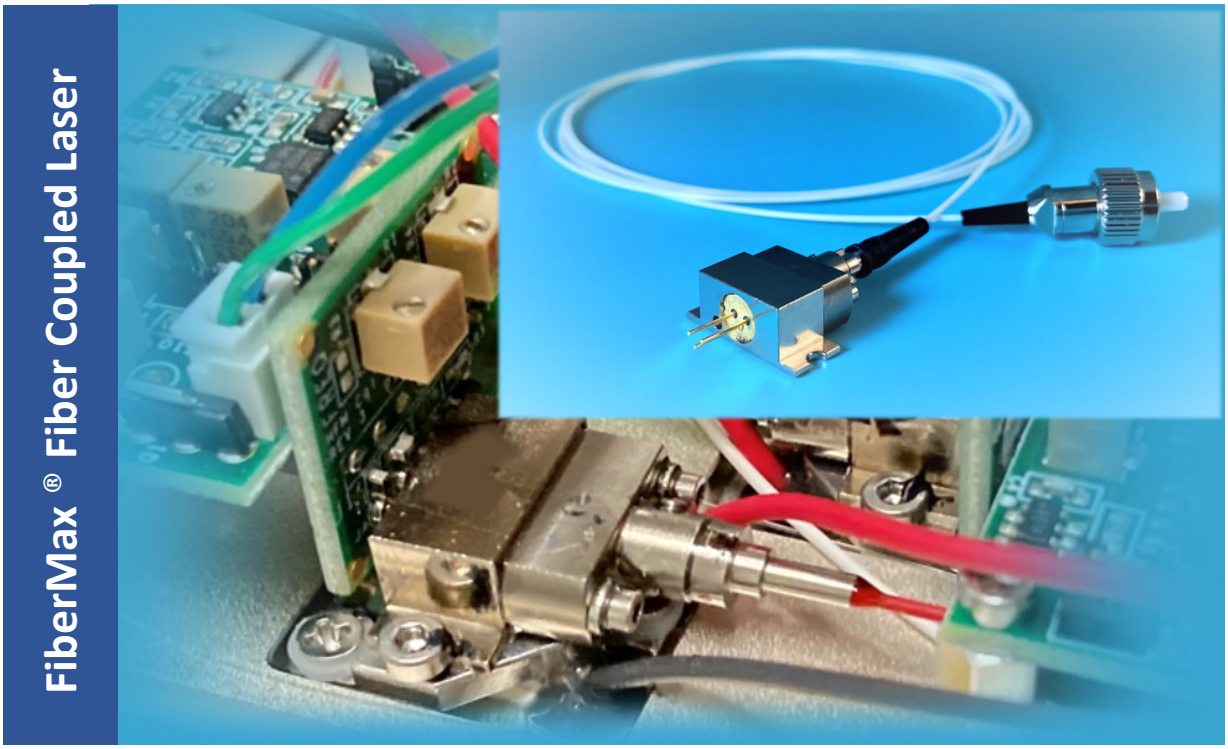
**FiberMax®**
**Fiber Coupled Laser**

# BLUE SKY RESEARCH




## Fiber Coupled Laser Component

Blue Sky Research is a world leading expert in precision fiber-coupling for a large range of laser diodes, from IR to violet . Based on its proprietary technology, the FiberMax® (FMXL) provides excellent coupling efficiency and stability in a cost-effective package. The thermally stable design of the FMXL is highly reliable and field-proven with hundreds of thousands of units operating in demanding applications. Standard FiberMax® laser components are available for quick delivery with common features: high performance laser diodes coupled into a single mode PM fiber with an FC/PC connector.

## Standard FiberMax® Features

- Lasers: 405, 450, 488, 520, 638, 658, 785, 830nm
- High coupling efficiency
- Highly reliable, +10,000 hrs. laser lifetime
- PM fiber standard, single & multimode options
- Collimation and Relay optics options available

## Advantages of Using Fiber

The unique properties of optical fibers reduce optical system complexity and enables lower cost. System performance can be optimized while using cost effective fiber for light relay and beam shaping. A single mode fiber creates a near perfect Gaussian beam without introducing aberrations. In addition, optical fibers maintain beam pointing tolerances throughout temperature variations better than all traditional optics, enabling a robust and stable system performance over wide operation conditions.

# FiberMax® Standard Product Specifications

Standard FiberMax® products comprise one fiber-coupled laser, a 1-meter PM single mode fiber with a 900µm PVC buffered jacket and an FC/PC connector. Each FiberMax® is shipped with individual laser characteristics/data.

| Product # | Lasing Wavelength λ (nm) | Optical Power Po (mW) | Threshold Current $I_{op}$ (mA)* Typ/Max | Operating Voltage Vop (V)* Typ/Max | Operating Current $I_{OP}$(mA)* Typ/Max | Monitor Current $I_{mon}$ (mA)* Typ/Max | Pin Out |
|---|---|---|---|---|---|---|---|
| FMXL-405-20 | 405 | 20 | 40/70 | 5.0/6.0 | 75/120 | 0.2/0.4 | B |
| FMXL-450-30 | 450 | 30 | 22/40 | 5.1/6 | 84/120 | NA** | F |
| FMXL-488-20 | 488 | 20 | 40/60 | 6.0/7.5 | 105/135 | NA** | F |
| FMXL-520-20 | 520 | 20 | 40/60 | 5.9/7 | 100/135 | 0.4/0.65 | B |
| FMXL-638-2 | 638 | 2 | 23/35 | 2.5/2.7 | 31/45 | 0.19/0.5 | B |
| FMXL-638-10 | 638 | 10 | 40/50 | 2.2/2.5 | 64/80 | 0.1/0.3 | B |
| FMXL-638-70 | 638 | 70 | 50/65 | 2.7/3.0 | 140/180 | 0.3/0.6 | B |
| FMXL-640-25 | 640 | 25 | 45/60 | 2.4/2.6 | 90/110 | 0.3/0.6 | B |
| FMXL-658-60 | 658 | 60 | 55/70 | 2.5/3.0 | 170/220 | 0.31/0.71 | B |
| FMXL-658-120 | 658 | 120 | 60/90 | 2.7/3.2 | 230/270 | 0.7/1.3 | B |
| FMXL-785-60 | 785 | 60 | 35/55 | 2.3/2.8 | 135/190 | 0.19/0.60 | B |
| FMXL-830-30 | 830 | 30 | 20/40 | 1.9/2.4 | 75/100 | 0.25/0.50 | B |
| FMXL-830-120 | 830 | 120 | 38/50 | 2.3/2.5 | 225/255 | 0.41/1.0 | B |

* Specifications are at constant temperature of 25°C

** These laser types do not have monitor photodiodes (PDs). We do offer custom FMXL lasers that do have monitor PDs.

Options for FiberMax® products:

- Laser Power Levels
- Other Laser wavelengths include; 473, 532, 705, 740, 808, 850 and 980nm
- Single mode or Multimode fiber output
- 3mm buffered or 3mm armored metal jacketing
- Connector types (dependent on output fiber)
- Cylindrical collimator or focusing optics in cylindrical housing

# General Product Specifications

## Environmental Specifications

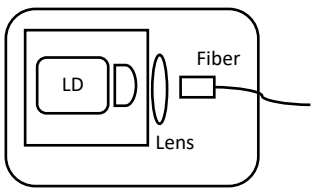
| Parameter | Units | Specification Min | Specification Max | Conditions |
|---|---|---|---|---|
| Operating Temperature | °C | - 10 | 50 | Non-Condensing |
| Storage Temperature | °C | -40 | 85 | Non-Condensing |
| Storage Humidity | % | 10 | 90 | Non-Condensing |

| Optical Fiber Specifications | | Wavelength | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Parameter | nm | 405 | 450 | 473 | 488 | 520 | 638 | 658 | 785 | 830 |
| Extinction Ratio (PM fiber, typical) | dB | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| Fiber Mode Field Diameter SMF & PM fibers (typical) | µm | 3.0 | 3.5 | 3.5 | 3.5 | 4.0 | 4.5 | 4.5 | 4.5 | 4.5 |
| Numerical Aperture (typical) | NA | 0.11 | 0.11 | 0.11 | 0.11 | 0.11 | 0.11 | 0.11 | 0.11 | 0.11 |

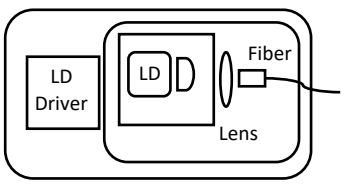
# Fiber-Coupled Laser Components & Modules

Blue Sky Research offers three different Fiber-Coupled laser components & modules which provide customers a variety of options for specific applications. They include;

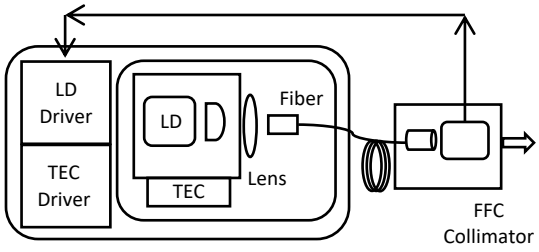
- FiberMax®, an OEM component allowing direct access to LD pinouts & an optical fiber output assembly
- FiberDrive™, a module with laser driver electronics
- FiberTec™, a complete laser system with thermal control via TEC, and LD stability-monitoring circuits




**FiberMax®**




**FiberDrive™**




**FiberTec™**

| | FiberMax® | FiberDrive™ | FiberTec™ | FiberMax® + Collimator | FiberTec™ + FFC collimator |
|---|---|---|---|---|---|
| Optical Output | Fiber + Connector | Fiber + Connector | Fiber + Connector | Free Space Collimated beam | Free Space Collimated Beam |
| Customer Benefits | Low Cost, LD drive electronics not included | Integrated LD Driver Electronics | Power Stability, LD driver, TEC & controller | Low Cost, Beam placement at target | Best optical & laser power stability, high PER |

# Collimation Optics

Blue Sky Research offers a miniature cylindrical collimator as an option for FiberMax® products. The cylindrical collimator is a miniature lens enclosure secured to the fiber pigtail's connector and houses an aspheric or doublet lens which provides a specific collimated beam diameter and divergence. The cylindrical collimator options have unique beam size and divergence specifications (e.g. M, N, P, Q) and are wavelength dependent. Collimated beam requirements must be specified at time of purchase. Optional focus optics are available.

| Collimator Specifications | | M | N | P | Q |
|---|---|---|---|---|---|
| Beam Diameter* @ 1/e$^2$ mm) | | 0.75 | 1.25 | 1.8 | 4.0 |
| Beam Divergence (mrad) ** | @ 830nm | 1.6 | 1.0 | 0.7 | 0.5 |
| | @ 635nm | 1.2 | 0.8 | 0.5 | 0.4 |
| | @ 520nm | 1.0 | 0.65 | 0.45 | 0.35 |
| | @488nm | 0.95 | 0.6 | 0.4 | 0.35 |
| | @405nm | 0.80 | 0.55 | 0.4 | 0.3 |

* Typical beam size for 635nm, +/- 25% covers all wavelengths

** Beam Diameter and Divergence will change with LD wavelength, contact Blue Sky Sales for exact specifications relative to your specific wavelength of interest

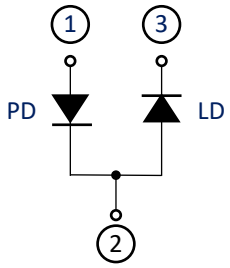
# ACC and APC Operation

ACC (automatic current control): Laser Diode driving current must be generated via a constant current source for ACC operation. User can define current value relative to laser power output.

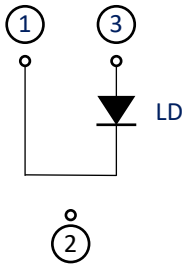
APC (automatic power control): Laser power is detected via a photodiode inside laser housing. An error signal is generated to adjust the LD current to lock the power to a user specified setting or preset value.

Based on application, customers choose to use either ACC or APC operation. Normally, ACC driving circuity provides lower noise operation and APC circuitry provides better long-term stability. FiberMax® with B pin-out can be directly used for both APC and ACC operation. F pin-out can only be used for ACC operation unless an external photodiode is used.

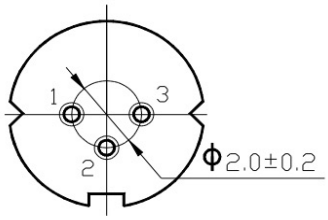
# FiberMax® Electrical Pin Out Configurations




B Pin Out



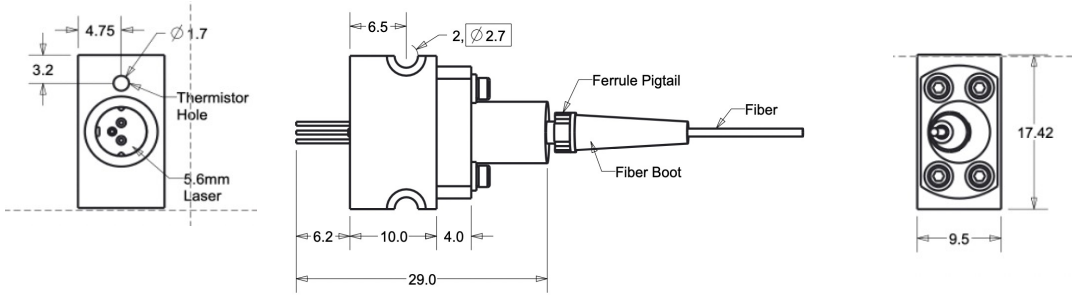

F Pin Out



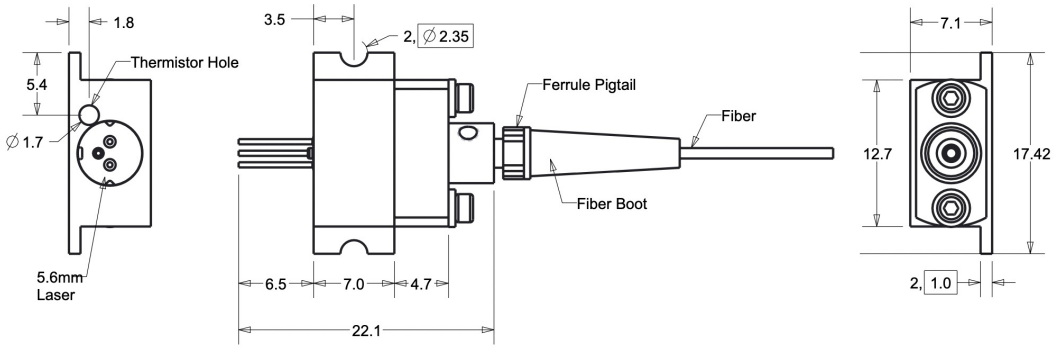

Pin orientation for FMXL products (bottom view)

# FiberMax® Mechanical Specifications (mm)

## 405nm – 520nm FiberMax® components

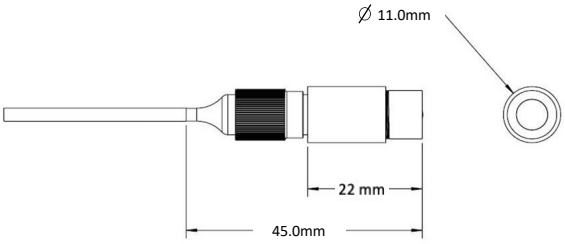



## 638nm – 830nm FiberMax® components

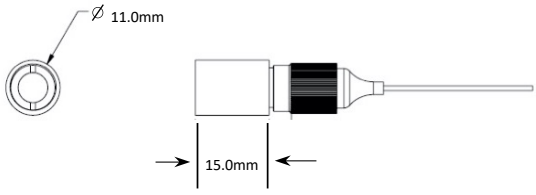



FiberMax® come with 1 meter connectorized PM fiber output as standard. Fiber with 900µm PVC jacket has a bend radius 13mm. Optional 3mm PVC or 3mm Armored metal jacket with bend radius of 30mm is also available.

# Cylindrical Collimators




Q Series Collimator




M, N & P Series Collimators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