomplish the removal, you'll need to loosen and remove four nuts and lock washers from inside the telescope tube. These are factory painted by Takahashi so be sure to position the OTA such that any flecks that come off will not drop onto the primary or secondary mirrors. Placing the OTA horizontally on a work surface with the mirror end slightly elevated will help. Keep some canned air handy to blow out any paint or dust that may be released.



Notice the native focuser is attached to the tube with four cross-tip screws that pass through to the inside of the tube and held in place with nuts and lock washers. Locate the four nuts as shown at left below.



You will need to loosen and remove these nuts and screws to remove the native focuser. For the smaller Epsilon 130 it may be easier to first remove the spider and secondary mirror. If performing this extra step, you'll need to loosen two of the internal nuts holding the spider in place.

Leaving two adjacent nuts in place will aid in your re-alignment when re-assembling the secondary mirror.



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



TCF-Leo kits for Takahashi Epsilon ED scopes



Step 3 – Install Replacement Saddle

With the native focuser removed, install the replacement saddle plate assembly using the same screws and nuts used to hold the native focuser saddle in place. Tighten and re-paint the nuts as necessary.

Note there are push-pull screws available for possible tilt adjustment later. The new Epsilon-130 and Epsilon-160 saddle plate assemblies also includes a gold locking ring and adjustable OPTEC-3600 dovetail to allow some adjustment of the TCF-Leo up or down if required.



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



TCF-Leo kits for Takahashi Epsilon ED scopes



Step 4 – Attach TCF-Leo Focuser

Now you can attach the TCF-Leo focuser to the OPTEC-3600 dovetail mount. There are three recessed socket setscrews in the base plate of the TCF-Leo that hold the focuser fixed against the dovetail mount. Orient for best position and balance, then tighten with the 5/64" T-handle supplied with the TCF-Leo focuser package.



Step 5 – Insert M60 Adapter and Corrector

Now insert the #17833 adapter with female M60x0.75mm threads into the drawtube of the TCF-Leo. You will need to have the focuser drawtube positioned at least half-way out (position = 56,000) or more to access the three socket setscrews holding the adapter in place.

The Takahashi Epsilon packages include a matching corrector lens that can now be screwed directly into the M60 adapter. Takahashi specifies a flange back-focus distance to the imaging sensor of 56.2mm (for the E-160). This distance will remain unchanged with proper positioning of the TCF-Leo focuser.

Note: configuring the camera back-focus spacing relative to the field flattener is beyond the scope of this document.



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



TCF-Leo kits for Takahashi Epsilon ED scopes



Step 6 – Rough Adjustments

With your camera attached to the Takahashi field flattener at the recommended spacing of 56.2mm, take an image of a bright star to check focus. The system is designed to come to focus with the TCF-Leo set at the focuser midpoint of 56,000 steps. However, you will find that fine focus adjustments will be required. With a bright star near focus, you should be able to evaluate and re-collimate the scope as needed. Follow Takahashi's recommended collimation instructions as described in the relevant instruction manual.

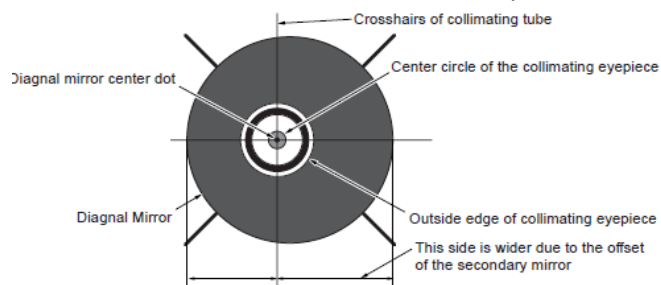
If your system appears substantially out of focus when first assembled, E-130 and E-160 owners can loosen the gold retaining ring on the saddle assembly and adjust the focuser/camera position in or out by rotating the OPTEC-3600 dovetail piece. You may wish to slightly loosen the TCF-Leo telescope-side setscrews or remove the focuser altogether while making this adjustment.



For Epsilon-180 owners, the recommended 12.5mm spacer may be added to the OPTEC-3600 dovetail to bring the scope nearer to optimal focus when positioned at the midpoint of travel. Contact Optec Support if unable to space the focuser and camera package properly.

Step 7 – Collimate the Epsilon

Proper collimation is essential for good imaging. Takahashi recommends an optional collimating tube and collimating eyepiece as described in the of their instruction manual. While a full explanation of collimation procedures is beyond this scope of this document, Optec maintains a repository of Takahashi's instruction manuals for the interested reader. See especially the Optical Alignment section for details.



[This figure illustrates the collimation of the correct secondary mirror.]
(Note) In this illustration the circle on the primary mirror has been left out.

Figure C-12

<https://optec.us/resources/documents/~misc/Takahashi/>



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



TCF-Leo kits for Takahashi Epsilon ED scopes



Step 8 – Adjust Tip-Tilt (only as needed)

The E-130 and E-160 replacement saddle assemblies include a set of three push-pull screws to adjust the focuser/field flattener/camera tilt when needed. The tip-tilt adjustment is preset with the saddle-to-dovetail distance set at 0.75mm. Any required adjustment will be very small and adjustment is ONLY recommended when an actual problem is observed in the final images. Many astro-cameras include an independent tilt mechanism. If a tilt problem exists, the tilt adjustment closest to the image plane is the recommended first-step when making adjustment to the optical alignment. Tilt adjustments can be challenging even to the seasoned astronomy.

Optec's tip-tilt solution is to use three sets of stainless-steel push and pull screws with each push-pull set spaced 120 degrees apart. The left screw for each pair is the push screw which will raise that side of the focuser while the right screw is the pull screw tightening that side of the focuser back down toward the saddle. Use each push-pull pair together working one screw against the other to move that section of the focuser in the desired direction. Live image analysis software such as [Innovations Foresight's SkyWave](#) software can be a helpful tool.

Auto-Focus Software

With the TCF-Leo Epsilon focuser package properly installed and adjusted, use your favorite auto-focus software with the FocusLynx ASCOM and Alpaca drivers to achieve automatic, unattended focusing. Many telescope and camera control packages include V-curve based auto-focus software. Contact your software provider for recommended techniques for auto-focus.

Video Channel

Optec is developing videos for installation and configuration of our many products for various software packages. Visit our Rumble video channel by searching "Optec" or clicking the link below.



<https://www.optecinc.com/video>



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



TCF-Leo kits for Takahashi Epsilon ED scopes



Optec User Group

The Optec User Group is now located at Groups.io which provides a forum to communicate with other users of Optec instruments. Other end-users can often provide answers to specific configuration questions and Optec staff routinely follow and answer many questions as well. Click the banner below to subscribe.

Groups.io Your Groups 1 Find or Create a Group Jeff Dickerman

Home Owner

Subscription

Admin 1

Pending 1

Members

Invite

Direct Add

Integrations

Settings

Aliases

Optec, Inc. User Group Optec@groups.io

The OPTEC user group exists to promote the proper usage of all of Optec's astronomy and telescope related products.

Group Information

www.optecinc.com

736 Members

748 Topics, Last Post: Jan 6

Started on 10/01/02

Feed

Or visit the Groups.io Optec User Group here: <https://groups.io/g/Optec>.

FocusMax is available through CCDWare - <http://www.ccdware.com/products/focusmax/>

Maxim D/L is copyright Diffraction Limited - <http://diffractionlimited.com/product/maxim-dl/>

TheSky X is offered by Software Bisque - <http://www.bisque.com/>

Sequence Generator Pro by Main Sequence Software - <https://www.mainsequencesoftware.com/>



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