

# PowerMeasuringModule



Fiber and disc laser



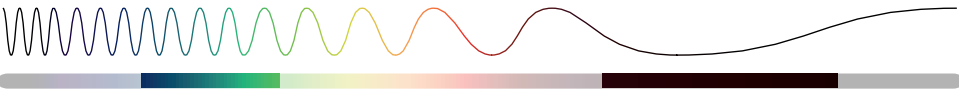
Diode laser



Ultrashort pulse laser



CO<sub>2</sub> laser



450 – 550 nm

900 – 1090 nm

**Fast, reliable and highly accurate for quality assurance in industrial laser applications.**



Caustic



Raw beam



Power



Beam profile



Pointing stability



Vector



Focus shift

POWER RANGE	400 W – 12 kW
BEAM QUALITY M <sup>2</sup>	up to single mode
BEAM DIAMETER	up to 30 mm
SPECIAL FEATURE	Accuracy ± 3 % Reproducibility ± 1 %
INTERFACES	PROFINET®, PROFIBUS®, Parallel, DeviceNet™, Ethernet/IP™, EtherCAT™

# Tech Corner

The PowerMeasuringModule (PMM) implements a fast, passively cooled power measurement using the proven calorimetric measurement principle. The measurement consists of two parts. It needs the absorber to measure the temperature rise during laser irradiation, which defines the incoming energy. The photodiode is required for the determination of the laser on-time. But due to its high-frequent sampling rate it provides quite more than that. It enables single pulse detection for pulses starting from 50  $\mu$ s. Thus, in addition to the average power, the peak power can also be calculated.

The actual laser power is finally calculated by means of energy divided by laser on-time. What makes this measurement principle preferable is the independency from various different effects, and the constantly high accuracy independent of ambient conditions. The typical measurement duration of such passively cooled calorimetric sensors is in the range of a few hundred milliseconds. This enables extremely fast measurements, e.g. during a part change cycle in a production line.

PRIMES guarantees quality through years of experience in calibrating power meters. But for a high acceptance in the industrial environment, it is necessary to ensure a high level of comparability for all the installed systems.

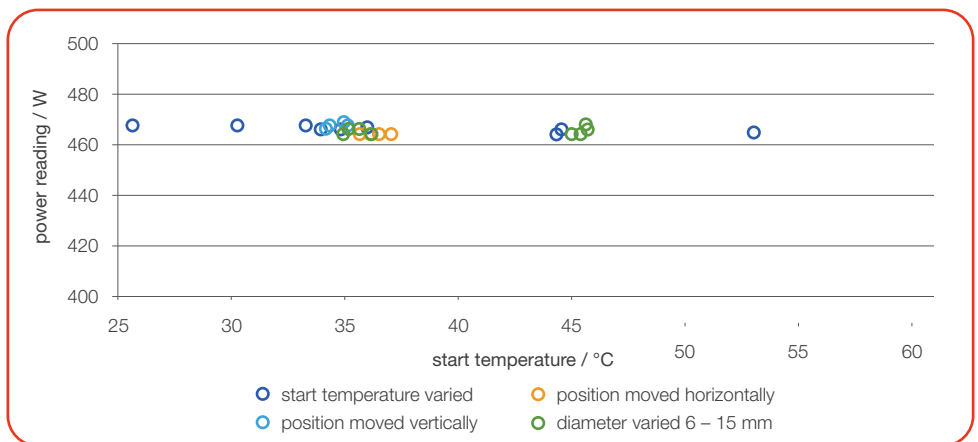


Figure: Independence from individual beam parameters

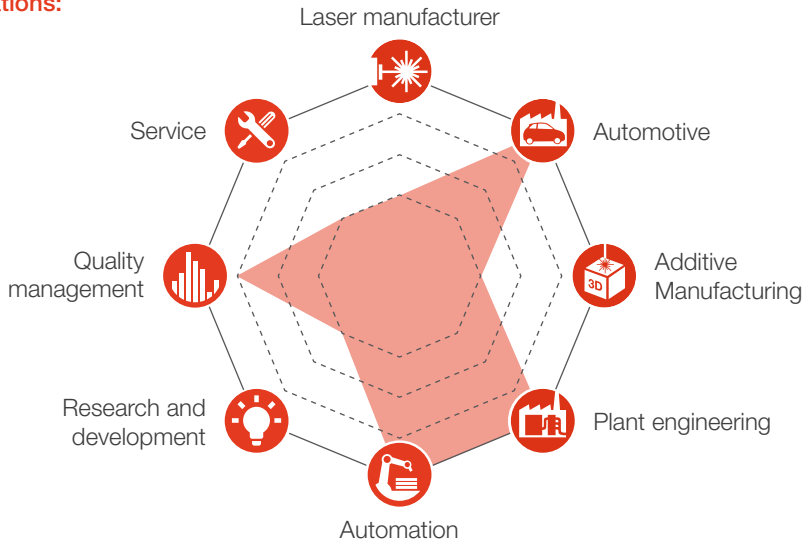
Based on the figured measurement series we would like to show that this is actually the case in field. Despite the variation of 4 parameters for those measurements, we see a standard deviation of only 0.3 % in this example. The measurement was carried out under difficult conditions, with only 460 W laser power, although the PMM allows up to 12 kW. So we are working at 3.8 % of full scale with consistent high accuracy. This is a requirement for all our power meters, in relation to the current measured value.

Operating the PMM is as simple as can be. Thanks to the availability of various fieldbus interfaces, the systems can be integrated in nearly every existing machine. The measurement results are transferred directly to the PLC. Process windows as well as warning- and limit values can be individually adapted to the application. Based on this, the system provides feedback to the operator.

MEASUREMENT PARAMETERS		PMM
Power range		400 – 12 000 W <sup>1)</sup>
Wavelength range		450 – 550 nm, 900 – 1 090 nm
Max. beam diameter		30 mm
Max. power density (peak) on the absorber (approx. 25 mm underneath the protective window) at beam diameters:		
> 10 mm		4 kW/cm <sup>2</sup>
10 – 3 mm		5 kW/cm <sup>2</sup>
3 – 1.5 mm		10 kW/cm <sup>2</sup>
< 1.5 mm		12 kW/cm <sup>2</sup>
Irradiation time <sup>1)</sup>		0.1 – 2.0 s (depending on laser power) 0.1 – 1.0 s (type AP3s)
Min. on/off times (duty cycle) for pulsed lasers		50 µs (e.g. max. 10 kHz at 50 % duty cycle)
Max. laser rise time		100 µs
Energy per measurement		400 – 3 500 J
Recommended energy per measurement		500 – 1 000 J
Total duration until measurement value output		< 5 s (AP3s); for devices with former thermalization standard: < 15 s
Nominal measurement frequency		500 J: 1 cycle/2 min; 1 000 J: 1 cycle /4 min
DEVICE PARAMETERS		
Max. absorber temperature		120 °C
Max. angle of incidence perpendicular to inlet aperture		± 10 °
Accuracy with an angle of incidence up to 10 °		± 3 %
Reproducibility		± 1 %
SUPPLY DATA		
Power supply		
DC IN		24 V DC +25 % / -20 %; 250 mA
DC OUT		24 V DC / max. 5 A
COMMUNICATION		
Interfaces (alternatively)		PROFINET® copper/fiber optics, PROFIBUS®, Parallel, DeviceNet™, Ethernet/IP™, EtherCAT™
DIMENSIONS AND WEIGHT		
Dimensions (L × W × H)		200 × 100 × 89 mm (closed) 246 × 100 × 227 mm (open)
Weight (approx.)		2.2 kg

<sup>1)</sup> The stated limit values are to be understood in correlation with the permitted maximum energy ( $E = P \cdot t$ ).

## Applications:



**System Description:** PRIMES PowerMeasuringModule (PMM) is the established standard for measuring high power lasers in industrial processes. It is designed for fast and reliable quality assurance in a rough and highly synchronised environment. Thanks to its standardised interfaces it is easy to integrate and delivers highly accurate measurement results directly to the plant. By using the well-known calorimetric principle, extremely fast measurements within 3 seconds are possible. Enough for a qualification e.g. during a part exchange in a production line.

**Your Benefit:** Laser power measurement within short cycle times enables close-meshed process control in laser material processing. Defective components as a result of process variations can thus be quickly identified. Short reaction times reduce scrap production. Service calls can be planned in a more targeted manner. **This saves time and costs in a price-sensitive production environment.**

## CONCLUSION

The PowerMeasuringModule (PMM) delivers highly accurate measurement results in almost no time. As an easy-to-integrate solution, the robust, industry proven measuring device is available with all common interfaces. The PRIMES PMM is your reliable partner for process control in industrial laser applications.

For further information please visit [www.primes.de/pmm](http://www.primes.de/pmm)

