

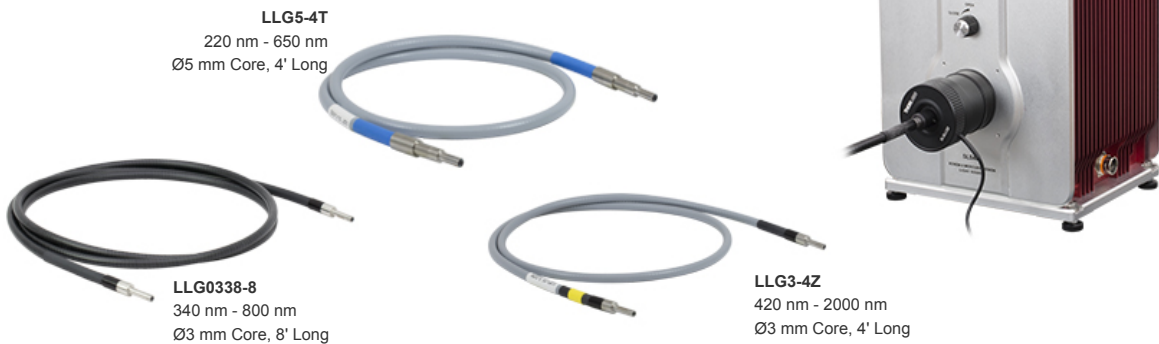
## LLG0538-8 - OCT 19, 2018

Item # LLG0538-8 was discontinued on OCT 19, 2018. For informational purposes, this is a copy of the website content at that time and is valid only for the stated product.

### LIQUID LIGHT GUIDES

- ▶ Wavelength Ranges from 220 to 2000 nm
- ▶ Ø3 and Ø5 mm Core Sizes Available from Stock
- ▶ 4', 6', or 8' Lengths Available

**Application Idea**  
 LLG Mounted to SM2-Threaded Light Source Using SLSLLG2 Collimating Adapter w/ Shutter



#### OVERVIEW

##### Features

- Excellent Transmission from 220 to 650 nm, 340 to 800 nm, or 420 to 2000 nm
- Suitable for Rugged Environments
- Adapters Designed to Mate Ø3 mm or Ø5 mm Liquid Light Guides to SM1 or SM2 Thread Standard Available Below
- Microscope Collimation Adapters Available Below

##### Compatible LLG Adapters

SM1 (1.035"-40) Adapters
SM2 (2.035"-40) Coupling/Collimating Adapters
Multi-Optic Cerna® Microscope Collimating Adapters
Single-Optic Microscope Collimating Adapters

Thorlabs' Liquid Light Guides (LLGs) offer outstanding transmission from 220 to 650 nm, 340 to 800 nm, or 420 to 2000 nm. These LLGs can be used with our stabilized broadband sources, free-space broadband sources, plasma light sources or UV light source. For large core diameters, liquid light guides are a more efficient transmission solution than fiber bundles as they eliminate the packing fraction loss (dead space) that fiber bundles have.

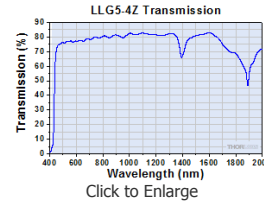
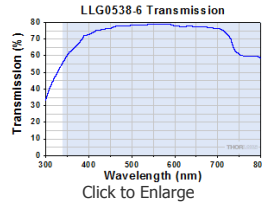
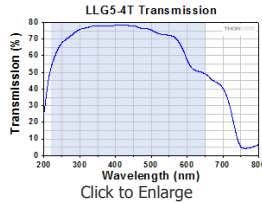
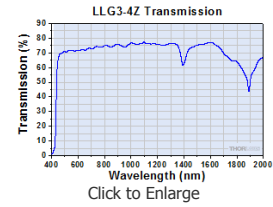
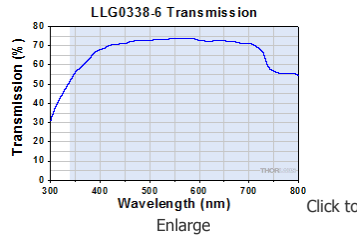
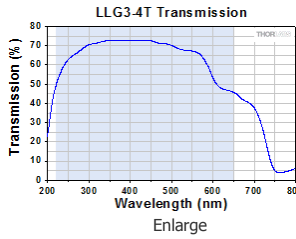
These liquid light guides are offered from stock with a core diameter of either 3 or 5 mm, and in lengths of 4' (1.2 m), 6' (1.8 m), or 8' (2.4 m). The LLG03-4H and LLG05-4H each have a yellow band that acts as a visual indicator when the LLG is used with the HPLS343 and HPLS345 high-power plasma light sources, respectively; the LLG is correctly inserted when the edge of the band is flush with the front panel of the instrument. The LLG3-4Z and LLG5-4Z also feature a yellow band, which indicates the end that must be used as the input because it contains a filter to protect the light guide from radiation below 420 nm. For LLGs without a yellow band either end can be used as the light input.

These light guides can be mounted to an optical breadboard by using one of our VH1(M) V-Mounts, a Ø1/2" (12.7 mm) post, and post holder. They can also be mounted to SM1-threaded (1.035"-40) components, SM2-threaded (2.035"-40) components, or microscope ports using the adapters sold below. Thorlabs also offers collimating and coupling adapters for the liquid light guides, which are sold separately below. The SLSLLGx coupling/collimating adapters feature external SM2 (2.035"-40) threading on the housing that makes them directly compatible with our Broadband Light Sources. Additionally, we offer a variety of collimating adapters that allow the LLGs to be coupled to a Cerna® microscope or the illumination ports used by various microscope manufacturers.

All of our LLGs are available with custom core diameters or custom lengths as made-to-order items by contacting Tech Support.

TRANSMISSION

All transmission data presented here is typical. For the LLG0338 and LLG0538 versions, the LLG0338-6 and LLG0538-6 data is shown. The maximum variation from lot to lot is  $\pm 5\%$ . As a function of length, only minimal variations ( $< 5\%$ ) are expected between our 4' (1.2 m), 6' (1.8 m), and 8' (2.4 m) long liquid light guides.

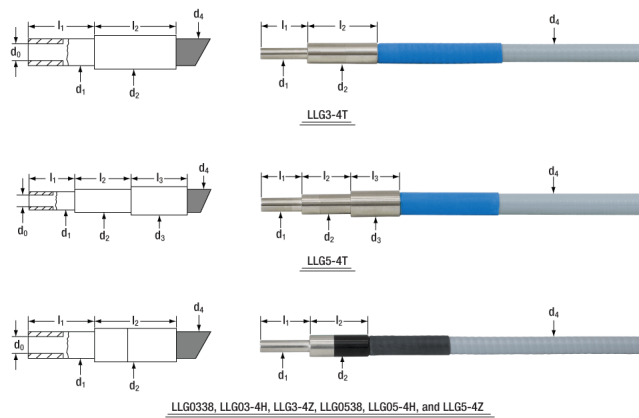


DIMENSIONS

Liquid Light Guide Dimensions

Item #	Active Core Diameter	Standard End Fittings						Protective Sleeve	Min Bend Radius
		$d_1$	$l_1$	$d_2$	$l_2$	$d_3$	$l_3$		
LLG3-4T	$\varnothing 3$ mm	$\varnothing 5 \pm 0/-0.1$ mm	$20 \pm 0.1$ mm	$\varnothing 9 \pm 0.1$ mm	$30 \pm 0.1$ mm	N/A	N/A	$\varnothing 7.5$ mm	50 mm
LLG0338, LLG03-4H, LLG3-4Z	$\varnothing 3$ mm	$\varnothing 5 \pm 0/-0.1$ mm	$20 \pm 0.1$ mm	$\varnothing 9 \pm 0.1$ mm	$24 \pm 0.1$ mm	N/A	N/A	$\varnothing 7$ mm	40 mm
LLG5-4T	$\varnothing 5$ mm	$\varnothing 7 \pm 0/-0.1$ mm	$20 \pm 0.1$ mm	$\varnothing 10 \pm 0.1$ mm	$24 \pm 0.1$ mm	$\varnothing 13 \pm 0.1$ mm	$24 \pm 0.1$ mm	$\varnothing 10.5$ mm	70 mm
LLG0538, LLG05-4H, LLG5-4Z	$\varnothing 5$ mm	$\varnothing 7 \pm 0/-0.1$ mm	$20 \pm 0.1$ mm	$\varnothing 10 \pm 0.1$ mm	$24 \pm 0.1$ mm	N/A	N/A	$\varnothing 9.5$ mm	60 mm

The drawings and photographs below illustrate the dimensions given in the table above.



CLEANING

Cleaning the Optical End Faces of Liquid Light Guides

The optical end faces of these liquid light guides are made of fused silica, PTFE and either aluminum, chrome plated brass, or stainless steel. All of these materials are very resistant to all common cleaning solvents, making them easy to clean. Please note that when using solvents to clean the end faces, you cannot submerge the tip of the light guide in the solvent, or use a heavily soaked cleaning pad, as the solvent may get into the light guide, causing damage. If you find that debris from the light guide end cannot be removed by using a solvent, you can gently use a razor blade to clean the tip, making sure that you do not chip the edge of the fused silica glass window.



**Ø3 mm Core Liquid Light Guides**

Item #	LLG3-4T	LLG03-4H	LLG0338	LLG3-4Z
Wavelength Range	220 - 650 nm	340 - 800 nm	340 - 800 nm	420 - 2000 nm
Numerical Aperture	0.42	0.59	0.59	0.52
Half Angle ( $\theta$ )	25°	36°	36°	31°
Minimum Bend Radius	50 mm	40 mm	40 mm	40 mm
Operating Temperature Range	5 to 30 °C (41 to 86 °F)	-5 to 35 °C (23 to 95 °F)	-5 to 35 °C (23 to 95 °F)	5 to 35 °C (41 to 95 °F)
Available Lengths	4' (1.2 m)	4' (1.2 m)	6' (1.8 m), 8' (2.4 m)	4' (1.2 m)
Input End Indicator	N/A	Yellow Band <sup>a</sup>	N/A	Yellow Band <sup>b</sup>

- On the LLG03-4H, the yellow band serves as a visual indicator for when used with the HPLS343 high-power plasma light source. The LLG is correctly inserted when the edge of the band is flush with the front panel of the instrument.
- On the LLG3-4Z, the yellow band indicates the end that must be used as the input because it contains a filter to protect the light guide from radiation below 420 nm.

Part Number	Description	Price	Availability
LLG3-4T	Liquid Light Guide Ø3 mm Core, 220 - 650 nm, 4' (1.2 m) Length	\$675.40	Today
LLG03-4H	Liquid Light Guide Ø3 mm Core, 340 - 800 nm, 4' (1.2 m) Length, Yellow Banded End for HPLS343	\$359.04	Today
LLG0338-6	Liquid Light Guide Ø3 mm Core, 340 - 800 nm, 6' (1.8 m) Length	\$422.28	Today
LLG0338-8	Liquid Light Guide Ø3 mm Core, 340 - 800 nm, 8' (2.4 m) Length	\$484.50	Today
LLG3-4Z	Liquid Light Guide Ø3 mm Core, 420 - 2000 nm, 4' (1.2 m) Length	\$337.18	Today

**Ø5 mm Core Liquid Light Guides**

Item #	LLG5-4T	LLG05-4H	LLG0538	LLG5-4Z
Wavelength Range	220 - 650 nm	340 - 800 nm	340 - 800 nm	420 - 2000 nm
Numerical Aperture	0.42	0.59	0.59	0.52
Half Angle ( $\theta$ )	25°	36°	36°	31°
Minimum Bend Radius	70 mm	60 mm	60 mm	60 mm
Operating Temperature Range	5 to 30 °C (41 to 86 °F)	-5 to 35 °C (23 to 95 °F)	-5 to 35 °C (23 to 95 °F)	5 to 35 °C (41 to 95 °F)
Available Lengths	4' (1.2 m)	4' (1.2 m)	6' (1.8 m), 8' (2.4 m)	4' (1.2 m)
Input End Indicator	N/A	Yellow Band <sup>a</sup>	N/A	Yellow Band <sup>b</sup>

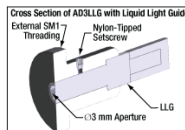
- On the LLG05-4H, the yellow band serves as a visual indicator for when used with the HPLS345 high-power plasma light source. The LLG is correctly inserted when the edge of the band is flush with the front panel of the instrument.
- On the LLG5-4Z, the yellow band indicates the end that must be used as the input because it contains a filter to protect the light guide from radiation below 420 nm.

Part Number	Description	Price	Availability
LLG5-4T	Liquid Light Guide Ø5 mm Core, 220 - 650 nm, 4' (1.2 m) Length	\$860.75	Today
LLG05-4H	Liquid Light Guide Ø5 mm Core, 340 - 800 nm, 4' (1.2 m) Length, Yellow Banded End for HPLS345	\$463.08	Today
LLG0538-6	Liquid Light Guide Ø5 mm Core, 340 - 800 nm, 6' (1.8 m) Length	\$546.72	Lead Time
LLG0538-8	Liquid Light Guide Ø5 mm Core, 340 - 800 nm, 8' (2.4 m) Length	\$619.14	Lead Time
LLG5-4Z	Liquid Light Guide Ø5 mm Core, 420 - 2000 nm, 4' (1.2 m) Length	\$429.71	Today

### SM1 Adapter for Liquid Light Guides

- ▶ Designed to Mate Ø3 mm or Ø5 mm Liquid Light Guides to SM1 Standard
- ▶ External SM1 (1.035"-40) Threading

These Liquid Light Guide Adapters allow the integration of our Ø3 mm and Ø5 mm liquid light guides into any of our selection of SM1-threaded (1.035"-40) components, such as fixed optic mounts, kinematic optic mounts, and lens tubes. The LLG is secured with a nylon-tipped setscrew using a 5/64" hex key (found in the CCHK kit).



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[APPLIST]  
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An SM1 Adapter for Liquid Light Guides is used with a lens tube to couple the output of a light source into a liquid light guide. Adjusting the depth of the SM1 adapter in the lens tube is necessary in order to achieve maximum throughput.

Part Number	Description	Price	Availability
AD3LLG	Customer Inspired! Ø3 mm LLG to SM1 Adapter	\$32.90	Today
AD5LLG	Customer Inspired! Ø5 mm LLG to SM1 Adapter	\$32.90	Today

### SM2 Coupling/Collimating Adapters for Liquid Light Guides

- ▶ Collimate Light from or Couple Light into Ø3 mm and Ø5 mm Core Liquid Light Guide
- ▶ Externally SM2-Threaded (2.035"-40) Mounting Threads
- ▶ 185 nm - 2.1 µm or 350 - 700 nm Wavelength Range
- ▶ SLSLLG2 Includes Integrated Electronic Shutter with External Controller
- ▶ Directly Compatible with SLS301, SLS401, and SLS402 Broadband Light Sources

These Liquid Light Guide Adapters allow the integration of our Ø3 mm and Ø5 mm liquid light guides into any of our selection of SM2-threaded (2.035"-40) components, in particular our SLS301, SLS401, and SLS402 broadband light sources. The adapter can be directly threading onto a light source without the need to adjust the position of the collimating lens.

The SLSLLG1 is designed with an uncoated collimating lens, which provides a wide operating range from 185 nm - 2.1 µm. For superior performance from 350 nm - 700 nm, the SLSLLG2 and SLSLLG3 lenses use an AR-coated lens that provides improved coupling efficiency in this wavelength range. Additionally, the SLSLLG2 features an integrated diaphragm shutter and an external controller that can operate at continuous frequencies up to 10 Hz and burst frequencies up to 15 Hz. For more information on the integrated shutter, please refer to the manual.

All liquid light guide adapters come with a Ø3 mm LLG to SM1 (Ø1.035"-40) AD3LLG adapter preinstalled, making them compatible with Ø3 mm core liquid light guides out of the box. They are also shipped with a Ø5 mm LLG to SM1 (Ø1.035"-40) AD5LLG adapter, which can be swapped in by unthreading the AD3LLG and replacing it with the AD5LLG. This allows the adapters to connect with Ø5 mm core liquid light guides.



Click to Enlarge  
An SLSLLG2 LLG adapter, with a liquid light guide, attached to an SLS402 light source.

		SLSLLG1	SLSLLG2	SLSLLG3
Wavelength Range		Uncoated: 185 nm - 2.1 µm	AR Coated: 350 nm - 700 nm; R <sub>avg</sub> < 0.5%	
Electronic Shutter		No	Yes <sup>a</sup>	No
Part Number		LA4464	ACL5040U-A	
Material		UV Fused Silica	B270 Optical Crown Glass	
Coupling Efficiency	SLS401 / SLS402	>30% (3 mm LLG); >35% (5 mm LLG)	>30% (3 mm LLG); >40% (5 mm LLG)	
	SLS301	>15% (3 mm LLG); >25% (5 mm LLG)	>20% (3 mm LLG); >30% (5 mm LLG)	
Mounting Thread		External SM2 (2.035"-40)		

<sup>a</sup> External controller included with the SLSLLG2 is the same as the one included with the SHB1. For additional information, please see the full presentation here.

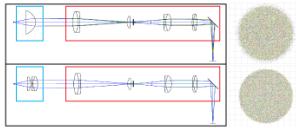
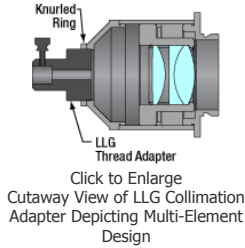
Part Number	Description	Price	Availability
SLSLLG1	Liquid Light Guide Adapter for Broadband Light Sources, 185 nm - 2.1 µm	\$364.14	Today
SLSLLG2	Liquid Light Guide Adapter with Shutter for Broadband Light Sources, 350 nm - 700 nm	\$1,304.58	Today
SLSLLG3	Liquid Light Guide Adapter for Broadband Light Sources, 350 nm - 700 nm	\$220.32	Today

**Multi-Optic Collimating Microscope Adapters for Thorlabs' Cerna Microscopes**

Thorlabs offers collimation adapters to couple Ø3 mm or Ø5 mm liquid light guides (LLGs) to our CSE2100 and CSE2200 Cerna® Epi-Illuminator Modules; see the table at the bottom right for compatibility information. For even illumination at the back focal plane of the objective, these adapters feature an optic pair of an achromatic doublet and a double convex lens.

These adapters utilize a male D3T dovetail adapter to connect to the end of the epi-illuminator module; for additional information about microscope dovetails, see the full web presentation. The LLG is secured via a thumbscrew at the back of the adapter.

These adapters are calibrated such that the image plane from the LLG output is located at the back aperture of the objective when used with the compatible epi-illuminator module; to optimize illumination for your microscope or realign the image plane, the collimation can be fine-adjusted via the knurled ring on the thread adapter (see image to the bottom left).



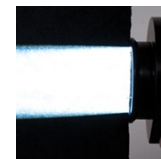
These simulations illustrate chromatic focal shift in a system with a collimated light source and a CSE2100 epi-illuminator module. A collimation adapter using a single optic (top) produces a larger focal shift for different wavelengths at the objective back aperture compared to a collimation adapter with a multi-element design (bottom).

Specifications				
Item #	LLG3A6	LLG5A6	LLG3A7	LLG5A7
Effective Focal Length	40 mm		70 mm	
Compatible Epi-Illuminator Module	CSE2100		CSE2200	
LLG Diameter	3 mm	5 mm	3 mm	5 mm
Collimating Optics	Achromatic Doublet & Double Convex Lens			
AR Coating	350 nm - 650 nm R <sub>avg</sub> < 0.5% at Each Surface			
Transmission Graph (Click Here for Raw Data)				
Numerical Aperture	0.3			
Magnification	Infinite			

Part Number	Description	Price	Availability
LLG3A6	Ø3 mm LLG Collimating Adapter for Cerna CSE2100, ARC: 350-650 nm	\$450.00	Today
LLG5A6	Ø5 mm LLG Collimating Adapter for Cerna CSE2100, ARC: 350-650 nm	\$450.00	Today
LLG3A7	Ø3 mm LLG Collimating Adapter for Cerna CSE2200, ARC: 350-650 nm	\$450.00	Today
LLG5A7	Ø5 mm LLG Collimating Adapter for Cerna CSE2200, ARC: 350-650 nm	\$450.00	Today

### Single-Element Collimating Microscope Adapters

Thorlabs offers collimation adapters with AR-coated aspheric condenser lenses (EFL = 40 mm) for collimating the output from our High-Power Light Sources. Four different collimator housings are available; each is designed to mate to the illumination port on an Olympus IX/BX, Leica DMI, Zeiss Axioskop, or Nikon Eclipse Ti microscope.



These adapters quickly mount onto the end of either the Ø3 mm or Ø5 mm Liquid Light Guide (LLG). The LLG is secured into the back of the collimator via a 4-40 setscrew with a 0.050" hex. The addition of these adapters allows the user to incorporate our HPLS343 and HPLS345 lamps into a microscope illumination port.

Compatible Microscopes	Olympus BX & IX Microscopes		Leica DMI Microscopes		Zeiss Axioskop Microscopes		Nikon Eclipse Ti Microscopes	
Item Photo (Click to Enlarge)								
Item #	LLG3A1-A	LLG5A1-A	LLG3A2-A	LLG5A2-A	LLG3A4-A	LLG5A4-A	LLG3A5-A	LLG5A5-A
LLG Diameter	3 mm	5 mm	3 mm	5 mm	3 mm	5 mm	3 mm	5 mm

Optic Specifications	
Item #	ACL5040-A Aspheric Condenser Lens
AR Coating	350 nm - 700 nm, R <sub>avg</sub> <0.5% at Each Surface
Focal Length	40.00 mm ± 5%
NA	0.554
Magnification	Infinite
Surface Quality	60-40 Scratch-Dig
Centration	<30 arcmin

Part Number	Description	Price	Availability
LLG3A1-A	Ø3 mm LLG Collimating Adapter, Olympus BX / IX, ARC: 350-700 nm	\$322.32	Today
LLG5A1-A	Ø5 mm LLG Collimating Adapter, Olympus BX / IX, ARC: 350-700 nm	\$322.32	Today
LLG3A2-A	Ø3 mm LLG Collimating Adapter, Leica DMI, ARC: 350-700 nm	\$322.32	Today
LLG5A2-A	Ø5 mm LLG Collimating Adapter, Leica DMI, ARC: 350-700 nm	\$322.32	Today
LLG3A4-A	Ø3 mm LLG Collimating Adapter, Zeiss Axioskop, ARC: 350-700 nm	\$322.32	Today
LLG5A4-A	Ø5 mm LLG Collimating Adapter, Zeiss Axioskop, ARC: 350-700 nm	\$322.32	Today
LLG3A5-A	Ø3 mm LLG Collimating Adapter, Nikon Eclipse Ti, ARC: 350-700 nm	\$424.32	Today
LLG5A5-A	Ø5 mm LLG Collimating Adapter, Nikon Eclipse Ti, ARC: 350-700 nm	\$424.32	Today

Visit the *Liquid Light Guides* page for pricing and availability information:  
[https://www.thorlabs.com/newgrouppage9.cfm?objectgroup\\_id=4273](https://www.thorlabs.com/newgrouppage9.cfm?objectgroup_id=4273)