Anything but Conventional: Our "Eye of the Tiger"

Our Formula 1 race car for extra fine, focused laser beams will tell you everything you need to know about the quality and precision of the laser beam in your processing system – and all that right in focus at full power. The HighPower-MSM-HighBrilliance reaches its full potential in development departments as well as quality assurance. And it sure lives up to its name.

Technology is constantly advancing. Are you using NIR lasers with ever higher beam quality and high intermediate power for laser material processing as well? And are you able to achieve tiny focus diameters in the range of 20 to several 100 micrometers using these laser tools? There is no known material capable of withstanding the power densities produced during this process. Yet it is at exactly such small focus diameters that conventional scanning measuring procedures for analysis stop functioning. PRIMES has therefore expanded its camera-based focus analysis system, MicroSpotMonitor, with a highly precise HighBrilliance option especially for such finely focused high-power lasers.

Heavyweight with Outstanding Measuring Properties

The HighPower-MSM-HighBrilliance measures the focus geometries of lasers with high brilliance and single mode lasers with up to 10 kW of beam power in the range of 20 – 1 000 micrometers beam diameter directly in the processing zone – even at full power. A CCD chip makes a two-dimensional record of the power density distribution of the laser beam, with an integrated constant gas supply protecting the measuring objective from soiling.

With the HighPower-MSM-HighBrilliance, you benefit from enhanced measuring properties:

- Internal focus shift < 10 % of the Rayleigh length/kW for single mode lasers
- Observation planes of all three internal beam paths are together on a better ±1 mm
Datasheet HighPower-MSM-HighBrilliance

The Principle

95% of the laser power is transmitted through the measuring objective via a beam splitter and absorbed. The remaining 5% are further attenuated in the measuring objective and dissipated by internal water-cooled absorbers. A partial beam with a few milliwatts of power is imaged magnified on the CCD sensor.

The measuring objective was designed for beam powers of up to 10 kW single mode. In addition, the HP-MSM-HB is also equipped with a safety interlock that will disrupt laser emission when there is overheating or a device failure. This protects the measuring device against damage.

Within the focus range, the HP-MSM-HB measures power density distributions individually on up to 50 measuring planes. Beam geometry such as beam position, beam dimensions as well as the tilt of the beam axes are determined from every single distribution in keeping with the ISO11146 standard (2nd moments and power inclusion 86%).

Beam propagation parameters such as focus location, focus radius, Rayleigh length, divergence, beam quality factor M², and beam parameter product can be derived from the beam geometry data.

Practical: The beam direction error can be determined from the fiber. In addition to measuring caustics, you can also use the HighPower-MSM-HighBrilliance to investigate the temporal trend of the power density distribution of a certain plane. With a timed trigger of about 2 seconds, the behavior of the laser on the workpiece plane can be considered for example.

Two Alternatives for 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 HP-MSM-HB semi-automatically, for repetitive measuring operations in service, quality assurance, and final inspection for example. They are both alternatively individually adapted to the current measuring process. Benefit: The programmed user prompts simplify operation of the HP-MSM-HB considerably.

Diverse Models & Options

1. Measure beam geometry straight from the fiber: with a special holder for optical cable. Adapter available for LLKB, LLKD, QBH and HLC 16.

2. Measure the beam power injected into the absorber directly: with the option for power measurement.

3. Evaluate measuring results and monitor limit values with the LaserDiagnosticsSoftware (LDS).

4. Alternative beam radius definitions thanks to LDS: 2nd moments, power inclusion 86%, channel/cutting/Gaussian fit process, power density decline process 86%, and two additional power inclusion processes with freely chosen power threshold.

Left: Measured power density distribution of a focussed 4 kW fiber laser
Right: Power density scaled presentation of a caustic measurement result
Technical Data

### MEASUREMENT PARAMETERS

<table>
<thead>
<tr>
<th>Power range</th>
<th>10 W – 10 kW average power (up to 20 kW on request)</th>
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<tbody>
<tr>
<td>Wavelength range</td>
<td>1 025 – 1 080 nm</td>
</tr>
<tr>
<td>Beam dimensions</td>
<td>20 µm – 600 µm</td>
</tr>
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### FUNCTION OF THE MEASURING SYSTEM

- 2-dimensional recording of the power density distribution of the laser beam in the xy-plane by means of a CCD chip
- 6-level switchable optical attenuator 0 – 100 dB
- Measuring range x-, y-direction: 0.03 – 2 mm
- 120 mm z-range
- Spatial resolution in x- and y-direction (number of measurement points per line 32, 64, 128, 256) up to 0.5 µm per pixel, diffraction limited by the objective
- Measurement duration standard window with 64 × 64 pixels: 100 ms, repetition rate of the measurement approximately: 0.5 – 1 Hz in video mode

### SUPPLY DATA

<table>
<thead>
<tr>
<th>Power supply</th>
<th>24 V DC ± 5 %, max. 1.8 A</th>
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<tbody>
<tr>
<td>Cooling (power measurement option)</td>
<td>6 – 12 l/min</td>
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### COMMUNICATION

| Interfaces                  | Ethernet                                           |

### DIMENSIONS AND WEIGHT

<table>
<thead>
<tr>
<th>Dimensions (L × W × H)</th>
<th>600 (excluding connectors) × 400 × 391 mm</th>
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<tbody>
<tr>
<td>Weight (approx.)</td>
<td>34 kg</td>
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### ENVIRONMENTAL CONDITIONS

<table>
<thead>
<tr>
<th>Operating temperature range</th>
<th>15 – 40 °C</th>
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<tbody>
<tr>
<td>Storage temperature range</td>
<td>5 – 50 °C</td>
</tr>
<tr>
<td>Reference temperature</td>
<td>22 °C</td>
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<tr>
<td>Permissible relative humidity (non-condensing)</td>
<td>10 – 80 %</td>
</tr>
</tbody>
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