# MicroSpotMonitor


## Mini, Micro, & Multi – All Facets of Measurement

**Radiation dominates matter: In the realm of very tiny structures, where microchannels are drilled and shapes just micrometers in size are created on surfaces, the MicroSpotMonitor is in its element. The camera-based measuring system can help you to check the laser beam you are using for micro working and recognize gradual signs of wear in advance. Take control – with the MicroSpotMonitor, which is suitable for use in a wide variety of different environments.**

The MicroSpotMonitor is the perfect measuring system for inspecting, monitoring, and qualifying very finely focused laser beams, such as those used for micro material processing. This proven system will automatically measure and analyze the spacial beam density distribution surrounding the focus in various positions along the beam propagation direction. The measuring results form the
basis for error analysis first and foremost and process optimization beyond that. The MicroSpotMonitor can be used in a wide variety of environments, thus offering diverse solutions for approaching your application.

## The Principle: Camera-Based Measuring Process

The MicroSpotMonitor (MSM) is capable of measuring the beam parameters of focused laser beams from lasers with medium power levels of up to 200 W in the range of 10 to 1 000 micrometers beam dimensions in the process zone. Being purely air-cooled, the system makes use of various beam splitters and neutral-density filters to project the attenuated laser beam on a CCD sensor. A plane's beam density distribution thus identified will indicated the beam position and beam radius. Beam parameters are determined and recorded with the aid of the integrated z-axis and the measurement of various positions along the beam diffusion directly.

You can choose the measuring objective of the MSM individually and regardless of the beam source to be measured. Here it is the wavelength ($\lambda$ = 340 to 1 090 nm) and the focus diameter of certain magnifications (3:1, 5:1, 15:1) that are decisive. The dynamic area of the integrated CCD sensor is expanded to over 130 dB using the exposure time controller, which makes it possible to measure caustics over more than 4 Rayleigh lengths (conforms to ISO 11146).

It is also possible to optionally equip the MicroSpotMonitor with a filter wheel containing neutral-density filters (OD1 to OD5), which enables measurements of power densities in the range of a few W/cm² to several MW/cm² without having to convert the system.

## Two Types of Operation

1. The PC-based LaserDiagnosticsSoftware enables you to measure beam density distribution manually and semi-automatically and determine the beam position and beam dimensions.

2. Scripts control the MSM semi-automatically, for repetitive measuring operations in service, quality assurance, and receiving for example.

Both types are individually adapted to the current measuring process. **Benefit:** The programmed user prompts simplify operation of the MicroSpotMonitor considerably.

## Diverse Models & Options

1. There are three different measuring objectives (MOB) to choose from, depending on the beam parameters: 3.3× MOB, 5× MOB, 15× MOB

2. Each available measuring objective can be designed for the following wavelength ranges: 340 – 360 nm, 515 – 545 nm, 1 030 – 1 090 nm. Other wavelength ranges are supported, but the lens coatings must be adapted.

3. Interchangeable fixed neutral-density filters are helpful for attenuating the most intense power from the pulsed and USP lasers.

4. The filter wheel equipped with neutral-density filters (OD1 to OD5) makes it easy to adjust the measuring range of the MSM.

5. Evaluate measuring results and monitor limit values with the LaserDiagnosticsSoftware. The software also allows for the use of alternative beam radius definitions: 2nd moments, power inclusion 86 %, channel process, power density decline procedure 86 %, cutting/Gaussian fit process as well as two additional power inclusion procedures with freely chosen power threshold.

## Beam Parameters

- Power density distribution on the individual measuring planes
- Focus dimensions
- Focus location in the space
- Rayleigh length
- Divergence
- Beam parameter product BPP
- Beam quality factor $M^2$

## The Key Benefits

1. Process development: document laser beam parameters simply and reproducibly.

2. Startup and acceptance of laser systems: carried out quickly and with consistent quality.

3. It is possible to recognize aging processes in optical components causing a change in beam parameters early on, which in turn facilitates targeted planning and maintenance work.

4. When there are system outages: idle times are reduced drastically due to the ease with which the source of the error is localized.

5. Measuring pulsed lasers.

# Technical Data

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| **MEASUREMENT PARAMETERS** | |
| Power range | 1 mW – 200 W |
| Wavelength range | 257 – 272 nm (on request), 340 – 360 nm, 515 – 545 nm, 1 030 – 1 090 nm |
| Beam dimensions | 10 - 1 000 µm |
| **DETERMINED PARAMETERS** | |
| Focus position x, y, z | yes |
| Focus radius x, y | yes |
| Beam quality factor $M^2$ | yes |
| Raw beam diameter with focussing element | yes |
| Beam parameter product BPP | yes |
| Divergence angle | yes |
| Power density distribution | 2D, 3D |
| **DEVICE PARAMETERS** | |
| Measuring range x-, y-direction | 0.02 – 2 mm (depending on the measuring objective) |
| Measuring range z-direction | 35 mm or 120 mm |
| Integrated variable attenuation (option) | Filter wheel with 5 OD filter (OD 0 – 5) |
| **SUPPLY DATA** | |
| Power supply | 24 V DC ± 5 %, max. 1.8 A |
| Compressed air for cyclone (cleaned, free of water and oil) | 0.5 bis 1 bar |
| Cooling water pressure | 2 bar primary pressure with an unpressurized outflow, max. 4 bar |
| Min. Cooling water flow rate | 1.5 l/min |
| Cooling water temperature $T_{in}$ [1)] | Dew point temperatur < $T_{in}$ < 30 °C |
| **COMMUNICATION** | |
| Interfaces | Ethernet, RS485 |
| **DIMENSIONS AND WEIGHT** | |
| Dimensions (L × W × H) | 427 (+12 mm) excluding connectors × 202 x 181 mm (+ 35 mm or 120 mm movement range) + Excess end of the measuring objective (depending on the measuring lens used) |
| Weight (approx.) | 15 kg |
| **ENVIRONMENTAL CONDITIONS** | |
| Operating temperature range | 10 – 40 °C |
| Storage temperature range | 5 – 50 °C |
| Reference temperature | 22 °C |
| Permissible relative humidity (non-condensing) | 10 – 80 % |

[1)] Please consult with PRIMES before doing anything that does not comply with this specification.