Multimode Scrambler - SpeckleFree™ (MMS-201)

Speckle patterns from a multimode fiber can cause problems in many applications that require uniform, stable light distributions at the fiber output. The MMS-201 multimode scrambler, a superior replacement for the MMS-101, is specially designed to solve this problem. Based on a General Photonics proprietary technology, the MMS-201 effectively randomizes multimode speckle patterns over time at a high frequency over 20kHz. The light distribution at the output appears uniform and stationary when viewed by cameras or detectors with averaging times >80 ms. In addition, the all-fiber optical path minimizes the scrambler's insertion loss. The fiber used for this device undergoes a special surface treatment to prevent breakage under stress, ensuring high device reliability. The MMS-201 can improve performance in various applications including DNA sequencing, multimode fiber sensing and test and measurement of multimode fiber devices.

Specifications:

Operating Wavelength Range	530 to 1630 nm
Fiber Type	50/125 µm step index standard, others optional
Fiber NA	0.2
Scrambling Frequency	22 ±1 kHz
Insertion Loss	≤1 dB at 635nm, including connectors
Return Loss	>50 dB (with PC connector) >55 dB (with APC connector)
Scrambling Efficiency[1, 2]	> 80% (effective power)
Flatness[3]	< 20% typical
Ripple[4]	< 10% typical
Optical Power Handling	400 mW
Power Supply	+24VDC/1.5A
Enable/Disable Signal	TTL high = enabled TTL low = disabled
Operating Temperature	10 to 40°C
Storage temperature	−20 to 70°C
Dimensions	23 (L) x 10.5 (W) x 6.5 (H) cm

Notes:
Specifications in this table apply for an MMS-201 made with 50µm step index multimode fiber.

1. Scrambling efficiency is defined as (Light energy ≥ 80% of maximum intensity/Total energy)* (area over which intensity is ≥ 80% of maximum intensity /total core area).
2. Measured over 80 ms integration time at 635 nm.
3. Flatness is defined as (maximum intensity – minimum intensity) expressed as a percentage of maximum intensity, where the maximum and minimum are defined over the center 80% of the fiber core area.
4. Ripple is defined as the maximum peak-to valley difference of intensity fluctuations, expressed as a percentage of maximum intensity, where the fluctuation differences and maximum intensity are measured within the center 80% of the fiber core area.

Features:

- Compact
- Reliable
- High speed
- Efficient
- Can be made with custom fiber

Applications:

- DNA sequencing
- Multimode fiber sensing
- Test and measurement
- MM to SM coupling
- Free-space optical communication

Order Information:

MMS – 201 — □ — □ — □ — □

Fiber Type:	Jacket Type:	Pigtail Length:	Connector Type:
50S = 50µm core step index	3 = 3mm 2 = 2mm 9 = 900µm	1 = 1 m Others specify	FC/PC, FC/APC, SC/PC, SC/APC or NC = no connectors

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Typical Performance Data:

SCRAMBLING DISABLED

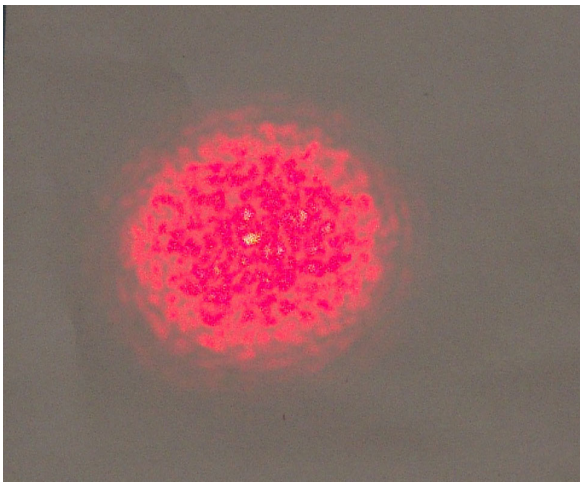


Figure 1. Far-field illumination pattern with scrambler disabled.

SCRAMBLING ENABLED

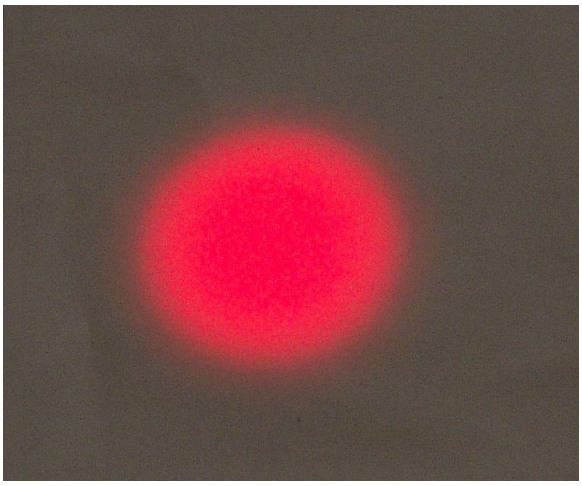
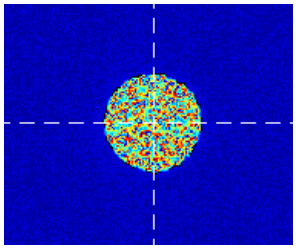
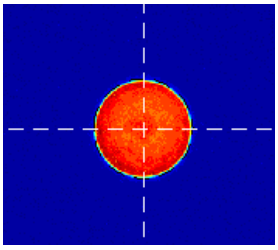


Figure 2. Far-field illumination pattern with scrambler enabled.

2-D Beam Profile



2-D Beam Profile



3-D Beam Profile

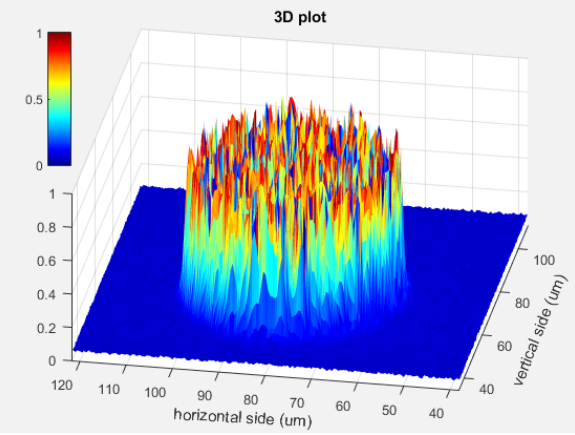


Figure 3. 2D and 3D beam profiles with scrambler disabled.

3-D Beam Profile

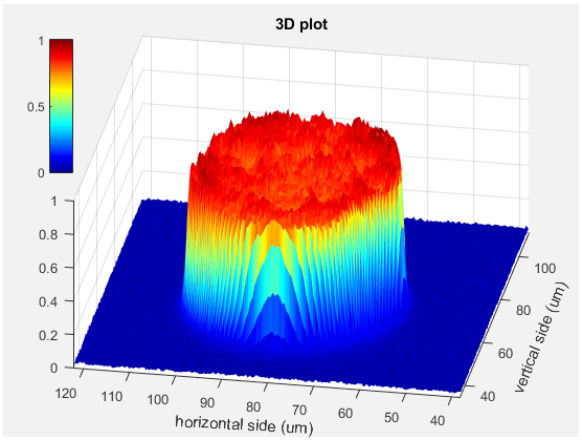


Figure 4. 2D and 3D beam profiles with scrambler enabled

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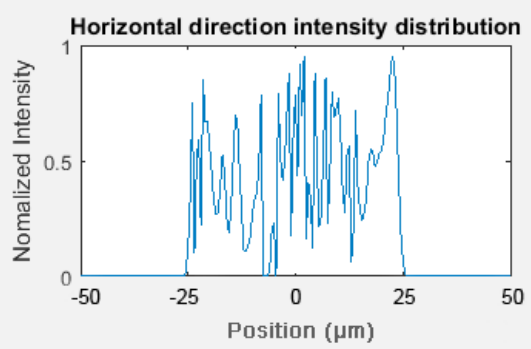
SCRAMBLING DISABLED



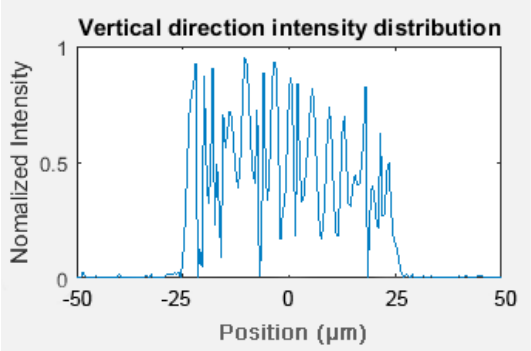
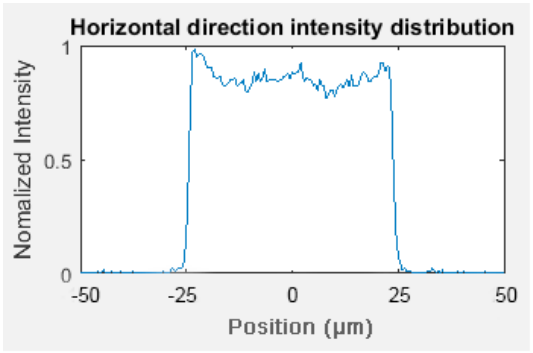


Figure 5. X and Y cross-sectional beam profiles with scrambler disabled.

SCRAMBLING ENABLED



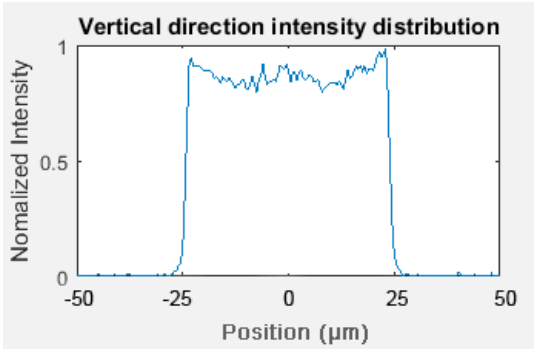


Figure 6. X and Y cross-sectional beam profiles with scrambler enabled.

Note: Data in Figures 3-6 taken at 635nm with 80 ms integration time.

Mechanical Dimensions (in inches):