

MicroSpotMonitor MSM



MicroSpotMonitor 35

The MicroSpotMonitor (MSM) is the ideal tool for controlling, monitoring, and qualifying very finely focused laser beams as they are employed in the field of micro material processing. The MSM automatically measures and analyzes the spatial beam distribution around the focus in different z-positions.

Basics

The focused laser beam has a great influence on the quality of the manufacturing result. It is the actual tool in case of most procedures of laser material processing.

Qualifying and monitoring this tool is the task of the MSM. By means of regular measurements it is, for example, possible to detect and record changes concerning the beam profile or the focus position. The results are not only useful for an error analysis but also for the optimization of a procedure in micro processing. The various fields of application of the MSM result in wide-ranging solutions.

In Practice

During process development, laser parameters can be documented easily and reproducibly. Set-up and qualification of laser systems can be done quickly and at a constant level of quality.

Aging processes in optical components, which result in a change of beam parameters, can be detected at an early stage. Therefore, accurate planning of maintenance is possible.

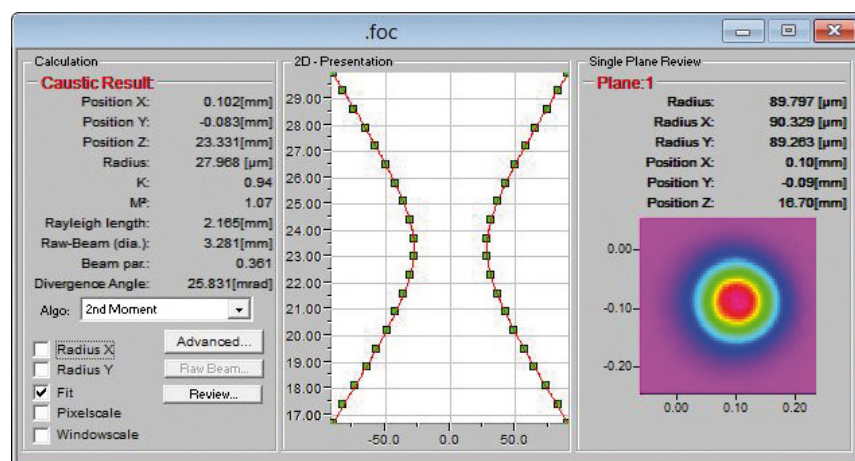
A consistent quality of processed parts is ensured.

In case of system breakdowns, the source of error can be located easily, which reduces the downtime considerably.

Measured Beam Parameters

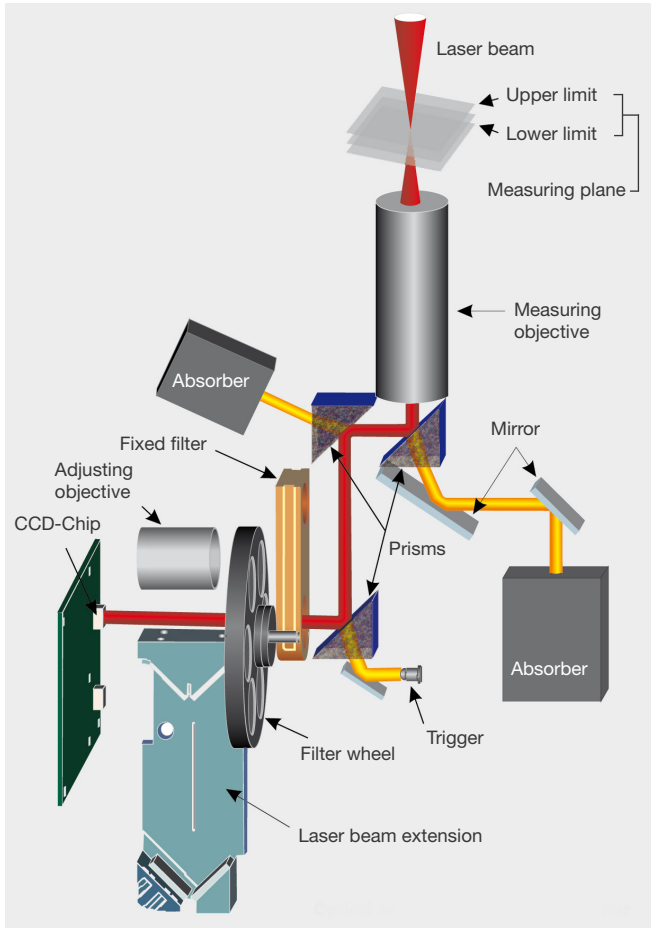
- Beam distribution of single section planes
- Focus dimensions
- Focus position in space
- Rayleigh length
- Divergence
- Beam parameter product SSP
- Beam Quality Factor M^2

The measurements are carried out in conformity with ISO 11146.



Presentation of the caustic measurement results of a single mode fiber laser

MicroSpotMonitor MSM



Schematic view of the optical system in the MSM

Measuring Procedure – the Principle

The MicroSpotMonitor determines beam parameters of focused laser beams at lasers with average powers up to 200 W in the range of 20 micrometers up to one millimeter directly in the processing zone. The solely air-cooled system displays the laser beam, which is attenuated by means of different beam splitters and a neutral density filter, on a CCD sensor. The beam position and the beam radius result from the determined beam

distribution of a plane. The described beam parameters result from the integrated z-axis and the repetition of the measurement at different positions within the laser beam.

The measuring objectives of the MSM are chosen individually, according to the beam source which is to be measured. Decisive are the wavelength (248 up to 1090 nm) and the magnification, which is determined by the focus diameter (3:1, 5:1, 15:1).

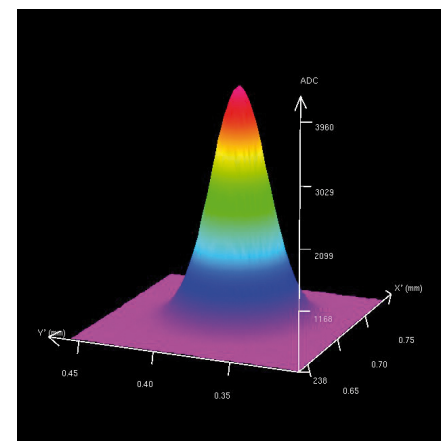
The dynamic range of the integrated CCD sensor is extended to more than 130 dB by means of an irradiation time control. This enables measurements of caustics with more than 4 Rayleigh lengths as demanded in ISO 11146.

As an option, the MSM can be supplemented by a filter wheel equipped with neutral glass filters (OD1 up to OD5). This filter wheel enables the measurement of power densities in the range of some W/cm^2 up to several MW/cm^2 without having to alter the system.

Operation

For the operation of the MSM there are two alternatives:

1. The computer-based LaserDiagnosticsSoftware (LDS) enables the manual or semi-automatic measurement of the beam distribution as well as the determination of the beam position and the beam dimensions.



3D presentation of the beam profile of a single mode fiber laser

MicroSpotMonitor MSM

2. Scripts control the MSM semi-automatically, e.g. for repetitive measuring tasks in service, quality assurance and acceptance. They are individually adapted to the current measuring procedure.

Advantage: The programmed user guidance can reduce the demands on the operation of the MSM considerably.

Models and Options

- Depending on the beam parameters, customers can choose from three different objectives:
 - 3.3× MOB (Measurement Objective)
 - 5× MOB
 - 15× MOB
- All objectives can be delivered for the following wavelengths:
 - 340 nm–360 nm
 - 515 nm–545 nm
 - 1030 nm–1090 nm
- Further wavelength ranges can be measured by means of the adaption of the objective coating.
- Interchangeable fixed neutral density filters for the attenuation of the peak powers of pulsed and USP lasers.
- The filter wheel equipped with neutral density filters (OD1 up to OD5) enables the comfortable adjustment of the measurement range of the MSM.
- The LaserDiagnosticsSoftware makes it possible to evaluate measuring results and to monitor limit values
- Moreover, the LaserDiagnosticsSoftware enables the use of alternative beam radius definitions: 2. moments (standard), moving slit method, 86 % power inclusion (standard), knife-edge method, Gaussian-fit, 86 % power-density-drop as well as two additional power inclusion procedures with a freely selectable power threshold.

Technical Data

Measurement Parameters

Power range	1 mW–200 W
Wavelength range	257–272 nm
	340–360 nm
	515–545 nm
	1030–1090 nm
Beam dimensions	20 µm–1 mm

Working Principle

- 2-dimensional recording of the power density distribution of the laser beam in the xy-plane by means of a CCD chip
- Measuring range x-, y-direction: depending on the used objective: 0.02 – 8 mm
- 35 mm z-range (120 mm also possible on request)
- Spatial resolution in x- and y-direction (number of measurement points per line 32, 64, 128, 256) up to 0.3 µm per pixel, diffraction limited by the objective
- Optional: 6-level switchable optical attenuator typ. 0 – 100 dB

Supply Data

Power supply	24 V DC ± 5 %, max. 1.8 A
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Communication

Interface	Ethernet
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Dimensions and Weight

Dimensions	
• Length	430 mm (excluding connectors)
• Width	202 mm
• Height	182 mm (+ 35 mm movement range, opt. 120 mm)
Weight	15 kg

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