

## TLK-P26 - April 03, 2018

Item # TLK-P26 was discontinued on April 03, 2018. For informational purposes, this is a copy of the website content at that time and is valid only for the stated product.

### TUNABLE LASER KIT COMPONENTS

► Components for ECL Kits Offer Highly Customizable Solutions

► Alter Cavity to Support Other Gain Chips



**TLK-G0750M**  
Littman  
Grating Module



**TLK-G1350R**  
Grating Module,  
1310 nm Operation



**TLK-352330-C**  
Mounted Aspheric  
Collimating Lens



**Z812**  
Motorized Actuator



**TLK-P26**  
Tunable Laser Kit  
Gain Chip Mounting Plate

#### OVERVIEW

This page includes products that are direct replacements of standard components in the Tunable Laser Kit and can be used to customize a tunable laser kit's performance. By using these components, customers can replace standard components and alter the laser's performance. The images and tables immediately below label the components in our standard Tunable Laser Kits.

#### Littman Tunable Laser Kits

Label	Description	Label	Description
A	Tuning Motor Mount	F	Collimating Lens
B	Gain Chip Mounting Plate	G	Littman Grating Platform
C	Half Butterfly Gain Chip	H	Littman Grating Module
D	Collimation Adjuster	I	Littman Mirror Module
E	Mode Hop Adjuster	J	Tuning Motor



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#### Littrow Tunable Laser Kits

Label	Description	Label	Description
A	Tuning Motor Mount	E	Mode Hop Adjuster
B	Gain Chip Mounting Plate	F	Collimating Lens
C	Half Butterfly Gain Chip	G	Littrow Grating Module
D	Collimation Adjuster	H	Tuning Motor



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#### GAIN CHIP SPECS

All quoted values are typical, unless otherwise indicated. Please see the gain chip's Spec Sheet (linked below) for the most detailed information on performance.

[This link opens a document that contains a comprehensive list of performance specifications and performance plots.](#)

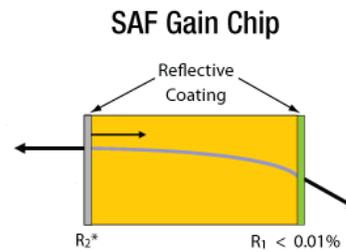
#### General Specifications

Item #	Spec Sheet	Reference Cavity	CWL <sup>a</sup>	Tuning Range <sup>a, b</sup>	Peak Power <sup>a</sup>	Chip Gain <sup>c</sup>	Gain Ripple	R <sub>1</sub>	R <sub>2</sub>	Chip Length
TFP780A		TLK-L780M <sup>d</sup>	770 nm	30 nm	50 mW	-	3 dB	0.01%	90% <sup>e</sup>	0.75 mm
SAF1171S		TLK-L780M <sup>d</sup>	1050 nm	60 nm	8 mW	30 dB	2.5 dB (Max)	0.005%	10% <sup>f</sup>	1 mm
SAF1175S		Littmann Cavity (Offered as OEM)	1220 nm	90 nm	40 mW	17 dB	0.5 dB	0.005%	10% <sup>f</sup>	1 mm
SAF1174S		TLK-L1300R <sup>d</sup>	1310 nm	100 nm	50 mW	35 dB	0.35 dB	0.005%	10% <sup>f</sup>	2 mm
SAF1450S2		TLK-L1450R <sup>d</sup>	1450 nm	120 nm	40 mW	20 dB	0.4 dB (Max)	0.005%	10% <sup>f</sup>	1.5 mm
SAF1550S2		TLK-L1550R <sup>d</sup>	1550 nm	120 nm	40 mW	17 dB	0.6 dB (Max)	0.005%	10% <sup>f</sup>	1 mm
SAF1550P2		TLK-L1550R <sup>d</sup>	1550 nm	120 nm	40 mW	17 dB	0.6 dB (Max)	0.005%	10% <sup>f</sup>	1 mm
SAF1900S		TLK-L1900M <sup>d</sup>	1900 nm	120 nm	7 mW	18 dB	1.5 dB	0.005%	20% <sup>f</sup>	2 mm

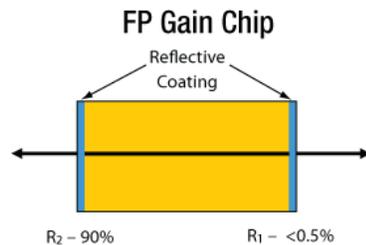
- The values given in the highlighted columns were measured in the specified reference cavity. Different external cavities will produce different performance specifications.
- 10 dB point.
- Single-pass optical gain at center of gain curve.
- This item is no longer available for individual purchase.
- Refer to the FP chip reflectivity diagram below.
- Refer to the SAF chip reflectivity diagram below.

ASE Specifications					
Item #	Center Wavelength (Typ.)	3 dB Bandwidth (Typ.)	ASE Current	Operating Current (Typ.)	Operating Current (Max)
TFP780A	780 nm	30 nm	80 mA (Typ.)	140 mA	180 mA
SAF1171S	1050 nm	60 nm	150 mA (Max)	-	150 mA
SAF1175S	1220 nm	80 nm	200 mA (Typ.)	200 mA	-
SAF1174S	1320 nm	80 nm	600 mA (Typ.)	500 mA	800 mA
SAF1450S2	1450 nm	100 nm	500 mA (Max)	-	500 mA
SAF1550S2	1550 nm	80 nm	300 mA (Typ.)	300 mA	600 mA
SAF1550P2	1550 nm	80 nm	300 mA (Typ.)	300 mA	600 mA
SAF1900S	1930 nm	150 nm	400 mA (Typ.)	500 mA	800 mA

**Note:** The light polarization is vertical inside the Fabry-Perot Gain Chip, while the light polarization is horizontal inside the SAF Gain Chips.



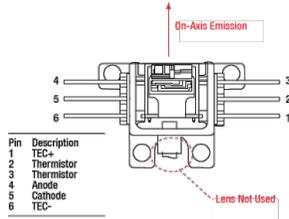
\*R<sub>2</sub> = 10% for all models in the SAF series except the SAF1900S, for which R<sub>2</sub> = 20%.



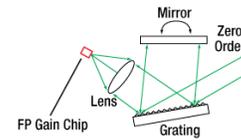
The Fabry-Perot (FP) laser diode has the two parallel ends of the semiconductor cleaved atomically flat to produce an oscillating cavity. Laser light is typically emitted through one of these highly reflective edges, using the semiconductor as the gain medium. FP lasers typically lase in a single longitudinal mode and exhibit temperature-dependent tunability over a small range. Since the end facets of the chip form the laser cavity, different longitudinal modes also appear in the emission, broadening the linewidth (100 - 1000 GHz). Given below are the typical TFP780A spectra and details on the packaged devices.

Item #	Center Wavelength	Power vs. Current	Power Spectrum
TFP780A	770 nm		

### Fabry-Perot Gain Chip Drawing



### Basic Littman Configuration



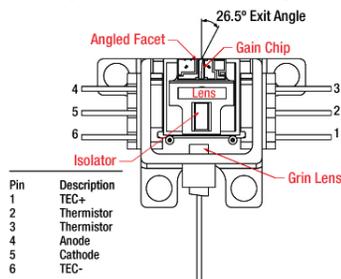
### SAF Gain Chip Lasing Performance Using Littrow Tunable Laser Kit

The innovative design of an SAF gain chip is ideal for use in external cavity lasers because it virtually eliminates unwanted feedback from the intracavity facet of the gain chip. These devices offer superior performance in a wide variety of external cavity configurations. Given below are typical spectra and details on the packaged devices.

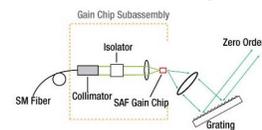
Item #	Center Wavelength	Power vs. Current	Power Spectrum
SAF1171S	1050 nm		
SAF1175S	1220 nm		
SAF1174S <sup>a</sup>	1320 nm		
SAF1450S2	1450 nm		
SAF1550S2	1550 nm		
SAF1550P2	1550 nm		
SAF1900S	1900 nm		

- Please note that the fluctuations in the power spectrum between 1350 and 1380 nm are associated with water vapor absorption. The power at these wavelengths can be improved by purchasing the TLK-E sealed laser enclosure and purging the enclosure with gas.

### Fiber-Coupled SAF Gain Chip Drawing



### Basic Littrow Configuration





Lasers consist of an active gain element and optical feedback to this gain element. The most common diode lasers are based on a Fabry-Perot design with a linear waveguide and reflective surfaces at both ends of the gain

Cavity Design	Littrow	Littman-Metcalf
High Output Power	x	
Wide Tuning Range	x	
Narrow Linewidth		x
Stationary 0 <sup>th</sup> Order Beam		x



chip to provide feedback. Some Fabry-Perot lasers are constructed for external feedback, but this is rare. Single angle facet (SAF) gain chips, on the other hand, have a curved waveguide with only one internally reflective endface and rely on external optical feedback to produce lasing.

Through the use of an external feedback mechanism, a user is able to tune a laser cavity to sustain a desired wavelength with minimal linewidth. This is highly desirable for many applications, particularly in metrology where precision is essential. Littrow and Littman-Metcalf configurations are the two most common ways to build an External Cavity Laser (ECL). Many other ECL configurations are based on these designs, but typically modify the cavity with additional optical components. Littrow cavities have minimal losses and thus intrinsically offer higher power, while Littman-Metcalf cavities produce a narrower linewidth.

A Littrow cavity provides feedback to the gain element through the use of a grating. One end of the gain element must allow light to exit, such as the design of an SAF. Light emitted from this end is first collimated. A grating then diffracts this collimated beam with the 1<sup>st</sup> order diffraction coupled back into the gain element, which allows it to support lasing. Wavelength tuning of the laser is possible by altering the angle of the grating relative to the cavity. 0<sup>th</sup> order diffraction from the grating will exit the laser's cavity at an angle dependent on the grating angle.

Littman-Metcalf configured ECLs use both a grating and a mirror for tuning. Similar to the Littrow configuration, light emitted from the uncoated end of the gain element must first be collimated. This beam is then diffracted by a grating. The 0<sup>th</sup> order diffraction reflects off of a mirror back on to the grating, where it is diffracted a second time before being coupled back into the gain element. Since light is diffracted twice, losses are higher (power loss), but the side mode suppression ratio (SMSR) is increased to produce a narrower linewidth laser. In this configuration the grating remains stationary, while the mirror is turned to tune the laser cavity's supported wavelength. Unlike with Littrow lasers, the direction of the 0<sup>th</sup> order free space beam remains stationary, which can be beneficial in some applications.

Many modifications to these cavities can be made to produce a higher polarization extinction ratio (PER) or to improve the SMSR. We offer components that allow users to convert our Littman configuration into a Littrow configuration (please see *Component Guide* tab). We always seek to tailor our products to our customers' applications. Please contact Tech Support and let us know what accessories would benefit your application.

## CONVERSION GUIDE

### Littman Cavity Configuration

These are the differentiating components of each Littman Tunable Laser Kit. The gain chip, top plate, grating module, and collimating lens are the components that you will need to convert from one supported wavelength to the next.

Included in Kit Item #	Center Wavelength	Gain Chip	Top Plate	Grating Module	Collimating Lens <sup>a</sup>
TLK-L1550M	1550 nm	SAF1550S2	TLK-P26	TLK-G0750M	TLK-352330-C

- Current TLKs use the 352230-C lens instead of the 352330-C lens used in the TLK-352330-C. However, using the TLK-352330-C will not affect the performance of the TLK.

### Littrow Cavity Configuration

These are the differentiating components of each Littrow Tunable Laser Kit. The Gain Chip, Top Plate, Grating Module, and Collimating Lens are the components you will need to convert from one supported wavelength to the next.

Included in Kit Item #	Center Wavelength	Gain Chip	Top Plate	Grating Module	Collimating Lens <sup>a</sup>
TLK-L1950R	1950 nm	SAF1900S	TLK-P26	TLK-G0900R	TLK-352330-C

- Current TLKs use the 352230-C lens instead of the 352330-C lens used in the TLK-352330-C. However, using the TLK-352330-C will not affect the performance of the TLK.

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## Tunable Laser Gain Chips with TEC

- ▶ Gain Chips Mounted for Easy Integration into External Cavity Lasers

- ▶ Half-Butterfly Assembly with Thermoelectric Cooler
- ▶ AR Coating Eliminates Unwanted Reflections, Increasing Laser Stability, Output Power, and Spectral Quality
- ▶ FP Chip Designed for Use in a Free-Space Littman Cavity
- ▶ SAF Chips Feature 1.0 m Long (Min), SM or PM Tight Jacket Pigtail with FC/APC Connector

Click the  icon below for more detailed performance specifications. The SAF gain chips can also be coupled to PM fiber. Please contact Tech Support for more information on customization and quotes.

**Note:** The TFP780A does not include a fiber-coupled output.

Gain Chip Item #	Compatible Laser Kits	Typical Center Wavelength*
TFP780A	TLK-L780M	770 nm
SAF1171S	TLK-L1050M	1050 nm
SAF1175S	TLK-L1220R	1220 nm
SAF1174S	TLK-L1300M TLK-L1300R	1320 nm
SAF1450S2	TLK-L1450R	1450 nm
SAF1550S2	TLK-L1550M TLK-L1550R	1550 nm
SAF1550P2	TLK-L1550M TLK-L1550R	1550 nm
SAF1900S	TLK-L1900M TLK-L1950R	1900 nm

Item #	Info	ASE Center Wavelength	ASE 3 dB Bandwidth	Peak Gain	Gain Ripple
TFP780A		780 nm	30 nm	-	3 dB
SAF1171S		1060 nm	60 nm	30 dB	2.5 dB (Max)
SAF1175S		1220 nm	80 nm	17 dB	0.5 dB
SAF1174S		1320 nm	80 nm	35 dB	0.35 dB
SAF1450S2		1450 nm	100 nm	20 dB	0.4 dB (Max)
SAF1550S2		1550 nm	80 nm	17 dB	0.6 dB (Max)
SAF1550P2		1550 nm	80 nm	17 dB	0.6 dB (Max)
SAF1900S		1900 nm	150 nm	18 dB	1.5 dB

All values typical unless otherwise noted. See the *Gain Chip Specs* tab for more information.

\*Center wavelength of the specified reference cavity.

Part Number	Description	Price	Availability
TFP780A	Mounted FP Gain Chip, Half Butterfly Pkg, CWL = 780 nm	\$2,378.64	3-5 Days
SAF1171S	Mounted SAF Gain Chip, Half Butterfly Pkg, CWL = 1050 nm, SM Fiber	\$3,233.40	Today
SAF1175S	Mounted SAF Gain Chip, Half Butterfly Pkg, CWL = 1220 nm, SM Fiber	\$2,701.98	Today
SAF1174S	Mounted SAF Gain Chip, Half Butterfly Pkg, CWL = 1320 nm, SM Fiber	\$2,701.98	Today
SAF1450S2	Mounted SAF Gain Chip, Half Butterfly Pkg, CWL = 1450 nm, SM Fiber	\$2,701.98	Today
SAF1550S2	Mounted SAF Gain Chip, Half Butterfly Pkg, CWL = 1550 nm, SM Fiber	\$2,701.98	Today
SAF1550P2	Mounted SAF Gain Chip, Half Butterfly Pkg, CWL = 1550 nm, PM Fiber	\$2,858.04	Today
SAF1900S	Mounted SAF Gain Chip, Half Butterfly Pkg, CWL = 1900 nm, SM Fiber	\$2,701.98	Today

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### Mounting Plates for Half-Butterfly Gain Chips

- ▶ Mounting Plates for 26.5° Angled Facets
- ▶ Select Based on Lateral Beam Exit Angle of Gain Chip

Thorlabs offers half-butterfly gain chip mounting plates that properly angle the gain chip relative to the rest of the laser cavity. Mounting plates may be interchanged on both Littman and Littrow cavity configurations to pair with a gain chip to generate the desired output wavelength. Please see the table to the right for the correct top plate based on the cavity configuration.

Mounting Plate Item #	Compatible Lasers	Laser Center Wavelength
TLK-P26	TLK-L1550M TLK-L1950R	1550 nm 1950 nm

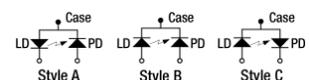
The gain chip mounting plates feature a 6-pin half butterfly mount and preconnected pin receptacles. Mounting plate connections are made to the tunable laser kit via gold-plated, spring-loaded connectors on the bottom of the plate. Note that mounting plates for TO-packaged diodes are listed below.

Part Number	Description	Price	Availability
TLK-P26	Tunable Laser Kit Mounting Plate, 26.5°	\$390.66	Lead Time

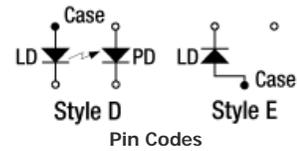
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### Mounting Plates for AR-Coated Laser Diodes in TO Cans

- ▶ Mounts Ø5.6 mm or Ø9 mm Diodes
- ▶ Integrated TEC and Thermistor
- ▶ Four-Pin Socket Accepts A, B, C, D, or E Pin Configurations (See Right)



These mounting plates integrate TO-packaged laser diodes into Thorlabs' Tunable Laser Kits. They are drop-in replacements for the standard Half-Butterfly Mounting Plates. As TO-packaged diodes are readily available with various center wavelengths, this represents an economical solution for building a customized tunable laser that operates at wavelengths for which a half-butterfly gain chip is not available.



The mounting plates incorporate a 10 kΩ thermistor into the diode bracket for accurate temperature readings, and a 1.5 A TEC element is placed in contact with this bracket via thermal grease, providing excellent heat transfer. If greater thermal control is required, the TEC element may be replaced with a larger TEC by the user.

These mounting plates ship ready to accommodate either a Ø5.6 mm or a Ø9 mm diode. Regardless of which model is ordered, a supplementary bracket is included to accept the other diode package size. When changing between brackets, ensure that the thermistor is disconnected from the wiring harness and re-apply thermal grease to the TEC element before re-attaching a laser diode bracket.

#### Installation Notes

To insert a laser diode in to the mounting plate, first remove the retaining ring from the bracket with an SPW301 spanner wrench. Next, insert a laser diode. Now thread the retaining ring behind the diode to secure it in the mount. Attach the laser diode socket to the diode and route the wires to the proper connection on the mounting plate.

Part Number	Description	Price	Availability
TLK-PM5	Customer Inspired! Tunable Laser Kit Mounting Plate for Ø5.6 mm TO-Packaged Laser Diodes	\$707.88	Today
TLK-PM9	Customer Inspired! Tunable Laser Kit Mounting Plate for Ø9 mm TO-Packaged Laser Diodes	\$707.88	Today

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### Tunable Laser Kit Base Module

- ▶ Base Plate of Tunable Laser Kit
- ▶ Includes Controller Interface with Laser Polarity Switches

The TLK-BM base module is the common mounting plate on which all other tunable laser components are mounted, and can be purchased here as a replacement for the base included in the Tunable Laser Kits. The TLK-BM includes a controller interface with polarity switches to support different AR-coated and laser diodes.

Part Number	Description	Price	Availability
TLK-BM	Customer Inspired! Tunable Laser Kit Base Module, Includes LD/TEC Controller Interface	\$1,251.54	3-5 Days

### Littrow Grating Modules

- ▶ Grating Modules for Operation at 980, 1310, or 1950 nm
- ▶ Includes Pivot Bracket, Arm, and Grating

Thorlabs offers five holographic reflection gratings featuring 900, 1350, or 1800 grooves/mm for use with TLK Series Littrow Tunable Laser Kits. The gratings are premounted on a pivot arm for easy installation into existing Tunable Laser Kits.

Littrow Grating Item #	Compatible Littrow Kit	Optimal Center Wavelength
TLK-G1800R	N/A	980 nm
TLK-G1350R*	TLK-L1300R	1310 nm
TLK-G0900R	TLK-L1950R	1950 nm

\*Position of grating on arm differs between both 1350 grooves/mm products.

Part Number	Description	Price	Availability
TLK-G1800R	Littrow Grating Module for Littrow Tunable Laser Kits, 1800 g/mm, 980 nm Operation	\$1,763.58	Today
TLK-G1350R	Littrow Grating Module for Littrow Tunable Laser Kits, 1350 g/mm, 1310 nm Operation	\$1,763.58	Today
TLK-G0900R	Littrow Grating Module for Littrow Tunable Laser Kits, 900 g/mm, 1950 nm Operation	\$1,679.94	Today

### Littman Grating Modules

- ▶ Grating Modules for Operation Centered at 770, 1050, or 1550 nm
- ▶ Includes Grating and Mount

Littman Grating Item #	Compatible Littman Kit	Optimal Center Wavelength
TLK-G1150M	TLK-L1050M	1050 nm

Thorlabs offers five holographic reflection gratings featuring 750 or 1150 grooves/mm for

use at 1550 or 1050 nm, respectively. The gratings, 17.0 mm x 7.3 mm, are premounted for easy installation into existing Tunable Laser Kits.

TLK-G0750M	TLK-L1550M	1550 nm
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Part Number	Description	Price	Availability
TLK-G1150M	Customer Inspired! Littman Grating Module for Littman Tunable Laser Kits, 1150 g/mm	\$504.90	3-5 Days
TLK-G0750M	Littman Grating Module for Littman Tunable Laser Kits, 750 g/mm	\$608.94	3-5 Days

### Tuning Actuator Mounts

- ▶ Mirror / Grating Actuator Motor Mount
- ▶ Radial Arm Retainer Spring
- ▶ TLK-MM2: Designed for Ø9.5 mm (Ø3/8") Barrel Actuators

The TLK-MM2 Tuning Motor Mount has a clamp for Ø9.5 mm (Ø3/8") barrel actuators. This allows the integration of actuators such as our PE4 manual and piezo drive or the Mitutoyo 148-142 high-resolution micrometer.

Part Number	Description	Price	Availability
TLK-MM2	Ø9.5 mm (3/8") Barrel Tuning Motor Mount for Tunable Laser Kits	\$234.60	3-5 Days

### DC Motor Tuning Actuator

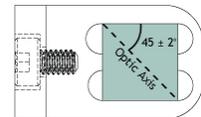
- ▶ Direct Replacement for TLK Tuning DC Servo Motor
- ▶ 12 mm Travel
- ▶ 29 nm Theoretical Resolution
- ▶ 3 mm/s Max Velocity

The Z812 is the standard DC servo motor used in Thorlabs' Tunable Laser Kits. Its 1/4"-80 threaded barrel mounts to the former TLK-MM1 Tuning Motor Mount. We recommend using the KDC101 Kinesis® Controller for this actuator.

Part Number	Description	Price	Availability
Z812	12 mm Motorized Actuator, 1/4"-80 Thread (0.5 m Cable)	\$628.32	Today

### Half-Wave Plate

- ▶ Zero-Order, Half-Wave Plate
- ▶ 780 nm Center Wavelength
- ▶ Mounts to Collimation Lens, Featured Below
- ▶ Optic Axis Oriented at  $45^\circ \pm 2^\circ$  with Respect to the Mount (See Drawing to Right)
- ▶ Custom Wave Plates Available, Contact Technical Support for Details



The TLK-WPH780 is a zero-order, half-wave plate for use with tunable laser kits. This mounted wave plate is most useful when working with short wavelength devices in TO can packaging where the user can optimize both the beam axis orientation (to illuminate the maximum number of grating lines) and the polarization of the light incident on the external cavity grating.

Part Number	Description	Price	Availability
TLK-WPH780	780 nm Mounted Half-Wave Plate	\$0.00	Today

### Mounted Aspheric Collimating Lens

- ▶ Mounted Aspheric Lens



▶ 1050 - 1620 nm Coating

Thorlabs' offers a premounted aspheric lens for easy integration and alignment into our Tunable Laser Kits. The TLK-352330-C Collimating Lens incorporates a  $\varnothing 5.00$  mm,  $f = 3.1$  mm,  $NA = 0.68$  Geltech Aspheric Lens with AR coating for 1050 - 1620 nm (Part # 352330-C).

Collimating Lens Item #	Compatible Laser Kit	Center Wavelength
TLK-352330-C	TLK-L1300M	1310 nm
TLK-352330-C	TLK-L1550M	1550 nm

Part Number	Description	Price	Availability
TLK-352330-C	Tunable Laser Kit Collimating Lens, AR Coating: 1050-1620 nm	\$190.74	Today

### Enclosure and Accessories

- ▶ Enclosure Protects Cavity and Allows for Purging
- ▶ Heater Kit Stabilizes Enclosure & Cavity Temperature
- ▶ Steering Mirrors for TLK-E Align Free-Space Laser Beams to Optical Table

The TLK-E enclosure is essential for the most sensitive applications. Designed to act as a sealed container, it allows the user to purge the system with gas to remove absorption lines. Thorlabs' Pure Air Circulator Unit, which generates an extremely dry, nearly particle-free environment, can be attached to the TLK-E enclosure with the use of hose adapters. To provide temperature stability beyond that of the thermoelectric cooler included with the gain chip, a heater kit (TLK-H) can be added. This heater attaches between the base plate of a Tunable Laser Kit and the bottom plate of the enclosure. By connecting a TC200 temperature controller, the temperature of the whole enclosure can be precisely stabilized. The TC200CAB10 connector cable can be used to connect the TLK-H to the TC200 controller.

When using a free-space tunable laser kit, such as the former TLK-L780M, it is often desirable to have your emitted beam aligned to your optical table (i.e., beam path follows the hole matrix). The TLK-SM-1 steering mirrors redirect the beam of a free-space Littman configuration beam so that it is aligned to the hole matrix. Please note that these mirrors attach to the base of the enclosure, and thus the enclosure is required.

Part Number	Description	Price	Availability
TLK-E	Tunable Laser Kit Enclosure	\$1,877.82	Today
TLK-SM-1	Steering Mirror for Littman TLK w/ Enclosure, 1 Mirror Element	\$370.26	3-5 Days