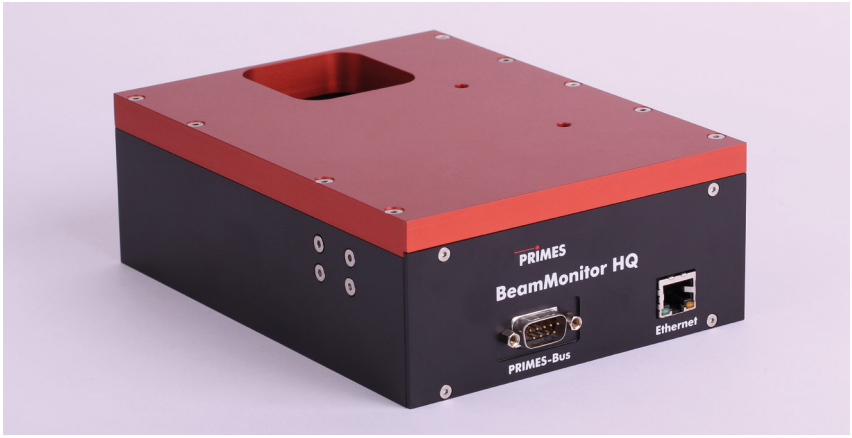
BeamMonitor & BeamMonitor-HQ



BeamMonitor50 HQ

BeamMonitors (BM) – adapted solutions for the measurement of unfocused laser beams.

The BeamMonitor (BM) is an industrial measuring device for the analysis of unfocused beams with a high output power.

As geometrical data, the beam symmetry as well as the power density distribution can provide information regarding the quality of the used optics, its degree of absorption and contamination as well alignment problems, regular checks are essential.

An unavoidable contamination of the surfaces of optical components is often the reason for a change in optical characteristics. Especially in case of transmissive components, such as output windows or beam splitters, the contamination leads to a higher absorption and therefore results in a thermal lensing effect. This influences both the beam diameter and the beam divergence.

In Practice

The free propagating “raw beam” is often modeled. Telescopes reduce or enlarge the beam diameter. Moreover, adaptive optics are employed which create not only stationary conditions, but also change the beam diameter or the divergence of the laser beam continuously and highly dynamically. Thereby, the focus dimensions in modern CO_2 laser systems for laser beam cutting or laser beam welding are changed, or the focus position is shifted towards the laser beam axis.

For “piercing in”, for example, the focus lies upon the material surface and is then “moved” into the material for the actual cutting process.

In case of laser beam welding, it is possible to tack with one setting and successively weld with different raw beam settings. In addition to the variation of the actual laser power, further parameters are analyzed and documented in order to optimize the process.

Moreover, BeamMonitors can provide assistance in detecting and documenting faulty beam positions or insufficient optics alignments.

Diode lasers or other solid-state lasers are checked in a collimated range and can be evaluated with relatively little effort. The deterioration of laser optics is one of the main reasons for problems concerning laser material processing, which also reduces the quality of the processing results.

With the BeamMonitor, the operator is given the opportunity to carry out a fast and reliable measurement of beam parameters. The BM is a measuring device for the determination of the spatial power density distribution of the radiation of CO_2- and solid-state lasers with high output powers. Both the beam dimensions and the beam position are calculated from the measuring data and then displayed graphically.

Measured Beam Parameters

- Beam position
- Beam dimensions
- Beam symmetry
- Power density distribution

The device is operated via a computer. Thus, the entire power density distribution can be displayed. By means of an Ethernet connection, a maximum repetition frequency of 0.4 Hz is possible. The linescan option, which is optionally available, enables a repetition frequency of approx. 30 Hz.

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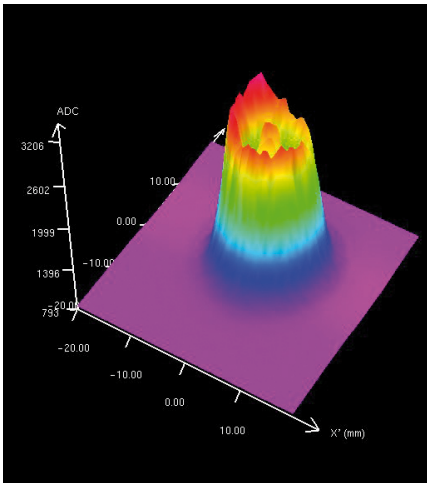


Measurement of the power density distribution with the BM50 HQ

Measuring Procedure – the Principle

The laser beam is scanned incrementally by a rotating measuring tip. In order to scan the entire beam profile, the mirror carrier is also moved in a linear motion. In doing so, a partial beam is deflected and guided towards the detector.

The incoming signal is digitized and transmitted to the evaluation unit. The employed 14 Bit A/D converter and a resolution of up to 256 × 128 pixels enable an exact analysis, even of small disturbances. The device was developed for the application in rough environments such as industrial production and is adaptable to any kind of spatial orientation.

The software has the following standard functions:

- Measurements: Single-, serial measurements (monitor operation) and measurement of the temporal development (linescan)
- Display: Isometry, false colors, contour lines and display of the numerical results
- Data formats: Storage in PRIMES- file format *.foc or ASCII

During the measurement, the entire beam exits the device and has to be absorbed separately and without any scattered radiation.

Operation

There are different application-specific solutions for the operation of the device, as well as a graphical user interface in Microsoft Windows®. The data transmission between the measuring device and the PC is based on the RS485 protocol and enables cable lengths of more than 50 m. For computer control, the signal is converted to RS232 via an interface converter. Ethernet connections are also available.

Furthermore, the following is implemented for special applications:

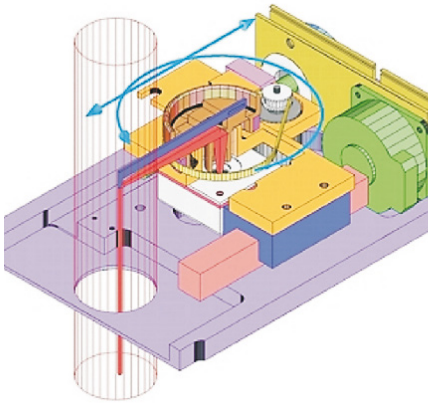
- Checking the beam symmetry
- Different color scaling for the false color display
- Alignment mode, which captures the results of the last 2 (3) measurements on the screen
- Direct recording of the measuring results into a data base (protocol function)

Models and Options

Depending on the beam diameter, different BeamMonitors with apertures of 50, 60 or 100 mm are available.

The BeamMonitor BM60 and BM100 are available for CO_2- or NIR lasers. As a dimensioning rule, the aperture must be 1.4 times the size of the laser beam diameter. Otherwise, edge intensities could easily hit the housing. This can not only lead to a strong rise in temperature up to the destruction of the BM but it can also distort the measuring result.

For a detailed analysis of CO_2 beams the BeamMonitor BM50 HQ with smaller outer dimensions is also available.



Opto-mechanical assembly of the BM60

BeamMonitor & BeamMonitor-HQ

Beam Monitor BM50 HQ

The new reference system for raw beam diagnostics of CO_2 lasers has been used successfully for a few years now.

The BeamMonitor BM50 HQ actually replaces typical Plexiglas penetrations for the determination of the beam profile or the beam symmetry. The analysis device enables fast measurements with high precision. This is guaranteed by a detector with a high dynamic range.

The BeamMonitor BM50 HQ is the perfect device for the analysis of your raw laser beam and the beam path quality. There are various application possibilities, from the monitoring of the beam during production up to the determination of the beam profile when the resonator is aligned.

The mechanical scanning system measures the power density of collimated laser beams at full power.

Due to the compact design as well as its low weight, the BeamMonitor BM50 HQ can be integrated perfectly into existing plants and is ideal for service use.

Accessories and Options

- **BM50 HQ**
  Linescan
- **BM60, BM100**
  Measurement of divergent beams in NIR, analog output for the operation at a fixed y-position

Technical Data

	BM60	BM100	BM50 HQ
Measurement Parameters			
Power range	50 – 25 000 W	50 – 25 000 W	10 kW
Wavelength range	10.6 or 1.06 µm	10.6 or 1.06 µm	10.6 µm
A/D conversion	12 bit	12 bit	12/14 bit
Irradiation time	2 s – infinity	2 s – infinity	2 s – infinity
Beam dimensions	6 – 40 mm	10 – 70 mm	5 – 35 mm
Max. beam divergence	< 100 mrad	< 100 mrad	< 100 mrad
Max. power density	< 10 kW/cm²	< 10 kW/cm²	< 10 kW/cm²
Accuracy (beam diameter)	± 5 %	± 5 %	± 5 %
Reproducibility (b.d.)	± 3 %	± 3 %	± 3 %
Nominal measring frequency	0.5 Hz	0.5 Hz	0.5 Hz – Linescan 30 Hz
Supply Data			
Power supply	24 V DC ± 5 %, max. 1.8 A	24 V DC ± 5 %, max. 1.8 A	24 V DC ± 5 %, max. 0.7 A
Communication			
Interfaces	RS 485, RS 232	RS 485, RS 232	Ethernet, RS 485, RS 232
Dimensions and Weight			
Dimensions (L × W × H)	316 × 212 × 83 mm	436 × 292 × 83 mm	183 × 139 × 68 mm
Weight	5.8 kg	9.0 kg	1.5 kg
Environmental Conditions			
Operating temperature range	+10°C up to +40°C		
Permissible relative humidity (non condensing)	10 – 80 %		

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