Passive Fiber Mode Scrambler/De-Speckler

No-Speed limitation, Fiber Core 50-105 µm, Wavelength 300 to 2600 nm, 10W

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The PFMS is an all-fiber passive mode homogenizer designed to overcome the modulation speed limitations of mechanical mode scramblers and to operate reliably with high-power pulsed lasers. Leveraging a proprietary patent-pending design, the PFMS incorporates a mode-homogenizing element between two multimode fibers to redistribute the optical field within the fiber core. This passive scrambling process stabilizes the beam profile and suppresses modal interference. In multimode fibers, mode field fluctuations can introduce signal instability, speckle, and modal noise. The PFMS eliminates these effects by delivering a stable, homogeneous output, ensuring accurate and repeatable results. It is ideally suited for applications demanding uniform beam quality without modulation speed limitation, such as life sciences, digital laser projection, interferometry, laser beam homogenization, lithography, metrology, and fiber-based sensor systems. Compact and plug-and-play, the PFMS is engineered for seamless integration into fiber-coupled assemblies, providing robust despeckling and long-term reliability in demanding environments including space deployment. The standard configuration is designed to handle up to 5W optical power. Special version is cable up to 50W optical power with liquid internal cooling technology.

Features

- High Power
- Low Cost
- High Stability
- High Reliability
- Wide Temperature Operation

Applications

- Test/Measurement
- Sensor Systems
- Instruments

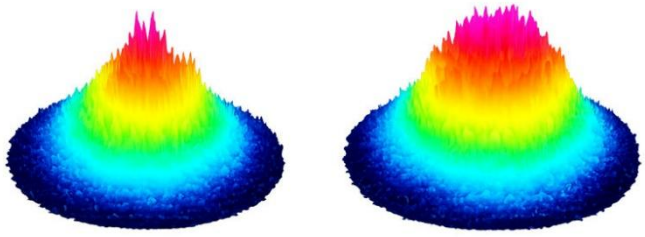
RoHS COMPLIANT

Specifications

Parameter	Min	Typical	Max	Unit
Wavelength	300		2600	nm
Insertion Loss [1]	0.5	1	2	dB
Optical Power Handling		5	50	W
Return Loss	50			dB
Operating Temperature	-20		100	°C
Storage Temperature	-40		85	°C
Fiber Diameter	50		400	µm

Notes:
[1] Without a connector, each connector adds 0.3dB

Beam Spot Before and After Homogenization



- Without Scrambler
- With Scrambler

Rev 05/07/26

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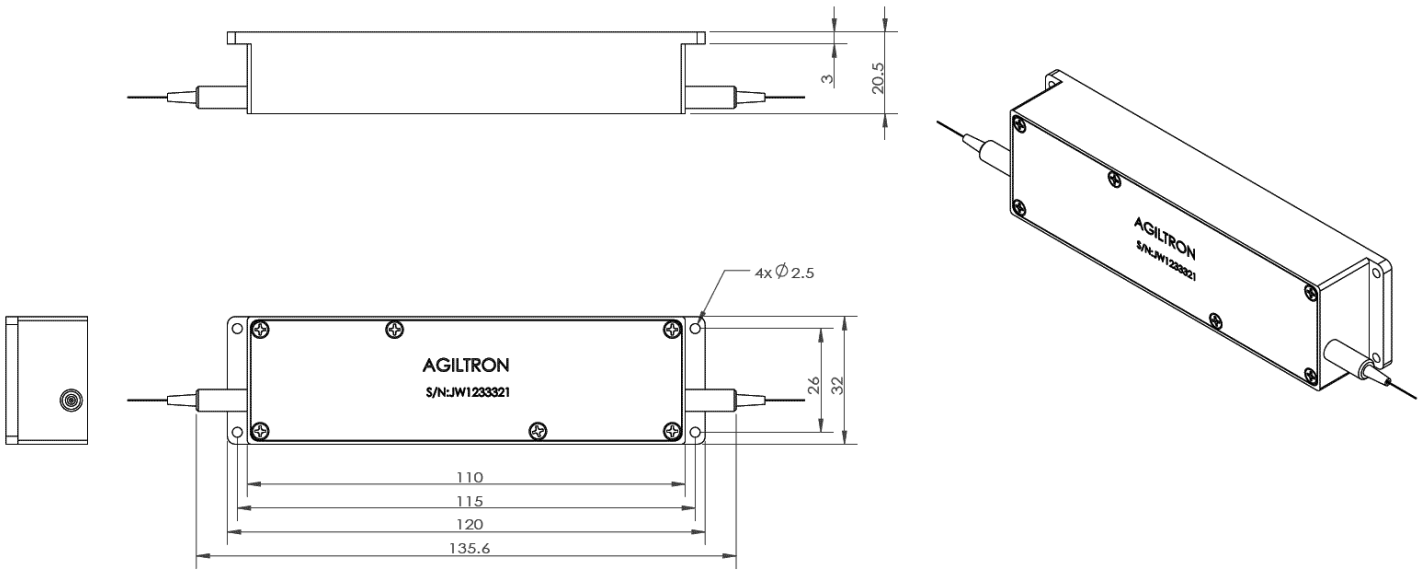
Mechanical Dimensions (mm)



*Product dimensions may change without notice. This is sometimes required for non-standard specifications.

Ordering Information (Part Number)

	☐	☐	☐	1	☐	☐	☐
Prefix	**Fiber Type**	**Configuration**	**Optical Power**		**Fiber Protection**	**Fiber Length**	**Connector** [1]
PFMS-	50/125, NA 0.22 = A 62.5/125, NA 0.22 = B 105/125, NA 0.22 = C 105/125, NA 0.15 = M Special = 0	Regular = 1	< 5W = 1 10W = 2 50W = 5 100W = 9 Special = 0		3mm = 1 0.9mm = 2 Special = 0	0.5m = 5 1.0m = 1 2.0m = 2 Special = 0	None = 1 SMA = 3 FC/PC = 4 Special = 0

Red color for special order

[1]. The default connector configuration uses fiber with 0.9 mm buffer protection. The connector cannot be installed directly onto bare fiber because the bare fiber is prone to damage during shipping. However, the connector can be assembled on bare fiber if a 3 cm protective loose tube is added for reinforcement. The customer may remove this protective tube after testing. The optical power handling of a standard connector is less than 0.5 W for SMF-28 fiber and decreases further for smaller-core fibers.

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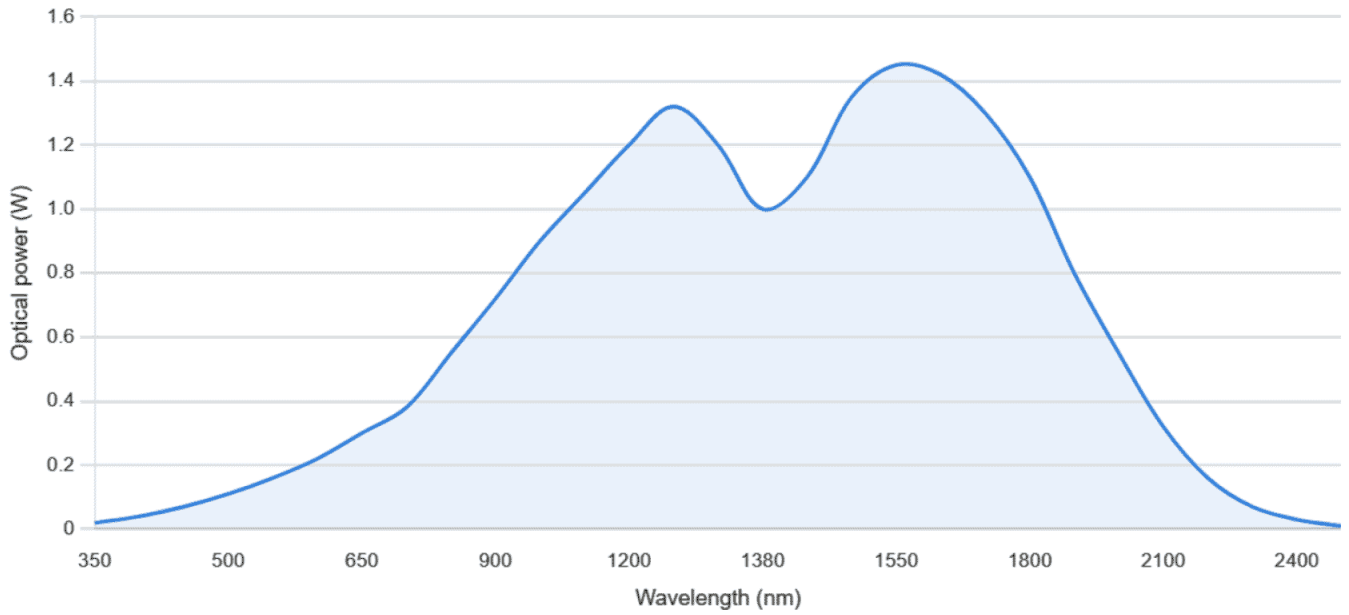
Regular Single Mode / Polarization Maintaining Fiber Optical Power Handing vs Wavelength



Single mode fiber optical power is limited by nonlinear effects in addition to absorption that increase loss and generate heat. The curve shows the approximate safe CW power envelope for standard single-mode fiber. Actual limits depend on fiber design, core size, length, and laser characteristics. Specialty fibers can significantly increase the power limit.

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