


# FocusMonitor FM+

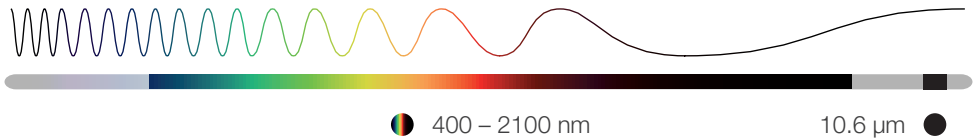


 Fiber and disc laser

 Diode laser

 Ultrashort pulse laser

 CO<sub>2</sub> laser




The established standard in high power laser beam diagnostics.

 Caustic

 Raw beam

 Power

 Beam profile

 Pointing stability

 Vector

 Focus shift

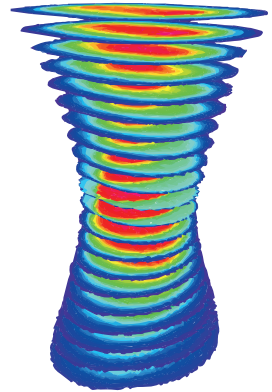
POWER RANGE	30 W – 100 kW
BEAM QUALITY M <sup>2</sup>	Single mode – Multi mode 1 to >100
BEAM DIAMETER	Focused 100 - 5 000 μm
HIGHLIGHT	Auto caustic, Linescan
INTERFACES	Ethernet

# Tech Corner

The FM+ is an opto-mechanically scanning measuring system that scans the laser beam with a special measuring tip. This tip is equipped with a small hole (typically with a diameter of approximately 20  $\mu\text{m}$ ), letting through only a small section of the laser beam. Two reflecting mirrors guide this portion of the laser light to a detector selected and configured depending on the used wavelength.

By moving the rotary disk forth and gradually leveling the complete unit upward, a caustic consisting of multiple power density distributions is created. The high orbital velocity of the rotating measuring tip facilitates the analysis of high power densities.

A very high signal-to-noise ratio is achieved thanks to the dynamics of the analog-digital converter used. Very low intensities are shown with equal precision next to the high peak intensities. That is one of the requirements for automatically measuring caustics in the area near the focal point over at least 4 Rayleigh lengths in accordance with ISO 11146.



To meet the requirements of constantly increasing power levels and beam qualities PRIMES is offering a unique addition: **The FS<sup>3</sup> (Fused Silica Sensor System)**

As the latest innovation in the FocusMonitor FM+ family, PRIMES introduces the FocusMonitor FM+ HPD. Through continuous development and the special design of the new measuring principle FS<sup>3</sup>, it is now possible to measure and evaluate laser beams with very high power densities of up to 50 MW/cm<sup>2</sup>. Beam diameters of 100  $\mu\text{m}$  – 1 200  $\mu\text{m}$  can be evaluated. The revolutionary design and the new functionality of the FM+ HPD are available for beam sources in the wavelength range of 515 – 545 nm as well as 1000 – 1 100 nm.



With the FM+ HPD, we present a milestone in the caustic analysis of laser beams in previously difficult to evaluate power ranges, which find use in cutting applications, for example.

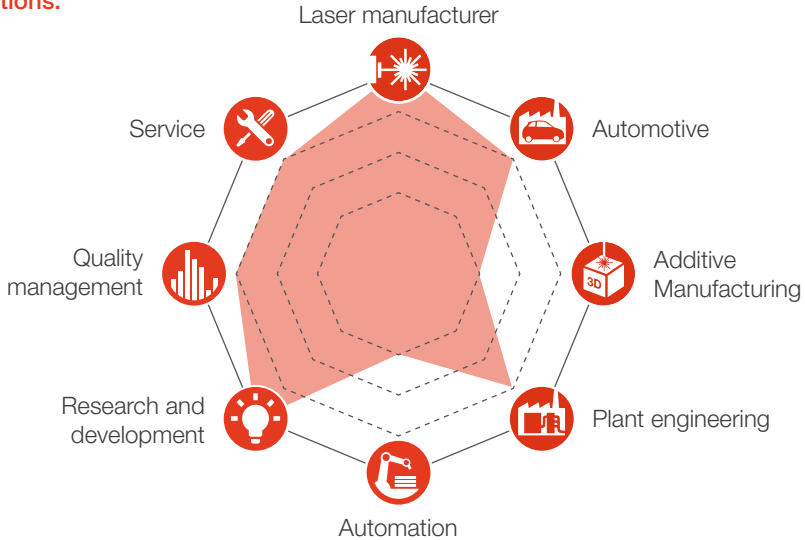
MEASUREMENT PARAMETERS		
	FM+	FM+ HPD
Power range	30 – 25 000 W <sup>1)</sup>	30 – 25 000 W
Wavelength range	400 – 12 000 nm	515 – 545 nm 1 000 – 1 100 nm
Beam diameter	100 – 3 000 $\mu\text{m}$ (up to 5 000 $\mu\text{m}$ optionally)	100 – 1 200 $\mu\text{m}$ <sup>3)</sup>
Max. power density at different wavelengths	CO <sub>2</sub> laser (10.6 $\mu\text{m}$ ): 30 MW/cm <sup>2</sup> Nd:YAG laser (1 000 – 1 100 nm): 10 MW/cm <sup>2</sup> VIS laser (515 – 550 nm): 5 MW/cm <sup>2</sup> Diode laser (800 – 1 000 nm): 1 MW/cm <sup>2</sup>	50 MW/cm <sup>2</sup>
Max. beam divergence (depending on measuring tip)	NIR high div: 200 mrad CO <sub>2</sub> high power: 240 mrad Diode: 500 mrad	120 mrad
DETERMINED PARAMETERS		
Focus position x, y, z	yes	yes
Focus radius x, y	yes	yes
Beam quality factor M <sup>2</sup>	yes	yes
Divergence angle	yes	yes
Power density distribution	2D, 3D	2D, 3D
DEVICE PARAMETERS		
Measurement window x-y	8 x 8 mm (12 x 12 mm optionally) <sup>2)</sup>	8 x 8 mm
Working range z	120 mm	120 mm
Resolution	32 x 32 px – 1 024 x 1 024 px	32 x 32 px – 1 024 x 1 024 px
Rotation speed	1 875, 3 750, 7 500 min <sup>-1</sup>	1 875 min <sup>-1</sup>
Linescan	yes	yes
SUPPLY DATA		
Power supply	24 V DC $\pm$ 5 %, max. 3.5 A	24 V DC $\pm$ 5 %, max. 3.5 A
Inert gas (water and oil free)	Helium, Nitrogen or Argon	Helium, Nitrogen, Argon, compressed air
Pressure inert gas	typ. 0.5 bar	typ. 0.5 bar
COMMUNICATION		
Interfaces	Ethernet, RS485	Ethernet, RS485
DIMENSIONS AND WEIGHT		
Dimensions (L x W x H)	280 x 242 x 218 mm	318 x 242 x 218 mm
Weight (approx.)	8.5 kg	8.5 kg

<sup>1)</sup> Higher power ranges on request.

<sup>2)</sup> Larger working ranges on request.

<sup>3)</sup> The size of the beam distribution to be measured must not exceed 1 200  $\mu\text{m}$  in the 86 % power inclusion. Within this range, measuring an array of spots is also possible.

## Applications:



**System description:** The FocusMonitor FM+ is a versatile opto-mechanically scanning diagnostics system for the analysis of focused laser beams from the far infrared to the blue spectral range. **It directly measures power density distributions of high power lasers and does therefore allow a comprehensive evaluation of complete setups at full power.**

**Your benefit:** The FocusMonitor FM+ is a state-of-the-art toolbox to reliably determine beam properties, geometric dimensions, focal positions, beam parameter products, beam quality factors and entire caustics of focused laser beams. The fast and easy exchange of the measuring tip enables the FM+ to measure different laser beam sources and systems solely by selecting the optimal measuring tip and corresponding detector.

## CONCLUSION

The FocusMonitor FM+ is a highly versatile toolbox with easily interchangeable measuring tips and detectors, which enables it to determine focused laser beams from the far infrared to the blue spectral range. This makes it highly recommended for the use in laser material processing.



長豐光學科技股份有限公司 Laser Mechanisms Taiwan Ltd.