MicroSpotMonitor MSM

The MicroSpotMonitor (MSM) is the ideal tool for checking, monitoring, and qualifying very finely focused laser beams as used in the field of micro material processing. The MicroSpotMonitor automatically measures and analyzes the spatial beam distribution around the focus in different positions along the beam propagation path.

The Basics

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

The task of the MicroSpotMonitor is the qualification and monitoring of focused laser beams as implemented in laser systems for micro materials processing. By means of regular measurements it is, for example, possible to detect and record changes concerning the beam profile, the focus position or the beam size. The results are not only useful for an error analysis but also for process optimization in micro processing. The MicroSpotMonitor can be used in many working environments and thus offers its users a wide range of applications and possibilities.

Tried and tested in Practice

The MicroSpotMonitor has been tried and tested in several applications and has many advantages: 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, enabling an accurate planning of maintenance.

A consistent quality of processed parts is ensured. In case of system breakdowns, the source of error can be easily located, which considerably reduces the downtime.

Measured Beam Parameters

- Beam distribution of single section planes
- Focus dimensions
- Focus position in space
- Rayleigh length
- Divergence
- Beam parameter product BPP
- Beam propagation ratio M^2

All measurements are carried out in conformity with ISO 11146.

The principle: Camera based measurements

The MicroSpotMonitor determines beam parameters of focused laser beams with average powers up to 200 W in the range from 20 micro meters up to one millimeter directly in the processing zone. The solely air-cooled system images the laser beam, which is attenuated by means of different beam splitters and a neutral density filter, onto a CCD sensor. The beam position and the beam radius are derived from the determined beam distribution of a plane. The beam parameters are calculated using the integrated z-axis and the repetition of the measurement at different positions along the laser beam path.

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

The dynamic range of the integrated CCD sensor is extended to more than 130 dB by controlling the irradiation time,

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enabling measurements of caustics with more than 4 Rayleigh lengths as demanded in ISO 11146.

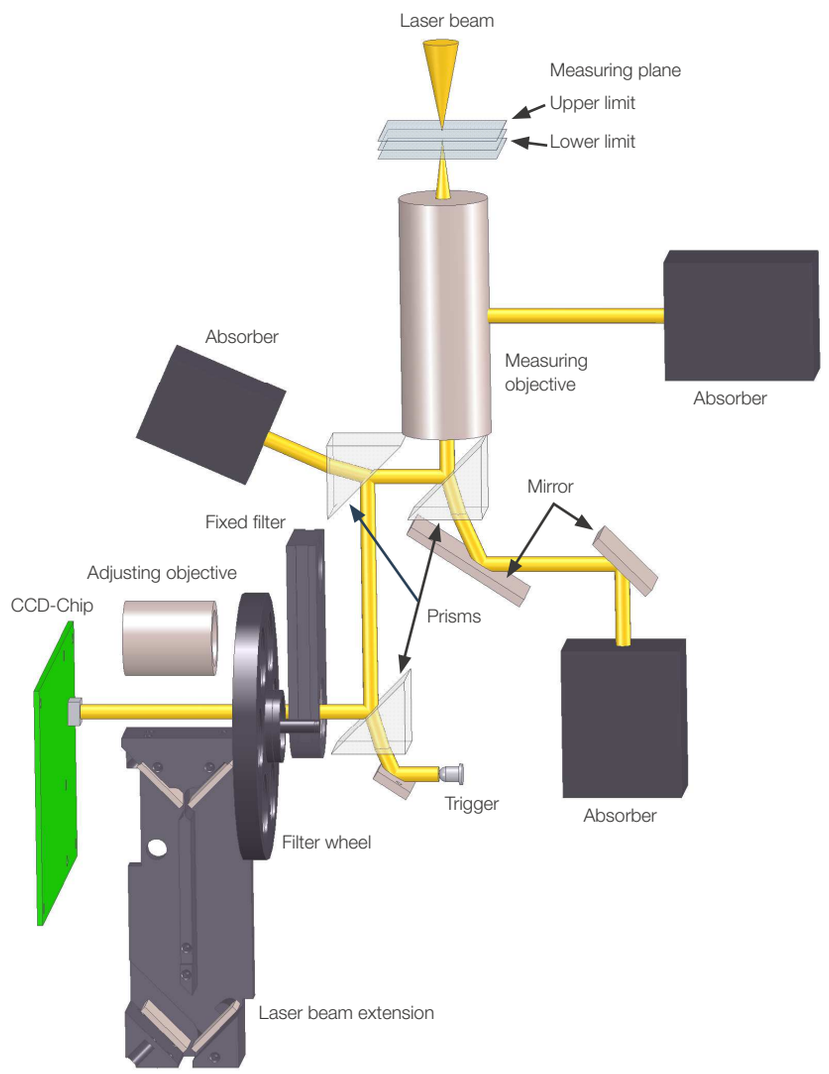
As an option, the MSM can be supplemented with a filter wheel equipped with neutral glass filters (OD1 up to OD5). This filter wheel enables the measurement of power densities in the range of a few W/cm² up to several MW/cm² without having to alter the system.

Two Alternatives for Operation:

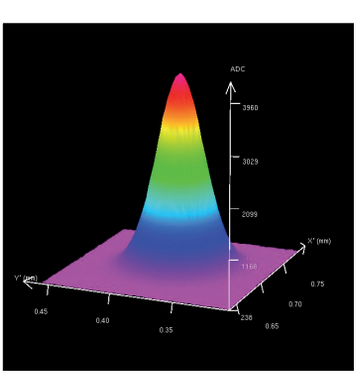
The operation of the MicroSpotMonitor has are two alternatives:

1. The PC-based LaserDiagnostics-Software (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.

2. Scripts control the MSM semi-automatically, for example in repetitive measuring tasks in service, quality assurance and acceptance. They are individually adapted to the current measuring procedure. Advantage of this operation: A programmed user guidance can considerably help in the reduction of the demands on the operation of the MSM.



Highly accurate deflection: the optical system of the MicroSpotMonitor



From all sides: Beam profile of a single-mode fiber-laser in the 3D presentation with the MicorSpotMonitor.

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Versatile: Models and Options

1. Depending on the beam parameters, the customer has three different objectives that he can select from:
   - 3.3× MOB (Measurement Objective)
   - 5× MOB
   - 15× MOB
2. Each of these objectives can be delivered for one or a combination of the following wavelength ranges:
   - 340 – 360 nm
   - 515 – 545 nm
   - 1030 – 1090 nm
3. In addition, further wavelength ranges are possible, which is achieved by modification of the objective coatings.
4. Interchangeable fixed neutral density filters assist in the attenuation of the peak powers of pulsed and USP lasers.
5. The filter wheel equipped with neutral density filters (OD1 up to OD5) enables the comfortable adjustment of the measurement range of the MSM.
6. The LaserDiagnosticsSoftware enables an evaluation of the measuring results and to reliably 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 (on request) 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) • 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
Communication	
Interface	Ethernet
Dimensions and Weight	
Dimensions • Length • Width • Height	 430 mm (excluding connectors) 202 mm 182 mm (+ 35 mm movement range, opt. 120 mm)
Weight	15 kg
Environmental Conditions	
Operating temperature range	+10 °C up to +40 °C
Permissible relative humidity (non-condensing)	10 – 80 %