

**M420L3 - March 15, 2018**

Item # M420L3 was discontinued on March 15, 2018. For informational purposes, this is a copy of the website content at that time and is valid only for the stated product.

**MOUNTED LEDS**

UV, Visible, and IR Models Available  
 Optimized Heat Management Results in Stable Output  
 Internal SM1 (1.035"-40) Threading  
 Collimation Adapters Available Separately

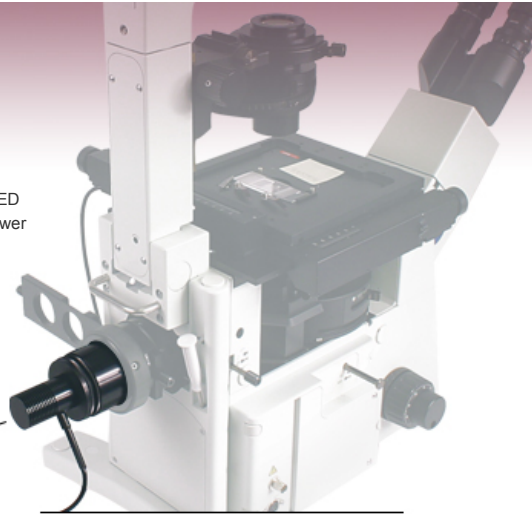


**M405LP1**  
 405 nm Mounted LED  
 1500 mW Output Power



**M505L3**  
 505 nm Mounted LED  
 400 mW Output Power

M625L3 with a Collimator  
 Used as a Light Source for a  
 Microscope



[Hide Overview](#)

**OVERVIEW**

**Mounted LED Features**

- Nominal Wavelengths Ranging from 265 nm to 1650 nm
- White, Broadband, and Dual-Peak LEDs Also Available
- Integrated EEPROM Stores LED Operating Parameters
- Thermal Properties Optimized for Stable Output Power
- Internal SM1 (1.035"-40) Threading (6 mm Deep) for Attaching Collimation Adapters or Ø1" Lens Tubes
- Collimation Adapters Available
  - Adjustable Collimation Adapters for Ø2" Optics
  - Microscope Adapters for Select Leica, Nikon, Olympus, or Zeiss Microscopes
- Mounted LEDs with Fixed-Focus Collimation Adapters for Microscopes Available
- 4-Pin Female Mating Connector for Custom Power Supplies can be Purchased Separately

Each uncollimated, mounted LED consists of a single LED that has been mounted to the end of a heat sink. Most of the LEDs on this page have a heat sink housing that has the same 1.20" external diameter as an SM1 lens tube. Some of the LEDs offered below generate more heat during operation, and so are mounted to a larger heat sink with a Ø57.0 mm plastic housing for increased heat dissipation and thermal stability (indicated by the green rows in the table to the right). All the heat sinks are equipped with 6 mm deep internal SM1 (1.035"-40) threads for easy integration with other Thorlabs components. The larger heat sinks are also equipped with four 4-40 tapped holes for compatibility with 30 mm cage systems.

The integrated EEPROM chip in each LED stores information about the LED (e.g., current limit, wavelength, and forward voltage) and can be read by Thorlabs' DC2200 and DC4100 LED Controllers. For more information about LED drivers, including the basic LEED1B driver, see the *LED Drivers* tab.

The spectrum of each LED and associated data file can be viewed by clicking on the links in the table to the right. Multiple windows can be opened simultaneously in order to compare LEDs.

**Optimized Thermal Management**

These mounted LEDs possess good thermal stability properties, eliminating

**Legend**

LED Mounted to Ø57.0 mm Housing

LED Mounted to Ø30.5 mm Housing

| Item #               | Color<br>(Click for Spectrum) <sup>a</sup> | Nominal<br>Wavelength <sup>a,b</sup> | Minimum LED<br>Power Output <sup>a</sup> |
|----------------------|--|--------------------------------------|--|
| M265L3 <sup>c</sup>  | Deep UV                                    | 265 nm                               | 10 mW                                    |
| M285L4 <sup>c</sup>  | Deep UV                                    | 285 nm                               | 45 mW                                    |
| M300L4 <sup>c</sup>  | Deep UV                                    | 300 nm                               | 26 mW                                    |
| M340L4 <sup>c</sup>  | Deep UV                                    | 340 nm                               | 53 mW                                    |
| M365L2 <sup>c</sup>  | UV   | 365 nm                               | 190 mW                                   |
| M365LP1 <sup>c</sup> | UV   | 365 nm                               | 1150 mW                                  |
| M375L4 <sup>c</sup>  | UV   | 375 nm                               | 1270 mW                                  |
| M385L2 <sup>c</sup>  | UV   | 385 nm                               | 270 mW                                   |
| M385LP1 <sup>c</sup> | UV   | 385 nm                               | 1650 mW                                  |
| M395L4 <sup>c</sup>  | UV   | 395 nm                               | 400 mW                                   |
| M405L3 <sup>c</sup>  | UV   | 405 nm                               | 870 mW                                   |
| M405LP1 <sup>c</sup> | UV   | 405 nm                               | 1500 mW                                  |
| M420L3 <sup>c</sup>  | Violet                                     | 420 nm                               | 750 mW                                   |
| M430L4 <sup>c</sup>  | Violet                                     | 430 nm                               | 490 mW                                   |
| M450LP1              | Royal Blue                                 | 450 nm                               | 1850 mW                                  |
| M455L3 <sup>d</sup>  | Royal Blue                                 | 455 nm                               | 900 mW                                   |
| M470L3 <sup>d</sup>  | Blue                                       | 470 nm                               | 650 mW                                   |
| M490L4               | Blue                                       | 490 nm                               | 205 mW                                   |
| M505L3 <sup>d</sup>  | Cyan                                       | 505 nm                               | 400 mW                                   |
| M530L3 <sup>d</sup>  | Green                                      | 530 nm                               | 350 mW                                   |
| M565L3 <sup>e</sup>  | Lime                                       | 565 nm                               | 880 mW                                   |

the issue of degradation of optical output power due to increased LED temperature. For more details, please see the *Stability* tab.

#### White Light, Dual-Peak, and Broadband LEDs

Our warm, neutral, and cold white LEDs feature broad spectra that span several hundred nanometers. The difference in appearance amongst these three LEDs can be described using the correlated color temperature, which indicates that the LEDs color appearance is similar to a black body radiator at that temperature. In general, warm white LEDs offer a spectrum similar to a tungsten source, while cold white LEDs have a stronger blue component to the spectrum; neutral white LEDs provide a more even illumination spectrum over the visible range than warm white or cold white LEDs. Cold white LEDs are more suited for fluorescence microscopy applications or cameras with white balancing, because of a higher intensity at most wavelengths compared to warm white LEDs. Neutral white LEDs are ideal for horticultural applications.

For horticultural applications requiring illumination in both red and blue portions of the spectrum, Thorlabs offers the MPRP1L4. This purple LED features dual peaks at 455 nm and 640 nm, respectively, to stimulate photosynthesis (see graph to compare the absorption peaks of photosynthesis pigments with the LED spectrum). The LED was designed to maintain the red/blue ratio of the emission spectrum over its lifetime to provide high uniformity of plant growth.

The MBB1L3 mounted broadband LED has been designed to have relatively flat spectral emission over a wide wavelength range. Its FWHM bandwidth ranges from 500 nm to 780 nm, while the 10 dB bandwidth ranges between 470 nm and 850 nm. For more information on the spectrum of this broadband source, please see the table to the right.

#### Collimation Adapters

Collimation adapters are available that incorporate an AR-coated aspheric lens for either 350 - 700 nm or 650 - 1050 nm in housings that are compatible with both LED housing styles (Ø57.0 mm or Ø30.5 mm housing).

Our adjustable collimation adapters can translate a Ø2" (50 mm) lens by up to 20 mm. A translating carriage, which can be locked using a 2 mm (5/64") hex key or balldriver, is used to provide collimation adjustment. Each adjustable collimation adapter includes an internal SM2 (2.035"-40) thread adapter so that the LEDs can be easily integrated with Thorlabs' SM2-threaded components, such as our microscope port adapters. These adapters are offered in versions with and without an optic.

We also offer fixed collimation adapters that mate to the epi-illumination ports on select Leica DMI, Nikon Eclipse Ti, Olympus IX/BX, or Zeiss Axioskop microscopes. See below for more details. Thorlabs also offers mounted LEDs with pre-attached microscope collimation adapters.

#### Multi-LED Source

A customizable multi-LED source may be constructed using our mounted LEDs and other Thorlabs items. This source may be configured for integration with Thorlabs' versatile SM1 Lens Tube Systems, 30 mm Cage Systems, and the microscope adapters sold below. Please see the *Multi-LED Source* tab for a detailed item list and instructions.

Thorlabs also offers integrated, user-configurable 4-Wavelength High-Power LED Sources.

#### Driver Options

Thorlabs offers four LED drivers: LEDD1B, DC2200, DC4100, and DC4104 (the latter two require the DC4100-HUB). See the *LED Drivers* tab for compatibility and driver features. The LEDD1B is capable of providing LED modulation frequencies up to 5 kHz, while DC4100 and DC4104 can modulate the LED at a rate up to 100 kHz. The DC2200 can provide modulation at up to 250 kHz if driven by an external source. In addition, the DC2200, DC4100, and DC4104 drivers are capable of reading the current limit from the EEPROM chip of the connected LED and automatically adjusting the maximum current setting to protect the LED. Please note that the DC4100 and DC4104 can only be used to drive LEDs requiring a forward voltage of 5 V or less.

| Item #                | Color<br>(Click for Spectrum) <sup>a</sup> | Nominal<br>Wavelength <sup>a,b</sup>  | Minimum LED<br>Power Output <sup>a</sup> |
|-----------------------|--|---------------------------------------|--|
| M590L3 <sup>d</sup>   | Amber                                      | 590 nm                                | 160 mW                                   |
| M595L3 <sup>e</sup>   | Amber                                      | 595 nm                                | 445 mW                                   |
| M617L3 <sup>d</sup>   | Orange                                     | 617 nm                                | 600 mW                                   |
| M625L3 <sup>d</sup>   | Red  | 625 nm                                | 700 mW                                   |
| M660L4                | Deep Red                                   | 660 nm                                | 940 mW                                   |
| M680L4                | Deep Red                                   | 680 nm                                | 180 mW                                   |
| M700L4                | Deep Red                                   | 700 nm                                | 80 mW                                    |
| M730L4 <sup>d</sup>   | Far Red                                    | 730 nm                                | 515 mW                                   |
| M780L3                | IR   | 780 nm                                | 200 mW                                   |
| M780LP1               | IR   | 780 nm                                | 800 mW                                   |
| M810L3                | IR   | 810 nm                                | 325 mW                                   |
| M850L3                | IR   | 850 nm                                | 900 mW                                   |
| M850LP1               | IR   | 850 nm                                | 1400 mW                                  |
| M880L3                | IR   | 880 nm                                | 300 mW                                   |
| M940L3                | IR   | 940 nm                                | 800 mW                                   |
| M970L4                | IR   | 970 nm                                | 600 mW                                   |
| M1050L2               | IR   | 1050 nm                               | 50 mW                                    |
| M1200L3               | IR   | 1200 nm                               | 30 mW                                    |
| M1300L3               | IR   | 1300 nm                               | 25 mW                                    |
| M1450L3               | IR   | 1450 nm                               | 31 mW                                    |
| M1550L3               | IR   | 1550 nm                               | 31 mW                                    |
| M1650L4               | IR   | 1650 nm                               | 13 mW                                    |
| MPRP1L4 <sup>e</sup>  | Purple                                     | 455 nm (12.5% <sup>f</sup> ) / 640 nm | 275 mW                                   |
| MBB1L3 <sup>g</sup>   | Broadband                                  | 470 - 850 nm <sup>h</sup>             | 70 mW                                    |
| MWWHL4 <sup>e</sup>   | Warm White                                 | 3000 K <sup>i</sup>                   | 570 mW                                   |
| MWWHLP1 <sup>e</sup>  | Warm White                                 | 3000 K <sup>i</sup>                   | 2000 mW                                  |
| MNWHL4 <sup>e</sup>   | Neutral White                              | 4900 K <sup>i</sup>                   | 740 mW                                   |
| MCWHL5 <sup>d,e</sup> | Cold White                                 | 6500 K <sup>i</sup>                   | 800 mW                                   |
| MCWHLP1 <sup>e</sup>  | Cold White                                 | 6500 K <sup>i</sup>                   | 2350 mW                                  |

- Due to variations in the manufacturing process and operating parameters such as temperature and current, the actual spectral output of any given LED will vary. Output plots and nominal wavelength specs are only intended to be used as a guideline.
- For LEDs in the visible spectrum, the nominal wavelength indicates the wavelength at which the LED appears brightest to the human eye. The nominal wavelength for visible LEDs may not correspond to the peak wavelength as measured by a spectrometer.
- Our 265 nm to 430 nm LEDs radiate intense UV light during operation. Precautions must be taken to prevent looking directly at the UV light and UV light protective glasses must be worn to avoid eye damage. Exposure of the skin and other body parts to the UV light should be avoided.
- These LEDs use a high-thermal-conductivity MCPCB material from SinkPAD, while the rest of the mounted LEDs use a high-thermal-conductivity MCPCB material from Bergquist.
- These LEDs are phosphor-converted and may not turn off completely when modulated above 10 kHz at duty cycles below 50%.
- Percentage of LED intensity that emits in the blue portion of the spectrum, from 400 nm to 525 nm. See spectrum graph for details.
- The MBB1L3 LED may not turn off completely when modulated at frequencies above 1 kHz with a duty cycle of 50%, as the broadband emission is produced by optically stimulating emission from phosphor. For modulation at frequencies above 1 kHz, the duty cycle may be reduced. For example, 10 kHz modulation is attainable with a duty cycle of 5%.
- 10 dB Bandwidth
- Correlated Color Temperature

[Hide Specs](#)

## S P E C S

### Legend

LED Mounted to Ø57.0 mm Housing

LED Mounted to Ø30.5 mm Housing

| Item #               | Color<br>(Click for<br>Spectrum) <sup>a</sup> | Nominal<br>Wavelength <sup>a,b</sup> | LED Output<br>Power <sup>a</sup> |         | Maximum<br>Current<br>(CW) | Forward<br>Voltage | Bandwidth<br>(FWHM) | Irradiance<br>(Typical) <sup>c</sup> | Electrical<br>Power | Viewing<br>Angle<br>(Full Angle<br>at Half Max) | Emitter<br>Size | Typical<br>Lifetime <sup>d</sup> |
|----------------------|---|--------------------------------------|----------------------------------|---------|----------------------------|--------------------|---------------------|--------------------------------------|---------------------|---|-----------------|----------------------------------|
|                      |   |                                      | Minimum                          | Typical |                            |                    |                     |                                      |                     |   |                 |                                  |
| M265L3 <sup>e</sup>  | Deep UV                                       | 265 nm                               | 10 mW                            | 12 mW   | 350 mA                     | 6.8 V              | 11 nm               | -                                    | 2.380 W             | 130°  | 1 mm x 1 mm     | >1 000 h                         |
| M285L4 <sup>e</sup>  | Deep UV                                       | 285 nm                               | 45 mW                            | 55 mW   | 500 mA                     | 6.2 V              | 12 nm               | 0.5 µW/mm <sup>2</sup>               | 3.100 W             | 120°  | 1 mm x 1 mm     | >10 000 h                        |
| M300L4 <sup>e</sup>  | Deep UV                                       | 300 nm                               | 26 mW                            | 32 mW   | 350 mA                     | 8.0 V              | 20 nm               | 0.3 µW/mm <sup>2</sup>               | 2.800 W             | 130°  | 1 mm x 1 mm     | >10 000 h                        |
| M340L4 <sup>e</sup>  | Deep UV                                       | 340 nm                               | 53 mW                            | 60 mW   | 700 mA                     | 4.6 V              | 11 nm               | 2.22 µW/mm <sup>2</sup>              | 3.220 W             | 110°  | 1 mm x 1 mm     | >3 000 h                         |
| M365L2 <sup>e</sup>  | UV  | 365 nm                               | 190 mW                           | 360 mW  | 700 mA                     | 4.4 V              | 7.5 nm              | 8.9 µW/mm <sup>2</sup>               | 3.080 W             | 120°  | 1 mm x 1 mm     | >10 000 h                        |
| M365LP1 <sup>e</sup> | UV  | 365 nm                               | 1150 mW                          | 1400 mW | 1400 mA                    | 3.75 V             | 9 nm                | 17.6 µW/mm <sup>2</sup>              | 5.250 W             | 120°  | 1.4 mm x 1.4 mm | >10 000 h                        |
| M375L4 <sup>e</sup>  | UV  | 375 nm                               | 1270 mW                          | 1540 mW | 1400 mA                    | 3.6 V              | 9 nm                | 19.2 µW/mm <sup>2</sup>              | 4760 mW             | 130°  | 1 mm x 1 mm     | >10 000 h                        |
| M385L2 <sup>e</sup>  | UV  | 385 nm                               | 270 mW                           | 430 mW  | 700 mA                     | 4.3 V              | 10 nm               | 11.8 µW/mm <sup>2</sup>              | 3.010 W             | 120°  | 1 mm x 1 mm     | >10 000 h                        |
| M385LP1 <sup>e</sup> | UV  | 385 nm                               | 1650 mW                          | 1830 mW | 1400 mA                    | 3.65 V             | 12 nm               | 23.3 µW/mm <sup>2</sup>              | 5.110 W             | 120°  | 1.4 mm x 1.4 mm | >10 000 h                        |
| M395L4 <sup>e</sup>  | UV  | 395 nm                               | 400 mW                           | 535 mW  | 500 mA                     | 4.5 V              | 16 nm               | 6.7 µW/mm <sup>2</sup>               | 2.250 W             | 126°  | 1 mm x 1 mm     | >10 000 h                        |
| M405L3 <sup>e</sup>  | UV  | 405 nm                               | 870 mW                           | 980 mW  | 1000 mA                    | 3.9 V              | 20 nm               | 33.6 µW/mm <sup>2</sup>              | 3.900 W             | 68°   | 1 mm x 1 mm     | >100 000 h                       |
| M405LP1 <sup>e</sup> | UV  | 405 nm                               | 1500 mW                          | 1700 mW | 1400 mA                    | 3.45 V             | 12 nm               | 24.6 µW/mm <sup>2</sup>              | 4.830 W             | 120°  | 1.4 mm x 1.4 mm | >10 000 h                        |
| M420L3 <sup>e</sup>  | Violet  | 420 nm                               | 750 mW                           | 820 mW  | 1000 mA                    | 3.5 V              | 15 nm               | 13.1 µW/mm <sup>2</sup>              | 3.500 W             | 125°  | 1 mm x 1 mm     | >10 000 h                        |
| M430L4 <sup>e</sup>  | Violet  | 430 nm                               | 490 mW                           | 600 mW  | 500 mA                     | 3.8 V              | 15 nm               | 35.3 µW/mm <sup>2</sup>              | 1.900 W             | 22°   | 1 mm x 1 mm     | >10 000 h                        |
| M450LP1              | Royal Blue                                    | 450 nm                               | 1850 mW                          | 2100 mW | 2000 mA                    | 3.5 V              | 18 nm               | 35.6 µW/mm <sup>2</sup>              | 7.000 W             | 120°  | 1.5 mm x 1.5 mm | 1 000 h                          |
| M455L3 <sup>f</sup>  | Royal Blue                                    | 455 nm                               | 900 mW                           | 1020 mW | 1000 mA                    | 3.2 V              | 18 nm               | 31.2 µW/mm <sup>2</sup>              | 3.200 W             | 80°   | 1 mm x 1 mm     | 100 000 h                        |
| M470L3 <sup>f</sup>  | Blue  | 470 nm                               | 650 mW                           | 710 mW  | 1000 mA                    | 3.2 V              | 25 nm               | 21.9 µW/mm <sup>2</sup>              | 3.200 W             | 80°   | 1 mm x 1 mm     | 100 000 h                        |
| M490L4               | Blue  | 490 nm                               | 205 mW                           | 240 mW  | 350 mA                     | 3.8 V              | 26 nm               | 2.5 µW/mm <sup>2</sup>               | 1.330 W             | 128°  | 1 mm x 1 mm     | >10 000 h                        |
| M505L3 <sup>f</sup>  | Cyan  | 505 nm                               | 400 mW                           | 440 mW  | 1000 mA                    | 3.3 V              | 30 nm               | 11.1 µW/mm <sup>2</sup>              | 3.300 W             | 80°   | 1 mm x 1 mm     | 100 000 h                        |
| M530L3 <sup>f</sup>  | Green   | 530 nm                               | 350 mW                           | 370 mW  | 1000 mA                    | 3.2 V              | 33 nm               | 9.5 µW/mm <sup>2</sup>               | 3.200 W             | 80°   | 1 mm x 1 mm     | 100 000 h                        |
| M565L3 <sup>g</sup>  | Lime  | 565 nm                               | 880 mW                           | 979 mW  | 1000 mA                    | 3.1 V              | 104 nm              | 11.7 µW/mm <sup>2</sup>              | 3.100 W             | 125°  | 1 mm x 1 mm     | 50 000 h                         |
| M590L3 <sup>f</sup>  | Amber   | 590 nm                               | 160 mW                           | 170 mW  | 1000 mA                    | 2.2 V              | 18 nm               | 5.3 µW/mm <sup>2</sup>               | 2.200 W             | 80°   | 1 mm x 1 mm     | 100 000 h                        |
| M595L3 <sup>g</sup>  | Amber   | 595 nm                               | 445 mW                           | 502 mW  | 700 mA                     | 3.05 V             | 80 nm               | 6.9 µW/mm <sup>2</sup>               | 2.135 W             | 125°  | 1 mm x 1 mm     | 50 000 h                         |
| M617L3 <sup>f</sup>  | Orange  | 617 nm                               | 600 mW                           | 650 mW  | 1000 mA                    | 2.2 V              | 18 nm               | 15.7 µW/mm <sup>2</sup>              | 2.200 W             | 80°   | 1 mm x 1 mm     | 100 000 h                        |
| M625L3 <sup>f</sup>  | Red   | 625 nm                               | 700 mW                           | 770 mW  | 1000 mA                    | 2.2 V              | 18 nm               | 18.0 µW/mm <sup>2</sup>              | 2.200 W             | 80°   | 1 mm x 1 mm     | 100 000 h                        |
| M660L4               | Deep Red                                      | 660 nm                               | 940 mW                           | 1050 mW | 1200 mA                    | 2.6 V              | 20 nm               | 20.88 µW/mm <sup>2</sup>             | 3.120 W             | 120°  | 1.5 mm x 1.5 mm | >10 000 h                        |
| M680L4               | Deep Red                                      | 680 nm                               | 180 mW                           | 210 mW  | 600 mA                     | 2.5 V              | 22 nm               | 14.5 µW/mm <sup>2</sup>              | 1.500 W             | 18°   | 1 mm x 1 mm     | >10 000 h                        |
| M700L4               | Deep Red                                      | 700 nm                               | 80 mW                            | 125 mW  | 500 mA                     | 2.7 V              | 20 nm               | 1.0 µW/mm <sup>2</sup>               | 1.350 W             | 128°  | 1 mm x 1 mm     | >10 000 h                        |
| Item #               | Color<br>(Click for<br>Spectrum) <sup>a</sup> | Nominal<br>Wavelength <sup>a,b</sup> | LED Output<br>Power <sup>a</sup> |         | Maximum<br>Current<br>(CW) | Forward<br>Voltage | Bandwidth<br>(FWHM) | Irradiance<br>(Typical) <sup>c</sup> | Electrical<br>Power | Viewing<br>Angle<br>(Full Angle<br>at Half Max) | Emitter<br>Size | Typical<br>Lifetime <sup>d</sup> |
| M730L4 <sup>f</sup>  | Far Red                                       | 730 nm                               | 515 mW                           | 595 mW  | 1000 mA                    | 2.3 V              | 37 nm               | 13.2 µW/mm <sup>2</sup>              | 2.300 W             | 80°   | 1 mm x 1 mm     | >10 000 h                        |

| Item #                | Color<br>(Click for<br>Spectrum) <sup>a</sup> | Nominal<br>Wavelength <sup>a,b</sup>     | LED Output<br>Power <sup>a</sup> |         | Maximum<br>Current<br>(CW) | Forward<br>Voltage | Bandwidth<br>(FWHM) | Irradiance<br>(Typical) <sup>c</sup> | Electrical<br>Power | Viewing<br>Angle<br>(Full Angle<br>at Half Max) | Emitter<br>Size          | Typical<br>Lifetime <sup>d</sup> |
|-----------------------|---|--|----------------------------------|---------|----------------------------|--------------------|---------------------|--------------------------------------|---------------------|---|--------------------------|----------------------------------|
|                       |   |  | Minimum                          | Typical |                            |                    |                     |                                      |                     |   |                          |                                  |
| M780L3                | IR  | 780 nm                                   | 200 mW                           | 300 mW  | 800 mA                     | 2.0 V              | 28 nm               | 47.3 $\mu\text{W}/\text{mm}^2$       | 1.600 W             | 20°   | 1 mm x 1 mm              | >10 000 h                        |
| M780LP1               | IR  | 780 nm                                   | 800 mW                           | 950 mW  | 800 mA                     | 7.8 V              | 30 nm               | 13.3 $\mu\text{W}/\text{mm}^2$       | 6.240 W             | 120°  | Ø3 mm<br>(3<br>Emitters) | >10 000 h                        |
| M810L3                | IR  | 810 nm                                   | 325 mW                           | 375 mW  | 500 mA                     | 3.6 V              | 25 nm               | 61.8 $\mu\text{W}/\text{mm}^2$       | 1.800 W             | 20°   | 1 mm x 1 mm              | >10 000 h                        |
| M850L3                | IR  | 850 nm                                   | 900 mW                           | 1100 mW | 1000 mA                    | 2.9 V              | 30 nm               | 22.9 $\mu\text{W}/\text{mm}^2$       | 2.900 W             | 90°   | 1 mm x 1 mm              | 100 000 h                        |
| M850LP1               | IR  | 850 nm                                   | 1400 mW                          | 1600 mW | 1500 mA                    | 3.85 V             | 30 nm               | 19.4 $\mu\text{W}/\text{mm}^2$       | 5.770 W             | 150°  | 1 mm x 1 mm              | >10 000 h                        |
| M880L3                | IR  | 880 nm                                   | 300 mW                           | 350 mW  | 1000 mA                    | 1.7 V              | 50 nm               | 5.6 $\mu\text{W}/\text{mm}^2$        | 1.700 W             | 132°  | 1 mm x 1 mm              | >10 000 h                        |
| M940L3                | IR  | 940 nm                                   | 800 mW                           | 1000 mW | 1000 mA                    | 2.75 V             | 37 nm               | 19.1 $\mu\text{W}/\text{mm}^2$       | 2.750 W             | 90°   | 1 mm x 1 mm              | 100 000 h                        |
| M970L4                | IR  | 970 nm                                   | 600 mW                           | 720 mW  | 1000 mA                    | 1.9 V              | 60 nm               | 7.4 $\mu\text{W}/\text{mm}^2$        | 1.900 W             | 130°  | 1 mm x 1 mm              | >10 000 h                        |
| M1050L2               | IR  | 1050 nm                                  | 50 mW                            | 70 mW   | 700 mA                     | 1.5 V              | 60 nm               | 1.9 $\mu\text{W}/\text{mm}^2$        | 1.050 W             | 120°  | 1 mm x 1 mm              | >10 000 h                        |
| M1200L3               | IR  | 1200 nm                                  | 30 mW                            | 35 mW   | 700 mA                     | 1.4 V              | 80 nm               | 0.7 $\mu\text{W}/\text{mm}^2$        | 0.980 W             | 134°  | 1 mm x 1 mm              | >10 000 h                        |
| M1300L3               | IR  | 1300 nm                                  | 25 mW                            | 30 mW   | 500 mA                     | 1.4 V              | 80 nm               | 0.6 $\mu\text{W}/\text{mm}^2$        | 0.700 W             | 134°  | 1 mm x 1 mm              | >10 000 h                        |
| M1450L3               | IR  | 1450 nm                                  | 31 mW                            | 36 mW   | 700 mA                     | 1.15 V             | 80 nm               | 0.4 $\mu\text{W}/\text{mm}^2$        | 0.805 W             | 136°  | 1 mm x 1 mm              | >10 000 h                        |
| M1550L3               | IR  | 1550 nm                                  | 31 mW                            | 36 mW   | 700 mA                     | 1.1 V              | 102 nm              | 0.5 $\mu\text{W}/\text{mm}^2$        | 1.050 W             | 136°  | 1 mm x 1 mm              | >10 000 h                        |
| M1650L4               | IR  | 1650 nm                                  | 13 mW                            | 16 mW   | 600 mA                     | 1.1 V              | 120 nm              | 1.2 $\mu\text{W}/\text{mm}^2$        | 0.660 W             | 20°   | 1 mm x 1 mm              | >10 000 h                        |
| MPRP1L4 <sup>g</sup>  | Purple  | 455 nm (12.5% <sup>h</sup> ) /<br>640 nm | 275 mW                           | 325 mW  | 300 mA                     | 3.1 V              | N/A                 | 3.7 $\mu\text{W}/\text{mm}^2$        | 0.930 W             | 115°  | 1 mm x 2 mm              | >10 000 h                        |
| MBB1L3 <sup>i</sup>   | Broadband                                     | 470 - 850 nm <sup>j</sup>                | 70 mW                            | 80 mW   | 500 mA                     | 3.6 V              | 280 nm              | 12.5 $\mu\text{W}/\text{mm}^2$       | 1.800 W             | 120°  | 1 mm x 1 mm              | 10 000 h                         |
| MWWHL4 <sup>g</sup>   | Warm White                                    | 3000 K <sup>k</sup>                      | 570 mW                           | 640 mW  | 1000 mA                    | 3.0 V              | N/A                 | 9.4 $\mu\text{W}/\text{mm}^2$        | 3.000 W             | 120°  | 1 mm x 1 mm              | >50 000 h                        |
| MWWHLP1 <sup>g</sup>  | Warm White                                    | 3000 K <sup>k</sup>                      | 2000 mW                          | 2300 mW | 700 mA                     | 11.7 V             | N/A                 | 37.0 $\mu\text{W}/\text{mm}^2$       | 8.200 W             | 125°  | 3.5 mm x<br>3.5 mm       | >100 000 h                       |
| MNWHL4 <sup>g</sup>   | Neutral White                                 | 4900 K <sup>k</sup>                      | 740 mW                           | 880 mW  | 1225 mA                    | 2.9 V              | N/A                 | 7.7 $\mu\text{W}/\text{mm}^2$        | 3.553 W             | 150°  | 1 mm x 1 mm              | >10 000 h                        |
| MCWHL5 <sup>f,g</sup> | Cold White                                    | 6500 K <sup>k</sup>                      | 800 mW                           | 840 mW  | 1000 mA                    | 3.2 V              | N/A                 | 24.8 $\mu\text{W}/\text{mm}^2$       | 3.200 W             | 80°   | 1 mm x 1 mm              | 100 000 h                        |
| MCWHLP1 <sup>g</sup>  | Cold White                                    | 6500 K <sup>k</sup>                      | 2350 mW                          | 2700 mW | 700 mA                     | 11.7 V             | N/A                 | 41.3 $\mu\text{W}/\text{mm}^2$       | 8.200 W             | 125°  | 3.5 mm x<br>3.5 mm       | >100 000 h                       |

- a. Due to variations in the manufacturing process and operating parameters such as temperature and current, the actual spectral output of any given LED will vary. Output plots and nominal wavelength specs are only intended to be used as a guideline.
- b. For LEDs in the visible spectrum, the nominal wavelength indicates the wavelength at which the LED appears brightest to the human eye. The nominal wavelength for visible LEDs may not correspond to the peak wavelength as measured by a spectrograph.
- c. Irradiance is measured at a distance of 200 mm from the LED.
- d. Thorlabs defines the lifetime of our LEDs as  $B_{50}/L_{50}$ , meaning that 50% of the LEDs with a given item # will fall below 50% of the initial optical power at the end of the specified lifetime. Please see the *Stability* tab for more details.
- e. Our 265 nm to 430 nm LEDs radiate intense UV light during operation. Precautions must be taken to prevent looking directly at the UV light and UV light protective glasses must be worn to avoid eye damage. Exposure of the skin and other body parts to the UV light should be avoided.
- f. These LEDs use a high-thermal-conductivity MCPCB material from SinkPAD, while the rest of the mounted LEDs use a high-thermal-conductivity MCPCB material from Bergquist.
- g. These LEDs are phosphor-converted and may not turn off completely when modulated above 10 kHz at duty cycles below 50%.
- h. Percentage of LED intensity that emits in the blue portion of the spectrum, from 400 nm to 525 nm. See spectrum graph for details.
- i. The MBB1L3 LED may not turn off completely when modulated at frequencies above 1 kHz with a duty cycle of 50%, as the broadband emission is produced by optically stimulating emission from phosphor. For modulation at frequencies above 1 kHz, the duty cycle may be reduced. For example, 10 kHz modulation is attainable with a duty cycle of 5%.
- j. 10 dB Bandwidth
- k. Correlated Color Temperature

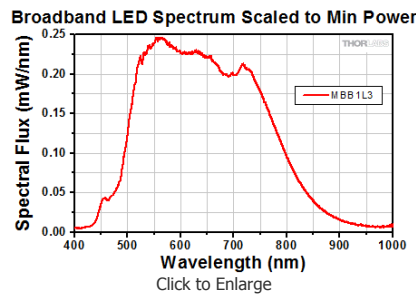
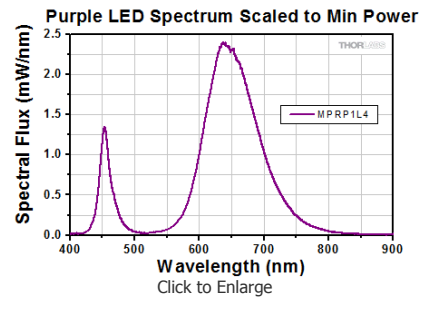
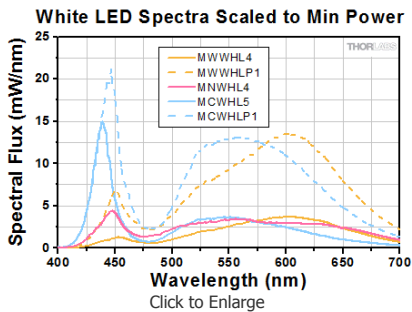
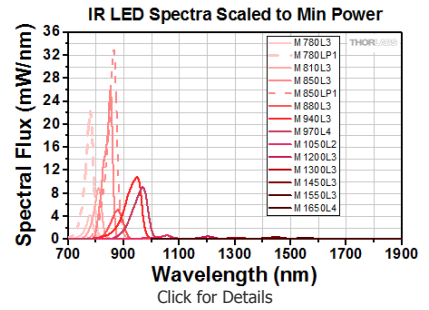
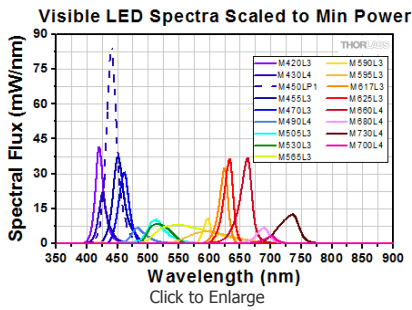
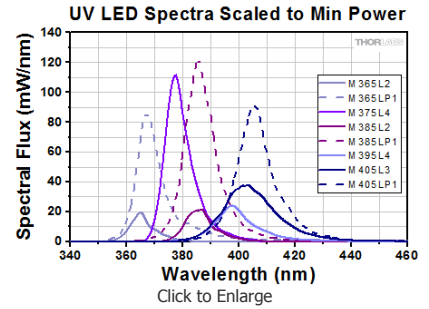
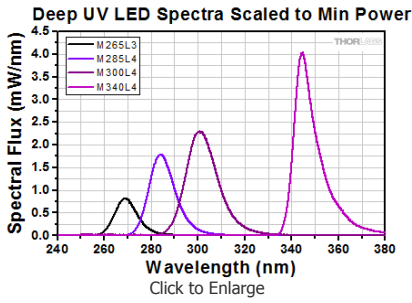
[Hide Relative Power](#)

## RELATIVE POWER

### Relative Power

The actual spectral output and total output power of any given LED will vary due to variations in the manufacturing process and operating parameters, such as temperature and current. Both a typical and minimum output power are specified to help you select an LED that suits your needs. Each mounted LED will provide at least the minimum specified output power at the

maximum current. In order to provide a point of comparison for the relative powers of LEDs with different nominal wavelengths, the spectra in the plots below have been scaled to the minimum output power for each LED. This data is representative, not absolute. An excel file with normalized and scaled spectra for all of the mounted LEDs can be downloaded [here](#).

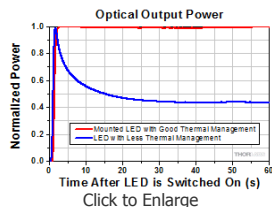


[Hide Stability](#)

## STABILITY

### LED Lifetime and Long-Term Power Stability

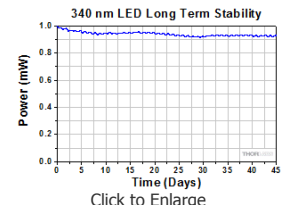
One characteristic of LEDs is that they naturally exhibit power degradation with time. Often this power degradation is slow, but there are also instances where large, rapid drops in power, or even complete LED failure, occur. LED lifetimes are defined as the time it takes a specified percentage of a type of LED to fall below some power level. The parameters for the lifetime measurement can be written using the notation  $B_{XX}/L_{YY}$ , where XX is the percentage of that type of LED that will provide less than YY percent of the specified output power after the lifetime has elapsed. Thorlabs defines the lifetime of our LEDs as  $B_{50}/L_{50}$ , meaning that 50% of the LEDs with a given Item # will fall below 50% of the initial optical power at the end of the specified lifetime. For example, if a batch of 100 LEDs is rated for 150 mW of output power, 50 of these LEDs can be expected to produce an output power of  $\leq 75$  mW after the specified LED lifetime has elapsed.



The thermal dissipation performance of these mounted LEDs has been optimized for stable power output. The heat sink is directly mounted to the LED mount so as to provide optimal thermal contact. By doing so, the degradation of optical output power that can be attributed to increased LED junction temperature is minimized (see the graph to the left).

### Optimized Thermal Management

The thermal dissipation performance of these mounted LEDs has been optimized for stable power output. The heat sink is directly mounted to the LED mount so as to provide optimal thermal contact. By doing so, the degradation of optical output power that can be attributed to increased LED junction temperature is minimized (see the graph to the left).



The M340L3 LED has a typical lifetime of >3,000 hours. In this case, the unit under test continued to provide more than 90% of its initial power after 45 days.

The sample plot to the right shows example data from long-term stability testing over a 45 day period for the M340L3, which has a lifetime of >3,000 hours (~125 days). The small power drop experienced by the LED after it is turned on is typical behavior during the first few minutes of operation. It corresponds to the period of time required for the LED to warm up to the point where it is thermally stable. Please note that this graph represents the performance of a single LED; the performance of individual LEDs will vary within the stated specifications.

[Hide Pin Diagram](#)

## PIN DIAGRAM

### Pin Connection - Male

The diagram to the right shows the male connector of the mounted LED assembly. It is a standard M8 x 1 sensor circular connector. Pins 1 and 2 are the connection to the LED. Pin 3 and 4 are used for the internal EEPROM in these LEDs. If using an LED driver that was not purchased from Thorlabs, be careful that the appropriate connections are made to Pin 1 and Pin 2 and that you do not attempt to drive the LED through the EEPROM pins.



| Pin | Specification | Color |
|-----|---------------|-------|
| 1   | LED Anode     | Brown |
| 2   | LED Cathode   | White |
| 3   | EEPROM GND    | Black |
| 4   | EEPROM IO     | Blue  |

[Hide LED Drivers](#)

## LED DRIVERS

| Compatible Drivers                                     | LEDD1B  | DC2200 <sup>a</sup>   | DC4100 <sup>a,b,c</sup>                                    | DC4104 <sup>a,b,c</sup>                                     |
|--|---|---|--|---|
| Click Photos to Enlarge                                |   |   |  |   |
| LED Driver Current Output (Max)                        | 1.2 A   | LED1 Terminal: 10.0 A<br>LED2 Terminal: 2.0 A <sup>d</sup>                                      | 1.0 A per Channel  | 1.0 A per Channel   |
| LED Driver Forward Voltage (Max)                       | 12 V  | 50 V  | 5 V  | 5 V   |
| Modulation Frequency Using External Input (Max)        | 5 kHz   | 250 kHz <sup>e,f</sup>  | 100 kHz <sup>f</sup><br>(Simultaneous Across all Channels) | 100 kHz <sup>f</sup><br>(Independently Controlled Channels) |
| External Control Interface(s)                          | Analog (BNC)  | USB 2.0 and Analog (BNC)  | USB 2.0 and Analog (BNC)                                   | USB 2.0 and Analog (8-Pin)                                  |
| Main Driver Features                                   | Very Compact Footprint<br>60 mm x 73 mm x 104 mm<br>(W x H x D) | Touchscreen Interface with Internal and External Options for Pulsed and Modulated LED Operation | 4 Channels <sup>b</sup>                                    | 4 Channels <sup>b</sup>                                     |
| EEPROM Compatible: Reads Out LED Data for LED Settings | -   | ✓   | ✓  | ✓   |
| LCD Display  | -   | ✓   | ✓  | ✓   |

- a. Automatically limits to LED's max current via EEPROM readout.
- b. The DC4100 and DC4104 can power and control up to four LEDs simultaneously when used with the DC4100-HUB. The LEDs on this page all require the DC4100-HUB when used with the DC4100 or DC4104.
- c. These LED drivers have a maximum forward voltage rating of 5 V and can provide a maximum current of 1000 mA. As a result, they cannot be used to drive LEDs which have forward voltage ratings greater than 5 V. LEDs with maximum current ratings higher than 1.0 A can be driven using this driver, but will not reach full power.
- d. The mounted LEDs sold below are compatible with the LED2 Terminal.
- e. Small Signal Bandwidth: Modulation not exceeding 20% of full scale current. The driver accepts other waveforms, but the maximum frequency will be reduced.
- f. Several of these LEDs produce light by stimulating emission from phosphor, which limits their modulation frequencies. The M565L3, M595L3, MPRP1L4, MWVHL4, MNVHL4, and MCVHL5 LEDs may not turn off completely when modulated above 10 kHz at duty cycles below 50%. The MBB1L3 LED may not turn off completely when modulated at frequencies above 1 kHz with a duty cycle of 50%. When the MBB1L3 is modulated at frequencies above 1 kHz, the duty cycle may be reduced; for example, 10 kHz modulation is attainable with a duty cycle of 5%.

[Hide Collimation](#)

## COLLIMATION

### Collimating the LED

Thorlabs' extensive catalog of mechanical and optical components provides a variety of configurations that can be used to collimate our mounted LEDs. Some of the applications of the collimated LEDs include custom imaging systems, microscope illuminators, or projectors. Our microscope collimation adapters, available below, feature microscope-compatible outputs and Ø2" aspheric condenser lenses. Adjustable collimation adapters, also available below, have external SM1 threading (1.035"-40) and internal SM2 threading (2.035"-40) for integration with standard Thorlabs components. If your setup requires a collimation package with the smallest possible profile, the LEDs can also be integrated with Ø1" collimating optics and SM1-threaded lens tubes. When exchanging the lens in your collimation adapter, please be careful to follow proper optics handling procedures (Optic Handling Tutorial).

#### Adjustable Collimation Adapter

Thorlabs' adjustable collimation adapters accept an Ø2" (Ø50 mm) collimation optic. Adapter Item #'s with a -A or -B suffix include an aspheric condenser lens coated for 350 - 700 nm or 650 - 1050 nm, respectively. These adapters are also offered without a pre-installed optic so that user-supplied components can be integrated with the LEDs. Several suggestions are presented in the table to the right.

Installing a new lens in the adjustable collimation adapter is a simple procedure:

1. Turn the adjustment knob to move the optic mounting carriage to the output end of the housing.

#### Suggested Items for Adjustable Collimation Adapters

| Item #   | Qty. | Description   |
|--|------|---|
| SPW604 <sup>a</sup>  | 1    | Spanner Wrench for SM2-Threaded Retaining Rings           |
| ACL50832U <sup>b</sup> , ACL50832U-A <sup>b</sup> ,<br>or ACL50832U-B <sup>b</sup> | 1    | Ø2" (Ø50.8 mm) Aspheric Condenser Lens (without Diffuser) |

- a. These adapters include a retaining ring that is thicker than our standard retaining ring so that the SPW604 can be used without scratching the highly curved surface of an aspheric condenser lens.



Click to Enlarge  
The SM2F Installed on a M365LP1 Mounted LED with ACL50832U-A Condenser Lens

2. Use the SPW604 spanner wrench to remove the retaining ring from the housing.
  3. Place a Ø2" (Ø50 mm) optic of your choice into the mounting carriage with the curved surface facing the output. For customers concerned with the homogeneity of the beam, the AR-coated aspheric condenser lens with diffuser is a good option.
  4. Use the SPW604 spanner wrench to screw the retaining ring into the mounting carriage, securing the optic in place.
  5. Screw the externally SM1-threaded end of the collimation adapter onto an LED of your choice as shown in the picture to the left.
- b. -A and -B refer to the type of AR coating on the lens. Thorlabs' LEDs with a nominal wavelength between 365 nm and 660 nm would require the -A coating, while the LEDs with a nominal wavelength between 730 nm and 1050 nm would require the -B Coating. IR LEDs that emit past 1050 nm can be collimated using an uncoated condenser lens, such as the ACL50832U. Deep UV LEDs with a wavelength ≤340 nm require a lens fabricated from UV Fused Silica, since many standard varieties of glass do not transmit below 350 nm.

### SM1-Threaded Collimation Assembly

For cases where a smaller profile than the adjustable collimation adapter is required, a simple LED collimation assembly can be built from the components listed in the table to the lower right.

1. First, install the optic in the adjustable lens tube, which allows one to control the working distance of the lens while collimating the LED. The SM1-threaded (1.035"-40) SM1V05 comes with a locking nut and a retaining ring. For customers concerned with the homogeneity of the beam, the AR-coated aspheric condenser lens with diffuser (ACL2520U-DG6-A or ACL2520U-DG6-B) is a good option. By the end of this step, the lens will rest on top of one retaining ring (SM1RR) and be secured in place by another retaining ring placed on top of it.
  - a. Use the spanner wrench (SPW801) to turn the included retaining ring in the adjustable length lens tube so that it is closer to the inside lip of the tube.
  - b. Carefully place the lens inside the adjustable length lens tube with the curved side facing away from the male-threaded end of the tube.
  - c. Secure the lens in place with another retaining ring (SM1RR) using the spanner wrench. Note: Do not use the SPW602 spanner wrench for this step. The thin SM1RR retaining ring does not provide sufficient clearance to tighten it with the SPW602 without scratching the steeply curved surface of an aspheric condenser lens.
2. Thread the male end of the SM1L03 lens tube into the female end of the LED and gently tighten it.
3. Partially thread the male end of the SM1V05 adjustable length lens tube assembly into the female end of the SM1L03-LED assembly.

| Suggested Items for SM1-Threaded Collimation Assembly  |      |  |
|--|------|--|
| Item #   | Qty. | Description  |
| SM1RR  | 2    | Ø1" Retaining Ring<br>(One Each Included with SM1V05 & SM1L03) |
| SPW801   | 1    | Adjustable Spanner Wrench <sup>a</sup>                         |
| ACL2520U-A <sup>b</sup> , ACL2520U-B <sup>b</sup> ,<br>ACL2520U-DG6-A <sup>b</sup> , ACL2520U-DG6-B <sup>b</sup> ,<br>ACL2520U <sup>b</sup> , or ACL2520U-DG6 <sup>b</sup> | 1    | Aspheric Condenser Lens<br>(with or without Diffuser)          |
| SM1V05 <sup>c</sup>  | 1    | Ø1" Rotating Adjustable Length<br>Lens Tube, 1/2" Long         |
| SM1L03   | 1    | Ø1" Lens Tube, 0.30" Long                                      |

- a. While these components are SM1 threaded, we recommend our adjustable spanner wrench due to the steep curvature of the aspheric condenser lens.
- b. -A and -B refer to the type of AR coating on the lens. Thorlabs' LEDs with a nominal wavelength between 365 nm and 660 nm would require the -A coating, while the LEDs with a nominal wavelength between 730 nm and 1050 nm would require the -B Coating. IR LEDs that emit past 1050 nm can be collimated using an uncoated condenser lens, such as the ACL2520U. Deep UV LEDs with a wavelength ≤340 nm require a lens fabricated from UV Fused Silica, since many standard varieties of glass do not transmit below 350 nm. The SM1V10 Adjustable Lens Tube can also be used for this application, however, the translation range of the optic cell will be reduced from 7.6 mm (thread depth of the SM1L03) to 6 mm (thread depth of the LED). If used, the SM1L03 would no longer be needed in the assembly.



Click to Enlarge  
Setup for Adjustable Length Lens Tube and Lens



Click to Enlarge  
Completed Assembly



Click to Enlarge  
Setup for Lens Tubes and LED Assembly

### Obtaining a Well-Collimated Beam

After installing the chosen mounting adapter on a mounted LED, the distance of the lens from the LED should be adjusted by following the steps below. A well-collimated beam has minimal divergence and will not converge at any point in the beam path. Be advised that due to the nature of the output from the LED (high emitter surface area), the beam cannot be perfectly collimated. Please refer to the table below for divergence data.

1. Power on the LED and check to see if it is properly collimated. It is easiest to check that the beam is collimated by noting the changes in the beam diameter over a range of about 1" to 2 feet away; change the distance of the lens from the LED and check again. Do this until the least divergent, non-converging, homogenous beam is obtained. The beam should be somewhat circular in diameter, may have a slightly polygonal shape, and should not be a clear image of the LED itself.
2. If you see an image of the LED, this means that the lens is not close enough to the LED. Move the lens closer to the LED until the image blurs and becomes homogenous – this is the point of collimation. Note: If the lens needs to be closer to the LED when using the SM1V05 assembly, use only one retaining ring to secure the lens in the SM1V05 so that the lens will rest on the inside lip of the SM1V05 adjustable length lens tube.



Click to Enlarge  
Image of the LED



Click to Enlarge  
Uncollimated Beam



Click to Enlarge  
Collimated Beam

3. Once the proper collimation position of the lens has been found, lock the position of the lens in place. For the SM1V05 assembly described above, loosen it from the SM1L03 lens tube by about ¼ to ½ turn, rotate the external locking nut until it is flush with the edge of the SM1L03 lens tube, and gently tighten both the assembly and the locking nut by ¼ to ½ turn (there should be slight resistance; do not over tighten). This will lock the collimation position in place.

For the adjustable collimation adapters, simply tighten the locking screw using a 2 mm (5/64") hex key.

The table below provides examples of how the half viewing angle changes for select LEDs with the addition of a Ø1" aspheric condenser lens.

| Item # | Color | Nominal Wavelength <sup>a</sup> | Optimum Lens to Emitter Distance <sup>b</sup> | Half Viewing Angle <sup>c</sup> |                              |                                 |
|--------|-------|---------------------------------|---|---------------------------------|------------------------------|---------------------------------|
|        |       |                                 |   | +1 mm Out of Focus <sup>d</sup> | at Optimum Focusing Distance | -1 mm Out of Focus <sup>d</sup> |
|        |       |                                 |   |                                 |                              |                                 |

| Item # | Color      | Nominal Wavelength <sup>a</sup> | Optimum Lens to Emitter Distance <sup>b</sup> | Half Viewing Angle <sup>c</sup> |                              |                                 |
|--------|------------|---------------------------------|---|---------------------------------|------------------------------|---------------------------------|
|        |            |                                 |   | +1 mm Out of Focus <sup>d</sup> | at Optimum Focusing Distance | -1 mm Out of Focus <sup>d</sup> |
| M365L2 | UV         | 365 nm                          | 12.7 mm                                       | 2.79°                           | 1.32°                        | 3.11°                           |
| M385L2 | UV         | 385 nm                          | 12.8 mm                                       | 2.68°                           | 1.33°                        | 3.06°                           |
| M405L2 | UV         | 405 nm                          | 12.9 mm                                       | 2.94°                           | 1.63°                        | 3.06°                           |
| M505L3 | Cyan       | 505 nm                          | 13.2 mm                                       | 3.52°                           | 2.72°                        | 3.46°                           |
| M625L3 | Red        | 625 nm                          | 14.4 mm                                       | 3.46°                           | 2.27°                        | 3.13°                           |
| M850L3 | IR         | 850 nm                          | 13.8 mm                                       | 3.29°                           | 3.10°                        | 3.93°                           |
| M940L3 | IR         | 940 nm                          | 13.9 mm                                       | 3.42°                           | 2.46°                        | 3.70°                           |
| MCWHL5 | Cold White | 6500 K <sup>e</sup>             | 13.9 mm                                       | 3.41°                           | 2.47°                        | 3.14°                           |

- a. The specifications listed in the table above are nominal values specified by the LED manufacturer.
- b. Optimum distance between the respective mounted LED and the ACL2520U lens used to collimate the beam.
- c. Power loss to  $1/e^2$  (13.5%).
- d.  $\pm 1$  mm out of focus from Optimum Distance between the respective mounted LED and the ACL2520U lens used to collimate the beam.
- e. Correlated Color Temperature.

The divergence data was calculated using Zemax.

[Hide Multi-LED Source](#)

## MULTI-LED SOURCE

### Creating a Custom Multi-LED Source for Microscope Illumination

Thorlabs offers the items necessary to create your own custom multi-LED light source using two or three of the mounted LEDs offered below. As configured in the following example, the light source is intended to be used with the illumination port of a microscope. However, it may be integrated with other applications using Thorlabs' versatile SM1 Lens Tube and 30 mm Cage Systems. Thorlabs also offers integrated, user-configurable 4-Wavelength LED Sources.

#### Design & Construction

First, light will be collimated by lenses mounted in lens tubes. Dichroic mirrors mounted in kinematic cage cubes then combine the output from the multiple LEDs. The mounted LEDs may be driven by LEDD1B Compact T-Cube LED Drivers (power supplies are sold separately). The LEDD1B LED Drivers allow each LED's output to be independently modulated and can provide up to 1200 mA of current. Please take care not to drive the LED sources above their max current ratings.

When designing your custom source, select mounted LEDs from below along with dichroic mirror(s) that have cutoff wavelength(s) between the LED wavelengths. The appropriate dichroic mirror(s) will reflect light from side-mounted LEDs and transmit light along the optical axis. Please note that most of these dichroic mirrors are "longpass" filters, meaning they transmit the longer wavelengths and reflect the shorter wavelengths. To superimpose light from three or more LEDs, add each in series (as shown below), starting from the back with longer wavelength LEDs when using longpass filters. Shortpass filters may also be used if the longer wavelength is reflected and the shorter wavelength is transmitted. Sample combinations of compatible dichroic mirrors and LEDs are offered in the three tables below.

It is also necessary to select an aspheric condenser lens for each source with AR coatings appropriate for the source. Before assembling the light source, collimate the light from each mounted LED as detailed in the *Collimation* tab. For mounting the aspheric lenses in the SM1V05 Lens Tubes using the included SM1RR retaining rings, we recommend the SPW801 Adjustable Spanner Wrench. A properly collimated LED source should have a resultant beam that is approximately homogenous and not highly divergent at a distance of approximately 2 feet (60 cm). An example of a well-collimated beam is shown on the *Collimation* tab.

After each LED source is collimated, thread the SM1V05 Lens Tubes at the end of each collimated LED assembly into their respective C4W Cage Cube ports using SM1T2 Lens Tube Couplers. Install each dichroic filter in an FFM1 Dichroic Filter Holder, and mount each filter holder onto a B4C Kinematic Cage Cube Platform. Each platform is then installed in the C4W Cage Cubes by partially threading the included screws into the bottom of the cube, and then inserting and rotating the B4C platform into place. Align the platform to the desired position and then firmly tighten the screws. To connect multiple cage cubes and the microscope adapter, use the remaining SM1T2 lens tube couplers along with an SM1L05 0.5" Lens Tube between adjacent cage cubes. Finally, adjust the rotation, tip, and tilt of each B4C platform to align the reflected and transmitted beams so they overlap as closely as possible.

If desired, a multi-LED source may be constructed that employs more than three LEDs. The limiting factors for the number of LEDs that can be practically used are the collimation of the light and the dichroic mirror efficiency over the specified range. Heavier multi-LED sources may be supported with our  $\varnothing 1"$  or  $\varnothing 1.5"$  Posts.



Click to Enlarge  
Multi-LED Source Coupled to Microscope  
Illumination Port





Click to Enlarge  
Three-LED Source Using Components Mounted LEDs and Dichroic Mirrors  
Detailed in Example Configuration 1



Click to Enlarge  
Beam Profile of Source with 3  
Mounted LEDs



Click to Enlarge  
Two-LED source. This is  
the same as Example 1,  
but with the blue LED  
removed.

| Parts List |  |                         |                           |           |        |
|------------|--|-------------------------|---------------------------|-----------|--------|
| #          | Product Description                                  |                         | Item #                    | 2 LEDs    | 3 LEDs |
|            |  |                         |                           | Item Qty. |        |
| 1          | Microscope<br>Illumination<br>Port Adapter:          | Olympus IX or BX        | SM1A14                    | 1         | 1      |
|            |  | Leica DMI               | SM1A21                    |           |        |
|            |  | Zeiss Axioskop          | SM1A23 <sup>a</sup>       |           |        |
|            |  | Nikon Eclipse Ti        | SM1A26                    |           |        |
| 2          | Mounted LED <sup>b</sup>                             |                         | -                         | 2         | 3      |
| -          | T-Cube LED Driver, 1200 mA Max Drive Current         |                         | LEDD1B <sup>c</sup>       | 2         | 3      |
| -          | 15 V Power Supply Unit for T-Cube                    |                         | KPS101 <sup>c</sup>       | 2         | 3      |
| 3          | 4-Way Mounting 30 mm Cage Cube                       |                         | C4W                       | 1         | 2      |
| 4          | Kinematic Cage Cube Platform for C4W/C6W             |                         | B4C                       | 1         | 2      |
| 5          | 30 mm Cage-Compatible Dichroic Filter Mount          |                         | FFM1                      | 1         | 2      |
| 6          | Dichroic Filter(s) <sup>d</sup>                      |                         | -                         | 1         | 2      |
| 7          | Externally SM1-Threaded End Cap                      |                         | SM1CP2                    | 1         | 2      |
| 8          | SM1 (1.035"-40) Coupler, External Threads, 0.5" Long |                         | SM1T2                     | 3         | 5      |
| 9          | Ø1" SM1 Lens Tube, 1/2" Long External Threads        |                         | SM1V05                    | 2         | 3      |
| -          | Aspheric<br>Condenser Lens                           | AR-Coated 350 - 700 nm  | ACL2520U-A <sup>c,e</sup> | 2         | 3      |
|            |  | AR-Coated 650 - 1050 nm | ACL2520U-B <sup>c,e</sup> |           |        |
| 10         | SM1 Lens Tube, 0.3" Thread Depth                     |                         | SM1L03                    | 2         | 4      |
| -          | Blank Cover Plate with Rubber O-Ring for C4W/C6W     |                         | B1C <sup>c</sup>          | 1         | 2      |

- a. The SM1A23 Zeiss Axioskop Microscope Adapter is shown.
- b. Mounted LEDs are available below.
- c. Item not pictured.
- d. Please see the following tables for suggested compatible LED and dichroic filter combinations, or create your own by taking into account the transmission and reflection wavelength ranges of our Dichroic Filters.
- e. Lenses are mounted in the SM1V05 Lens Tube in front of each LED. For each lens, select an AR coating corresponding to the emission wavelength of the LED source.

| Example Configuration 1 |          | Example Configuration 2 |          | Example Configuration 3   |          |
|-------------------------|----------|-------------------------|----------|---------------------------|----------|
| Mounted LEDs            |          | Mounted LEDs            |          | Mounted LEDs              |          |
| #                       | Item #   | #                       | Item #   | #                         | Item #   |
| 2a                      | M625L3   | 2a                      | M625L3   | 2a                        | M1050L2  |
| 2b                      | M530L3   | 2b                      | M455L3   | 2b                        | MCWHL5   |
| 2c                      | M455L3   | 2c                      | M1050L2  | <b>Dichroic Filter(s)</b> |          |
| Dichroic Filter(s)      |          | Dichroic Filter(s)      |          |                           |          |
| #                       | Item #   | #                       | Item #   | #                         | Item #   |
| 6a                      | DMLP605R | 6a                      | DMLP505R | 6a                        | DMLP900R |
| 6b                      | DMLP505R | 6b                      | DMSR805R |                           |          |

[Hide Ray Data](#)

## RAY DATA

Ray data for Zemax is available for some of the bare LEDs incorporated into these high-powered light sources. This data is provided in a zipped folder that can be downloaded by clicking on the red document icons (📄) next to the part numbers in the pricing tables below. Every zipped folder contains an information file and one or more ray files for use with Zemax:

- **Information File:** This document contains a summary of the types of data files included in the zipped folder and some basic information about their use. It includes a table listing each document type and the corresponding filenames.
- **Ray Files:** These are binary files containing ray data for use with Zemax.

For the LEDs marked with an superscript "a" in the table to the right, the following additional pieces of information are also included in the zipped folder:

| Item #                | Information File          | Available Ray Files                            | File Size | Click to Download |
|-----------------------|---------------------------|--|-----------|-------------------|
| M365L2                | M365_Info.pdf             | 100,000 Rays and 1 Million Rays                | 27.4 MB   |                   |
| M385L2                | M385_Info.pdf             | 1 Million Rays and 5 Million Rays              | 148 MB    |                   |
| Item #                | Information File          | Available Ray Files                            | File Size | Click to Download |
| M450LP1 <sup>a</sup>  | LD_CQAR_20150731_info.pdf | 100,000 Rays, 500,000 Rays, and 5 Million Rays | 123 MB    |                   |
| M455L3 <sup>a,b</sup> | LD_CQ7P_290311_info.pdf   | 100,000 Rays, 500,000 Rays, and 5 Million Rays | 125 MB    |                   |
| M505L3 <sup>a</sup>   | LV_CK7P_191212_info.pdf   | 100,000 Rays, 500,000 Rays, and 5 Million Rays | 123 MB    |                   |
| M850L3 <sup>a</sup>   | SFH4715S_100413_info.pdf  | 100,000 Rays, 500,000 Rays, and 5 Million Rays | 140 MB    |                   |
| M940L3 <sup>a</sup>   | SFH_4725S_110413_info.pdf | 100,000 Rays, 500,000 Rays, and 5 Million Rays | 140 MB    |                   |

- a. A radiometric color spectrum, bare LED CAD file, and sample Zemax file are also available for these LEDs.
- b. The ray data files for the M455L3 can be used for the M470L3 as well by manually resetting the source wavelength in Zemax.
- c. Wavelength-specific data and files, such as the radiometric color spectrum and sample Zemax files, only apply to the M455L3. The ray data files for the M617L3 can be used for the M590L3 and M625L3 as well by manually resetting the source wavelength in Zemax. Wavelength-specific data and files, such as the radiometric color spectrum and sample Zemax files, only apply to the M617L3.

- **Radiometric Color Spectrum:** This .spc file is also intended for use with Zemax.
- **CAD Files:** A file indicating the geometry of the bare LED. For the dimensions of the high-power mounted LEDs that include the package, please see the support drawings provided by Thorlabs.
- **Sample Zemax File:** A sample file containing the recommended settings and placement of the ray files and bare LED CAD model when used with Zemax.

The table to the right summarizes the ray files available for each LED and any other supporting documentation provided.

[Hide Use with Cerna](#)

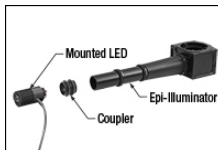
## USE WITH CERNA

### Using Mounted LEDs in Cerna® Microscope Systems

Mounted LEDs, which can have either narrowband or broadband spectra, are useful for a range of applications within Thorlabs' Cerna microscopy platform:

- Fluorescence Microscopy
- Brightfield Microscopy
- Near Infrared/Infrared (NIR/IR) Microscopy

If you are interested in using a mounted LED with a Cerna modular microscopy system, the mounted LED can be attached by way of the single-cube epi-illuminator module (Item # WFA2001), which contains AR-coated optics optimized for the 350 - 700 nm wavelength range. The mounted LED and epi-illuminator module are connected together by an externally threaded coupler (Item # SM1T10, provided with the WFA2001), which includes two knurled locking rings (Item # SM1NT, also provided with the WFA2001) that are tightened by hand. The mounted LED is then powered by a driver, sold separately. Please see the *LED Drivers* tab to identify the appropriate driver for your mounted LED. If you wish to connect multiple mounted LEDs to the epi-illuminator module, contact Technical Support.



Click to

Enlarge

An exploded view of the mounted LED and its connection with the WFA2001 epi-illuminator module.



Click to

Enlarge

Attaching the mounted LED is possible before or after connecting the epi-illuminator module to the microscope.



Click to

Enlarge

The mounted LED and epi-illuminator module attached to the Cerna microscope.

Please see the *Overview* tab to choose the appropriate color spectrum of mounted LED for your imaging needs. Again, note that the epi-illuminator module is optimized for 350 - 700 nm wavelength illumination sources.

Certain mounted LEDs are also compatible with our illumination kits for trans-illumination. Please contact Technical Support if you wish to use an LED not currently offered as a component of these kits, as the collimating optics are optimized for certain beam characteristics.

[Hide LED Selection Guide](#)

## LED SELECTION GUIDE

### Light Emitting Diode (LED) Selection Guide

| (Click Representative Photo to Enlarge; Not to Scale) |                    |                      |                  |                       |  |                                 |                                |  |            |
|---|--------------------|----------------------|------------------|-----------------------|--|---------------------------------|--------------------------------|--|------------|
| Wavelength  | Unmounted LEDs     | LEDs in SMT Packages | PCB-Mounted LEDs | Heatsink-Mounted LEDs | Collimated LEDs for Microscopy (Item # Prefix <sup>a</sup> ) | Fiber-Coupled LEDs <sup>b</sup> | High-Power LEDs for Microscopy | 4-Wavelength LED Source Options <sup>c</sup> | LED Arrays |
| <b>Single Color LEDs</b>                              |                    |                      |                  |                       |  |                                 |                                |  |            |
| 245 nm  | LED245W (0.07 mW)  | -                    | -                | -                     | -  | -                               | -                              | -  | -          |
| 250 nm  | LED250J (1 mW Min) | -                    | -                | -                     | -  | -                               | -                              | -  | -          |

### Components for Cerna® Compatibility

#### Epi-Illumination

WFA2001 Epi-Illuminator Module

#### Trans-Illumination

Illumination Kits

**Light Emitting Diode (LED) Selection Guide**

|                          |  |                             |                         |                              |   |                                       |                                       |  |                    |
|--------------------------|--|-----------------------------|-------------------------|------------------------------|---|---------------------------------------|---------------------------------------|--|--------------------|
| 255 nm                   | LED255J<br>(1 mW Min)                        | -                           | -                       | -                            | -   | -                                     | -                                     | -  | -                  |
| 260 nm                   | LED260W<br>(0.3 mW)<br>LED260J<br>(1 mW Min) | -                           | -                       | -                            | -   | -                                     | -                                     | -  | -                  |
| 265 nm                   | LED265W<br>(0.3 mW)                          | -                           | M265D2<br>(10 mW Min)   | M265L3<br>(10 mW Min)        | -   | -                                     | -                                     | -  | -                  |
| 275 nm                   | LED275W<br>(0.8 mW)<br>LED275J<br>(1 mW Min) | -                           | -                       | -                            | -   | -                                     | -                                     | -  | -                  |
| 280 nm                   | LED280J<br>(1 mW Min)                        | -                           | -                       | -                            | -   | -                                     | -                                     | -  | -                  |
| 285 nm                   | LED285W<br>(0.8 mW)                          | -                           | M285D2<br>(45 mW Min)   | M285L4<br>(25 mW Min)        | -   | M285F3<br>(368 μW)                    | -                                     | -  | -                  |
| 290 nm                   | LED290W<br>(0.8 mW)                          | -                           | -                       | -                            | -   | -                                     | -                                     | -  | -                  |
| 300 nm                   | LED300W<br>(0.5 mW)                          | -                           | M300D3<br>(26 mW Min)   | M300L4<br>(26 mW Min)        | -   | M300F2<br>(320 μW)                    | -                                     | -  | -                  |
| 315 nm                   | LED315W<br>(0.6 mW)                          | -                           | -                       | -                            | -   | -                                     | -                                     | -  | -                  |
| 340 nm                   | LED341W<br>(0.33 mW)                         | -                           | M340D3<br>(53 mW Min)   | M340L4<br>(53 mW Min)        | -   | M340F3<br>(1.06 mW)                   | -                                     | -  | -                  |
| 365 nm                   | -  | -                           | M365D1<br>(190 mW Min)  | M365L2<br>(190 mW Min)       | M365L2<br>(60 mW) <sup>d</sup>                                    | M365F1<br>(4.1 mW)                    | SOLIS-365C<br>(3.0 W) <sup>e</sup>    | Available<br>(85 mW)                               | LIU365A<br>(31 mW) |
|                          |  |                             | M365D2<br>(1150 mW Min) | M365LP1<br>(11-50 mW Min)    | M365LP1<br>(350 mW) <sup>d</sup>                                  | M365FP1<br>(15.5 mW)                  |                                       |  |                    |
| 375 nm                   | LED375L<br>(1 mW)                            | -                           | M375D4<br>(1270 mW Min) | M375L4<br>(1270 mW Min)      | -   | M375F2<br>(4.23 mW)                   | -                                     | -  | -                  |
|                          | LED370E<br>(2.5 mW)                          | -                           |                         |                              |   |                                       |                                       |  |                    |
| 385 nm                   | LED385L<br>(5 mW)                            | -                           | M385D1<br>(270 mW Min)  | M385L2<br>(270 mW Min)       | M385L2<br>(90 mW) <sup>d</sup>                                    | M385F1<br>(10.7 mW)                   | SOLIS-385C<br>(4.0 W) <sup>e</sup>    | Available<br>(95 mW)                               | -                  |
|                          |  |                             | M385D2<br>(1650 mW Min) | M385LP1<br>(1650 mW Min)     | M385LP1<br>(520 mW) <sup>d</sup>                                  | M385FP1<br>(23.2 mW)                  |                                       |  |                    |
| 395 nm                   | LED395L<br>(6 mW)                            | -                           | M395D3<br>(400 mW Min)  | M395L4<br>(400 mW Min)       | -   | M395F3<br>(6.8 mW)                    | -                                     | -  | -                  |
| <b>Wavelength</b>        | <b>Unmounted LEDs</b>                        | <b>LEDs in SMT Packages</b> | <b>PCB-Mounted LEDs</b> | <b>Heatsink-Mounted LEDs</b> | <b>Collimated LEDs for Microscopy (Item # Prefix<sup>a</sup>)</b> | <b>Fiber-Coupled LEDs<sup>b</sup></b> | <b>High-Power LEDs for Microscopy</b> | <b>4-Wavelength LED Source Options<sup>c</sup></b> | <b>LED Arrays</b>  |
| <b>Single Color LEDs</b> |  |                             |                         |                              |   |                                       |                                       |  |                    |
| 405 nm                   | LED405L<br>(6 mW)                            | -                           | -                       | M405L3<br>(870 mW Min)       | M405L3<br>(440 mW) <sup>d</sup>                                   | M405F1<br>(3.7 mW)                    | SOLIS-405C<br>(3.9 W) <sup>e</sup>    | Available<br>(95 mW)                               | -                  |
|                          | LED405E<br>(10 mW)                           |                             |                         | M405D2<br>(1500 mW Min)      | M405LP1<br>(1500 mW Min)  | M405LP1<br>(450 mW) <sup>d</sup>      |                                       |  |                    |
| 420 nm                   | -  | -                           | M420D2<br>(750 mW Min)  | M420L3<br>(750 mW Min)       | -   | M420F2<br>(16.2 mW)                   | -                                     | Available<br>(290 mW)                              | -                  |
| 430 nm                   | LED430L<br>(8 mW)                            | -                           | M430D2<br>(490 mW Min)  | M430L4<br>(490 mW Min)       | -   | -                                     | -                                     | -  | -                  |
| 445 nm                   | -  | -                           | -                       | -                            | -   | -                                     | SOLIS-445C<br>(5.4 W) <sup>e</sup>    | -  | -                  |
| 450 nm                   | LED450L<br>(7 mW)                            | LEDS450<br>(250 mW)         | M450D3<br>(1850 mW Min) | M450LP1<br>(1850 mW Min)     | -   | -                                     | -                                     | -  | -                  |



**Light Emitting Diode (LED) Selection Guide**

|                          |                       |                             |                         |                              |   |                                       |                                       |  |                     |
|--------------------------|-----------------------|-----------------------------|-------------------------|------------------------------|---|---------------------------------------|---------------------------------------|--|---------------------|
| 660 nm                   | LED660L<br>(13 mW)    | -                           | M660D2<br>(940 mW Min)  | M660L4<br>(940 mW Min)       | M660L4<br>(400 mW) <sup>d</sup>                                   | M660F1<br>(14.5 mW)                   | -                                     | Available<br>(210 mW)                              | -                   |
| 670 nm                   | LED670L<br>(12 mW)    | -                           | -                       | -                            | -   | -                                     | -                                     | -  | -                   |
| 680 nm                   | LED680L<br>(8 mW)     | -                           | M680D2<br>(180 mW Min)  | M680L4<br>(180 mW Min)       | -   | M680F3<br>(2.7 mW)                    | -                                     | -  | -                   |
| 700 nm                   |                       | -                           | M700D2<br>(80 mW Min)   | M700L4<br>(80 mW Min)        |   | M700F3<br>(1.7 mW)                    |                                       |  |                     |
| 730 nm                   | -                     | -                           | M730D2<br>(515 mW Min)  | M730L4<br>(515 mW Min)       | M730L4<br>(165 mW) <sup>d</sup>                                   | -                                     | -                                     | -  | -                   |
| 740 nm                   | -                     | -                           | -                       | -                            | -   | M740F2<br>(6.0 mW)                    | -                                     | -  | -                   |
| 780 nm                   | LED780E<br>(18 mW)    | -                           | M780D2<br>(200 mW Min)  | M780L3<br>(200 mW Min)       | M780L3<br>(130 mW) <sup>d</sup>                                   | M780F2<br>(7.5 mW)                    | -                                     | -  | LIU780A<br>(315 mW) |
|                          |                       |                             | M780D3<br>(800 mW Min)  | M850LP1<br>(800 mW Min)      |   |                                       |                                       |  |                     |
| 810 nm                   | -                     | -                           | M810D2<br>(325 mW Min)  | M810L3<br>(325 mW Min)       | M810L3<br>(210 mW) <sup>d</sup>                                   | M810F2<br>(6.5 mW)                    | -                                     | -  | -                   |
| 850 nm                   | LED851W<br>(8 mW)     | -                           | M850D2<br>(900 mW Min)  | M850L3<br>(900 mW Min)       | M850L3<br>(330 mW) <sup>d</sup>                                   | M850F2<br>(13.4 mW)                   | SOLIS-850C<br>(2.7 W) <sup>e</sup>    | -  | LIU850A<br>(322 mW) |
|                          | LED851L<br>(13 mW)    |                             | M850D3<br>(1400 mW)     | M850LP1<br>(1400 mW)         |   |                                       |                                       |  |                     |
| 870 nm                   | LED870E<br>(22 mW)    | -                           | -                       | -                            | -   | -                                     | -                                     | -  | -                   |
| 880 nm                   | -                     | -                           | M880D2<br>(300 mW Min)  | M880L3<br>(300 mW Min)       | -   | M880F2<br>(3.4 mW)                    | -                                     | -  | -                   |
| 910 nm                   | LED910E<br>(12 mW)    | -                           | -                       | -                            | -   | -                                     | -                                     | -  | -                   |
| 940 nm                   | LED940E<br>(18 mW)    | -                           | M940D2<br>(800 mW Min)  | M940L3<br>(800 mW Min)       | M940L3<br>(320 mW) <sup>d</sup>                                   | M940F1<br>(6.5 mW)                    | -                                     | -  | -                   |
| 970 nm                   | -                     | -                           | M970D3<br>(600 mW Min)  | M970L4<br>(600 mW Min)       | -   | M970F3<br>(8.1 mW)                    | -                                     | -  | -                   |
| <b>Wavelength</b>        | <b>Unmounted LEDs</b> | <b>LEDs in SMT Packages</b> | <b>PCB-Mounted LEDs</b> | <b>Heatsink-Mounted LEDs</b> | <b>Collimated LEDs for Microscopy (Item # Prefix<sup>a</sup>)</b> | <b>Fiber-Coupled LEDs<sup>b</sup></b> | <b>High-Power LEDs for Microscopy</b> | <b>4-Wavelength LED Source Options<sup>c</sup></b> | <b>LED Arrays</b>   |
| <b>Single Color LEDs</b> |                       |                             |                         |                              |   |                                       |                                       |  |                     |
| 1050 nm                  | LED1050E<br>(2.5 mW)  | -                           | M1050D1<br>(50 mW Min)  | M1050L2<br>(50 mW Min)       | -   | M1050F1<br>(1.4 mW)                   | -                                     | -  | -                   |
|                          | LED1050L<br>(4 mW)    |                             |                         |                              |   |                                       |                                       |  |                     |
| 1070 nm                  | LED1070L<br>(4 mW)    | -                           | -                       | -                            | -   | -                                     | -                                     | -  | -                   |
|                          | LED1070E<br>(7.5 mW)  |                             |                         |                              |   |                                       |                                       |  |                     |
| 1085 nm                  | LED1085L<br>(5 mW)    | -                           | -                       | -                            | -   | -                                     | -                                     | -  | -                   |
| 1200 nm                  | LED1200E<br>(2.5 mW)  | -                           | M1200D2<br>(30 mW Min)  | M1200L3<br>(30 mW Min)       | -   | -                                     | -                                     | -  | -                   |
|                          | LED1200L<br>(5 mW)    |                             |                         |                              |   |                                       |                                       |  |                     |
| 1300 nm                  | LED1300E<br>(2 mW)    | -                           | M1300D2<br>(25 mW Min)  | M1300L3<br>(25 mW Min)       | -   | -                                     | -                                     | -  | -                   |
|                          | LED1300L<br>(3.5 mW)  |                             |                         |                              |   |                                       |                                       |  |                     |



### Light Emitting Diode (LED) Selection Guide

|                               |                     |                     |                         |                          |                                 |                     |                                  |   |                     |
|-------------------------------|---------------------|---------------------|-------------------------|--------------------------|---------------------------------|---------------------|----------------------------------|---|---------------------|
| 440 - 660 nm<br>(White)       | LEDWE-15<br>(13 mW) | -                   | -                       | -                        | -                               | -                   | -                                | - | -                   |
| 470 - 850 nm<br>(Broadband)   | -                   | -                   | MBB1D1<br>(70 mW Min)   | MBB1L3<br>(70 mW Min)    | -                               | MBB1F1<br>(1.2 mW)  | -                                | - | -                   |
| 6500 K<br>(Cold White)        | -                   | -                   | MCWHD2<br>(800 mW Min)  | MCWHL5<br>(800 mW Min)   | MCWHL5<br>(320 mW) <sup>d</sup> | -                   | SOLIS-1C<br>(3.3 W) <sup>e</sup> | - | -                   |
|                               |                     |                     | MCWHD3<br>(2350 mW Min) | MCWHLP1<br>(2350 mW Min) |                                 |                     |                                  |   |                     |
| 6200 K<br>(Cold White)        | -                   | -                   | -                       | -                        | -                               | MCWHF2<br>(21.5 mW) | -                                | - | -                   |
| 5000 K<br>(Cold White)        | -                   | LEDSW50<br>(110 mW) | -                       | -                        | -                               | -                   | -                                | - | -                   |
| 4600 - 9000 K<br>(Cold White) | -                   | -                   | -                       | -                        | -                               | -                   | -                                | - | LIUCWHA<br>(250 mW) |
| 4000 K<br>(Warm White)        | -                   | LEDSW40<br>(115 mW) | -                       | -                        | -                               | MWWHF2<br>(16.3 mW) | -                                | - | -                   |
| 3000 K<br>(Warm White)        | -                   | LEDSW30<br>(100 mW) | -                       | MWWHL4<br>(570 mW Min)   | -                               | -                   | SOLIS-2C<br>(3.2 W) <sup>e</sup> | - | -                   |
|                               |                     |                     | MWWHD3<br>(2000 mW Min) | MWWHLP1<br>(2000 mW Min) |                                 |                     |                                  |   |                     |
| 5700 K<br>(Day Light White)   | -                   | -                   | -                       | -                        | -                               | -                   | SOLIS-3C<br>(3.5 W)              | - | -                   |

- a. These Collimated LEDs are compatible with the standard and epi-illumination ports on the following microscopes: Olympus BX/IX (Item # Suffix: -C1),  
b. Leica DMI (Item # Suffix: -C2), Zeiss Axioskop (Item # Suffix: -C4), and Nikon Eclipse (Bayonet Mount, Item # Suffix: -C5).  
c. Typical power when used with MM Fiber with Ø400 µm core, 0.39 NA.  
d. Our LED4D 4-Wavelength LED Source is available with select combinations of the LEDs at these wavelengths.  
e. Typical power for LEDs with the Leica DMI collimation package (Item # Suffix: -C2).  
f. Minimum power for the collimated output of these LEDs. The collimation lens is installed with each LED.  
g. Percentage of LED intensity that emits in the blue portion of the spectrum, from 400 nm to 525 nm.

#### Hide Mounted LEDs with EEPROM and Ø57.0 mm Heat Sink

#### Mounted LEDs with EEPROM and Ø57.0 mm Heat Sink

Integrated EEPROM for Automated LED Settings  
Lifetime >10 000 Hours (Except M450LP1; See *Specs* and *Stability* Tabs for Details)  
Integrated Large Heat Sink for Optimized Thermal Management  
Output can be Modulated with Suitable Controller (See the *LED Drivers* Tab)  
Compatible with 30 mm Cage System and SM1 Lens Tubes  
Cable Length: 2 m

Each of these LEDs is mounted to the end of a large heat sink, capable of dissipating the large amount of heat emitted from the diode, that is covered by a Ø57.0 mm vented plastic housing. The heat sink is equipped with internal SM1 (1.035"-40) threads and four 4-40 tapped holes for compatibility with Thorlabs' SM1 lens tubes and 30 mm cage systems, respectively.

Please note that these mounted LEDs with output wavelengths of 365 nm, 385 nm, or 405 nm radiate intense UV light during operation. Precautions must be taken to prevent looking directly at the UV light, and UV light protective glasses must be worn to avoid eye damage. Exposure of the skin and other body parts to the UV light should be avoided. These LEDs are not intended for use in household illumination applications.



Click to Enlarge  
[APPLIST]  
[APPLIST]  
M385LP1 LED Inserted into CP02 Cage Plate and Mounted Using Ø6 mm Cage Rods



Click to Enlarge  
[APPLIST]  
[APPLIST]  
M385LP1 LED with SM1L03 Lens Tube Post Mounted Using an SM1RC/MSlip Ring

| Part Number | Description                                | Price    | Availability |
|-------------|--|----------|--------------|
| M365LP1     | 365 nm, 1150 mW (Min) Mounted LED, 1400 mA | \$434.52 | Lead Time    |
| M385LP1     | 385 nm, 1650 mW (Min) Mounted LED, 1400 mA | \$434.52 | Today        |
| M405LP1     | 405 nm, 1500 mW (Min) Mounted LED, 1400 mA | \$434.52 | Today        |
| M450LP1     | 450 nm, 1850 mW (Min) Mounted LED, 2000 mA | \$307.02 | Today        |
| M780LP1     | 780 nm, 800 mW (Min) Mounted LED, 800 mA   | \$333.54 | Today        |
| M850LP1     | 850 nm, 1400 mW (Min) Mounted LED, 1500 mA | \$348.84 | Today        |
| MWWHLP1     | 3000 K, 2000 mW (Min) Mounted LED, 700 mA  | \$312.12 | Today        |
| MCWHLP1     | 6500 K, 2350 mW (Min) Mounted LED, 700 mA  | \$312.12 | Today        |

#### Hide Mounted LEDs with EEPROM and Ø30.5 mm Heat Sink

#### Mounted LEDs with EEPROM and Ø30.5 mm Heat Sink

Integrated EEPROM for Automated LED Settings  
Long Lifetimes >10 000 Hours (Except M265L3 and M340L4; See *Specs* and *Stability* Tabs for Details)  
Stable Output Intensity by Optimized Thermal Management  
Output can be Modulated with Suitable Controller (See the *LED Drivers* Tab)  
Compatible with Thorlabs' SM1 Lens Tubes

Fits Inside a 30 mm Cage System  
Cable Length: 2 m

These LEDs with output powers less than 1300 mW are mounted to the end of a Ø30.5 mm heat sink for heat dissipation and thermal stability. The heat sink is equipped with internal SM1 (1.035"-40) threads for compatibility with Thorlabs' SM1 lens tubes.

Please note that our LEDs with wavelengths from 265 nm to 420 nm radiate intense UV light during operation. Precautions must be taken to prevent looking directly at the UV light, and UV light protective glasses must be worn to avoid eye damage. Exposure of the skin and other body parts to the UV light should be avoided. Mounted LEDs are not intended for use in household illumination applications.



Click to Enlarge  
MWWHL4 LED  
Mounted in  
an SM1RC Slip Ring

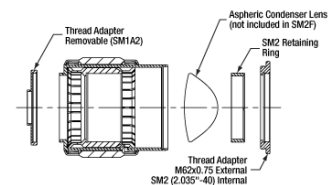
| Part Number | Description  | Price      | Availability |
|-------------|--|------------|--------------|
| M265L3      | 265 nm, 10 mW (Min) Mounted LED, 350 mA                    | \$1,283.16 | Today        |
| M285L4      | 285 nm, 45 mW (Min) Mounted LED, 500 mA                    | \$860.00   | Today        |
| M300L4      | 300 nm, 26 mW (Min) Mounted LED, 350 mA                    | \$469.20   | Today        |
| M340L4      | 340 nm, 53 mW (Min) Mounted LED, 700 mA                    | \$294.78   | Today        |
| M365L2      | 365 nm, 190 mW (Min) Mounted LED, 700 mA                   | \$488.58   | Today        |
| M375L4      | NEW! 375 nm, 1270 mW (Min) Mounted LED, 1400 mA            | \$170.00   | 3-5 Days     |
| M385L2      | 385 nm, 270 mW (Min) Mounted LED, 700 mA                   | \$488.58   | Today        |
| M395L4      | 395 nm, 400 mW (Min) Mounted LED, 500 mA                   | \$294.78   | Today        |
| M405L3      | 405 nm, 870 mW (Min) Mounted LED, 1000 mA                  | \$220.32   | Today        |
| M420L3      | 420 nm, 750 mW (Min) Mounted LED, 1000 mA                  | \$294.78   | Lead Time    |
| M430L4      | 430 nm, 490 mW (Min) Mounted LED, 500 mA                   | \$165.00   | Today        |
| M455L3      | 455 nm, 900 mW (Min) Mounted LED, 1000 mA                  | \$279.48   | Today        |
| M470L3      | 470 nm, 650 mW (Min) Mounted LED, 1000 mA                  | \$279.48   | Today        |
| M490L4      | 490 nm, 205 mW (Min) Mounted LED, 350 mA                   | \$194.82   | Today        |
| M505L3      | 505 nm, 400 mW (Min) Mounted LED, 1000 mA                  | \$279.48   | Today        |
| M530L3      | 530 nm, 350 mW (Min) Mounted LED, 1000 mA                  | \$279.48   | Today        |
| M565L3      | 565 nm, 880 mW (Min) Mounted LED, 1000 mA                  | \$220.32   | Today        |
| M590L3      | 590 nm, 160 mW (Min) Mounted LED, 1000 mA                  | \$200.94   | Today        |
| M595L3      | 595 nm, 445 mW (Min) Mounted LED, 700 mA                   | \$220.32   | Lead Time    |
| M617L3      | 617 nm, 600 mW (Min) Mounted LED, 1000 mA                  | \$200.94   | Today        |
| M625L3      | 625 nm, 700 mW (Min) Mounted LED, 1000 mA                  | \$200.94   | Today        |
| M660L4      | 660 nm, 940 mW (Min) Mounted LED, 1200 mA                  | \$220.32   | Today        |
| M680L4      | Customer Inspired!680 nm, 180 mW (Min) Mounted LED, 600 mA | \$197.88   | Today        |
| M700L4      | 700 nm, 80 mW (Min) Mounted LED, 500 mA                    | \$197.88   | Today        |
| M730L4      | 730 nm, 515 mW (Min) Mounted LED, 1000 mA                  | \$197.88   | Today        |
| M780L3      | 780 nm, 200 mW (Min) Mounted LED, 800 mA                   | \$220.32   | Today        |
| M810L3      | 810 nm, 325 mW (Min) Mounted LED, 500 mA                   | \$205.02   | Today        |
| M850L3      | 850 nm, 900 mW (Min) Mounted LED, 1000 mA                  | \$220.32   | Today        |
| M880L3      | 880 nm, 300 mW (Min) Mounted LED, 1000 mA                  | \$220.32   | Today        |
| M940L3      | 940 nm, 800 mW (Min) Mounted LED, 1000 mA                  | \$220.32   | Today        |
| M970L4      | 970 nm, 600 mW (Min) Mounted LED, 1000 mA                  | \$170.00   | Today        |
| M1050L2     | Customer Inspired!1050 nm, 50 mW (Min) Mounted LED, 700 mA | \$236.64   | 3-5 Days     |
| M1200L3     | Customer Inspired!1200 nm, 30 mW (Min) Mounted LED, 700 mA | \$293.76   | Today        |
| M1300L3     | Customer Inspired!1300 nm, 25 mW (Min) Mounted LED, 500 mA | \$293.76   | Today        |
| M1450L3     | 1450 nm, 31 mW (Min) Mounted LED, 700 mA                   | \$293.76   | Today        |
| M1550L3     | Customer Inspired!1550 nm, 31 mW (Min) Mounted LED, 700 mA | \$293.76   | Today        |
| M1650L4     | 1650 nm, 13 mW (Min) Mounted LED, 600 mA                   | \$293.00   | Today        |
| MPRP1L4     | 455 nm (12.5%) / 640 nm, 275 mW (Min) Mounted LED, 300 mA  | \$150.00   | Lead Time    |
| MBB1L3      | Broadband (470 - 850 nm), 70 mW (Min) Mounted LED, 500 mA  | \$514.08   | 3-5 Days     |
| MWWHL4      | 3000 K, 570 mW (Min) Mounted LED, 1000 mA                  | \$172.38   | Today        |
| MNWHL4      | 4900 K, 740 mW (Min) Mounted LED, 1225 mA                  | \$150.00   | Today        |
| MCWHL5      | 6500 K, 800 mW (Min) Mounted LED, 1000 mA                  | \$200.94   | Today        |

[Hide Adjustable Collimation Adapters for Ø2" \(Ø50 mm\) Optics](#)

### Adjustable Collimation Adapters for Ø2" (Ø50 mm) Optics

Integrate a Ø2" (Ø50 mm) Collimation Optic with Thorlabs' Mounted LEDs  
Adjust and Set Lens Position via Rotating Ring with Locking Setscrew  
Available with or without AR-Coated Lens (See Table Below for Details)  
Compatible with Thorlabs' SM2-Threaded Microscope Port Adapters

These adapters allow a Ø2" (Ø50 mm) collimation optic to be integrated with the mounted LEDs sold above. The adapters can translate the lens by up to 20 mm. They are offered in versions without a collimation optic or with a removable AR-coated aspheric condenser lens for 350 - 700 nm or 650 - 1050 nm. All of these adapters attach to the LED housing via external SM1 threads, allowing them to be used with both the Ø30.5 mm and Ø57.0 mm housings.



Click for details





Click to Enlarge  
SM2F Adapter Installed  
on a  
M365LP1 Mounted LED

The collimation lens is mounted in an inner carriage that provides rotating translation along the Z-axis by turning the knurled adjustment ring (engraved with the Item # in the photos to the left) and is locked into position by turning the locking screw on the side of the adjustment ring with a 2 mm (5/64") hex key. Lines, spaced 2 mm apart, are engraved on the housing as a rough guide for how far the carriage has been translated. The mounting threads on the housing remain fixed during translation, allowing these adapters to be mounted between fixed lens tubes. These collimation adapters use an extra-thick SM2-threaded retaining ring designed for holding aspheric condenser lenses. The retaining rings can be tightened or loosened using an SPW604 spanner wrench.

The adjustable collimation adapters include the SM1A2 thread adapter to enable integration with mounted LEDs, an aspheric condenser lens, a SM2 retaining ring, and a M62 x 0.75-to-SM2 thread adapter. (The SM2F does not include an aspheric condenser lens.)

The input and output apertures of the collimation adapters are threaded for compatibility with various components; please see the table below for details.

#### Inserting or Removing Optics

To insert or remove an optic in these collimation adapters, use the adjustment ring to translate the inner carriage to the output end of the housing. Remove the included retaining ring using the spanner wrench. If there is a lens installed already, remove it from the carriage. Insert another Ø2" (Ø50 mm) optic into the carriage, and use the retaining ring to secure it.

Using a lens with a substrate or AR coating that does not transmit the wavelength of your LED is not recommended. Deep UV LEDs (wavelengths ≤ 340 nm) require a lens fabricated from UV Fused Silica, since many standard varieties of glass do not transmit below 350 nm. IR LEDs that emit at wavelengths ≥ 1050 nm can be collimated using an uncoated condenser lens, such as the Ø50 mm ACL50832U which has a wavelength range of 380 - 2100 nm.

| Item #            | Compatible Optic | Lens Travel Range | Input Threading                       | Output Threading                      | Included Lens | AR Coating Range | Lens Focal Length | Operating Temperature          |
|-------------------|------------------|-------------------|---------------------------------------|---------------------------------------|---------------|------------------|-------------------|--------------------------------|
| SM2F <sup>a</sup> |                  |                   |                                       |                                       | N/A           | N/A              | N/A               | 15 - 60 °C<br>(Non-Condensing) |
| SM2F32-A          | Ø2" (Ø50 mm)     | 20 mm (0.79")     | External SM1 (1.035"-40) <sup>b</sup> | Internal SM2 (2.035"-40) <sup>c</sup> | ACL50832U-A   | 350 - 700 nm     | 32.0 mm           |                                |
| SM2F32-B          |                  |                   |                                       |                                       | ACL50832U-B   | 650 - 1050 nm    | 32.0 mm           |                                |

- a. The SM2F does not include a collimation optic, allowing user-supplied optics to be integrated with Thorlabs' mounted LEDs.
- b. This thread is part of a removable adapter; removing the adapter reveals external SM2 (2.035"-40) threading.
- c. This thread is part of a removable adapter; removing the adapter reveals internal M62 x 0.75 threading.

| Part Number | Description   | Price    | Availability |
|-------------|---|----------|--------------|
| SM2F        | Adjustable Collimation Adapter for Ø2" or Ø50 mm Optic                  | \$252.96 | Today        |
| SM2F32-A    | Adjustable Collimation Adapter with Ø2" Lens, AR Coating: 350 - 700 nm  | \$269.28 | Today        |
| SM2F32-B    | Adjustable Collimation Adapter with Ø2" Lens, AR Coating: 650 - 1050 nm | \$269.28 | Today        |

[Hide Microscope Collimation Adapters with Ø50 mm Lens](#)

#### Microscope Collimation Adapters with Ø50 mm Lens

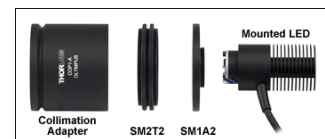
AR-Coated Aspheric Lens with Low f/# (Approximately 0.8)  
Compatible with Select Leica, Nikon, Olympus, or Zeiss Microscopes  
Easily Adjust Beam Collimation / Focus  
Requires SM2T2 Coupler and SM1A2 Adapter (Each Sold Separately) when Used with the LEDs Above

Thorlabs offers collimation adapters with Ø50 mm AR-coated aspheric condenser lenses (EFL: 40 mm) for collimating the output from the mounted LEDs sold above. Two AR coating ranges (350 - 700 nm and 650 - 1050 nm) and four different collimator housings are available. Each housing is designed to mate to the illumination port on selected Olympus\*, Leica, Nikon, or Zeiss microscopes. Compatible microscopes are listed in the Collimation Adapter Selection Guide table below.

Using an adapter with a substrate or AR coating that does not transmit the wavelength of your LED is not recommended. Deep UV LEDs (M265L3, M285L4, M300L4, and M340L3) require a lens fabricated from UV Fused Silica, since many standard varieties of glass do not transmit below 350 nm. IR LEDs that emit beyond 1050 nm (M1200L3, M1300L3, M1450L3, M1550L3, and M1650L4) can be collimated using an uncoated condenser lens; the ACL5040U is an uncoated version of the Ø50 mm lenses used in the collimation packages below that has a wavelength range of 380 - 2100 nm. See the *Collimation* tab above for more information on collimation options.

The LED sources described above can be fitted to the collimators by using an SM2T2 Coupler and SM1A2 Adapter (not included) as shown in the image at right. This assembly can be easily adapted to different LED sources by unscrewing the LED housing.

\*Please note that due to the optical design of the transmitted lamphouse port of the BX and IX microscopes, it may be necessary to purchase a separate adapter, which is available from Olympus.



Click for Details

Installation of a collimation adapter to a mounted LED using the SM2T2 and SM1A2 thread adapters. The same setup can be used to attach the collimation adapter to the LEDs above that use a Ø57.0 mm housing.

The ACL5040U is an uncoated version of the Ø50 mm lenses used in the collimation packages below that has a wavelength range of 380 - 2100 nm. See the *Collimation* tab above for more information on collimation options.

| Collimation Adapter Selection Guide |                   |             |   |   |   |   |
|-------------------------------------|-------------------|-------------|---|---|---|---|
| Compatible Microscopes              |                   |             | Olympus BX & IX <sup>a</sup>  | Leica DMI   | Zeiss Axioskop & Examiner <sup>b</sup>  | Nikon Eclipse Ti  |
| AR Coating Range of Condenser Lens  | Lens Focal Length | Lens Item # |  |  |  |  |
|                                     |                   |             | Click to Enlarge  | Click to Enlarge  | Click to Enlarge  | Click to Enlarge  |
| 350 - 700 nm                        | 40.0 mm           | ACL5040U-A  | COP1-A  | COP2-A  | COP4-A  | COP5-A  |
| 650 - 1050 nm                       | 40.0 mm           | ACL5040U-B  | COP1-B  | COP2-B  | COP4-B  | COP5-B  |

- a. Please note that due to the optical design of the transmitted lamphouse port of the BX and IX microscopes it may be necessary to purchase a separate adapter which is available from Olympus.
- b. These adapters are compatible with any Zeiss microscopes that use the same dovetail as the Zeiss Axioskop or Examiner microscopes.

| Part Number | Description | Price | Availability |
|-------------|-------------|-------|--------------|
|-------------|-------------|-------|--------------|

|        |  |          |       |
|--------|--|----------|-------|
| COP1-A | Collimation Adapter for Olympus BX & IX, AR Coating: 350 - 700 nm            | \$188.70 | Today |
| COP1-B | Collimation Adapter for Olympus BX & IX, AR Coating: 650 - 1050 nm           | \$220.32 | Today |
| COP2-A | Collimation Adapter for Leica DMI, AR Coating: 350 - 700 nm                  | \$188.70 | Today |
| COP2-B | Collimation Adapter for Leica DMI, AR Coating: 650 - 1050 nm                 | \$220.32 | Today |
| COP4-A | Collimation Adapter for Zeiss Axioskop & Examiner, AR Coating: 350 - 700 nm  | \$188.70 | Today |
| COP4-B | Collimation Adapter for Zeiss Axioskop & Examiner, AR Coating: 650 - 1050 nm | \$220.32 | Today |
| COP5-A | Collimation Adapter for Nikon Eclipse Ti, AR Coating: 350 - 700 nm           | \$223.38 | Today |
| COP5-B | Collimation Adapter for Nikon Eclipse Ti, AR Coating: 650 - 1050 nm          | \$259.08 | Today |
| SM1A2  | Adapter with External SM1 Threads and Internal SM2 Threads                   | \$24.99  | Today |
| SM2T2  | SM2 (2.035"-40) Coupler, External Threads, 1/2" Long                         | \$35.45  | Today |

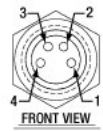
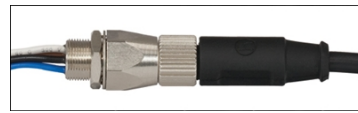
[Hide Mounted LED Mating Connector](#)

### Mounted LED Mating Connector

Pico (M8) Receptacle  
 Female 4-Pin for Front Mounting  
 0.5 m Long, 24 AWG Wires  
 M8 x 0.5 Panel Mount Thread  
 IP 67 and NEMA 6P Rated

The CON8ML-4 connector can be used to mate mounted LEDs featured on this page to user-supplied power supplies. We also offer a male 4-Pin M8 connector cable (Item # CAB-LEDD1).

| Pin | Color | Specification |
|-----|-------|---------------|
| 1   | Brown | LED Anode     |
| 2   | White | LED Cathode   |
| 3   | Black | EEPROM GND    |
| 4   | Blue  | EEPROM IO     |

CON8ML-4 Shown Connected to the 4-Pin M8 Plug of Mounted LED

| Part Number | Description                                    | Price   | Availability |
|-------------|--|---------|--------------|
| CON8ML-4    | 4-Pin Female Mating Connector for Mounted LEDs | \$31.37 | Today        |



Spectrum

