



Laser Welding Monitor LWM



**online - monitoring at the laser
beam welding process**

- **real-time monitoring is contactless and non-destructive**
- **cw and pw mode**
- **simple teach-in for setting the reference welds**
- **100% documentation of monitored signals**
- **multi-detector system**
- **adaptable detector configuration**
- **suitable for CO₂-, Nd:YAG- and diode laser applications**

The Laser Welding Monitor LWM is a process control system that is capable of accepting or rejecting a weld during the production laser welding cycle. It automatically produces full documentation for each weld which can easily be integrated into a quality assurance system.

Depending on the type of beam source, CO₂ or Nd:YAG, and the application, the welding process is monitored by one or several detectors which are sensitive to different wavelengths.

The so-called plasma detector produces a signal that correlates the laser beam energy with the work piece. Fluctuations in laser power, variations in the focal position, changes in the shield gas supply and varying gaps between materials will all be identified. The temperature detector not only identifies changes in the heat distribution / heat derivation in the work piece but also other errors like mispositioning, partial welding through the work piece and welding failures relating to the bonding of materials. The back reflection detector provides an indication of the welding depth and can also indicate the condition of the protective window.

The Laser Welding Monitor LWM is a self-learning real time control system where the data relating to the refer-

ence pattern welds is held in the system memory. During the production welding cycle these reference results are compared to the actual signals of the current welding production run. Any differences are evaluated in real time and the probability of the occurrence of a significant weld error is calculated. The process signals for all welds are stored in the memory and can be recalled for analysis by quality control.

A display of the process drift over a number of welds can highlight any loss in laser power or contamination of optics in the head.

Simultaneous storage of all the results from component welds is possible with this system. This data can then be archived for future use and can be quickly re-called should it be necessary to analyse a component part later in the future.

Typical monitoring applications are laser welding of car bodies, tailored blanks, gearbox parts, fuel injection nozzles, drive shafts, contacting on electric and electronic components and seal welding of housings.



Illustration Welding Signals Laser Welding Monitor LWM

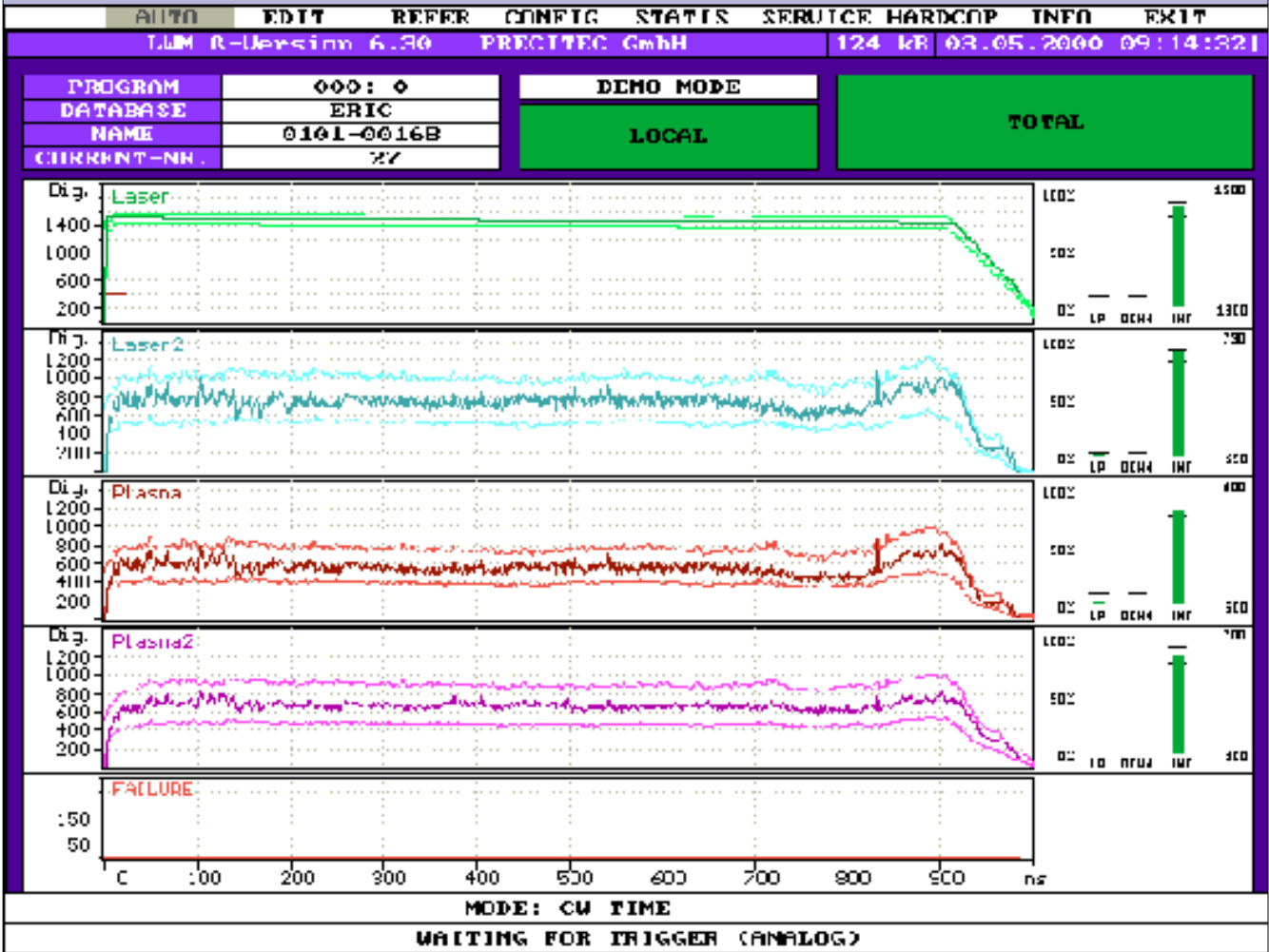
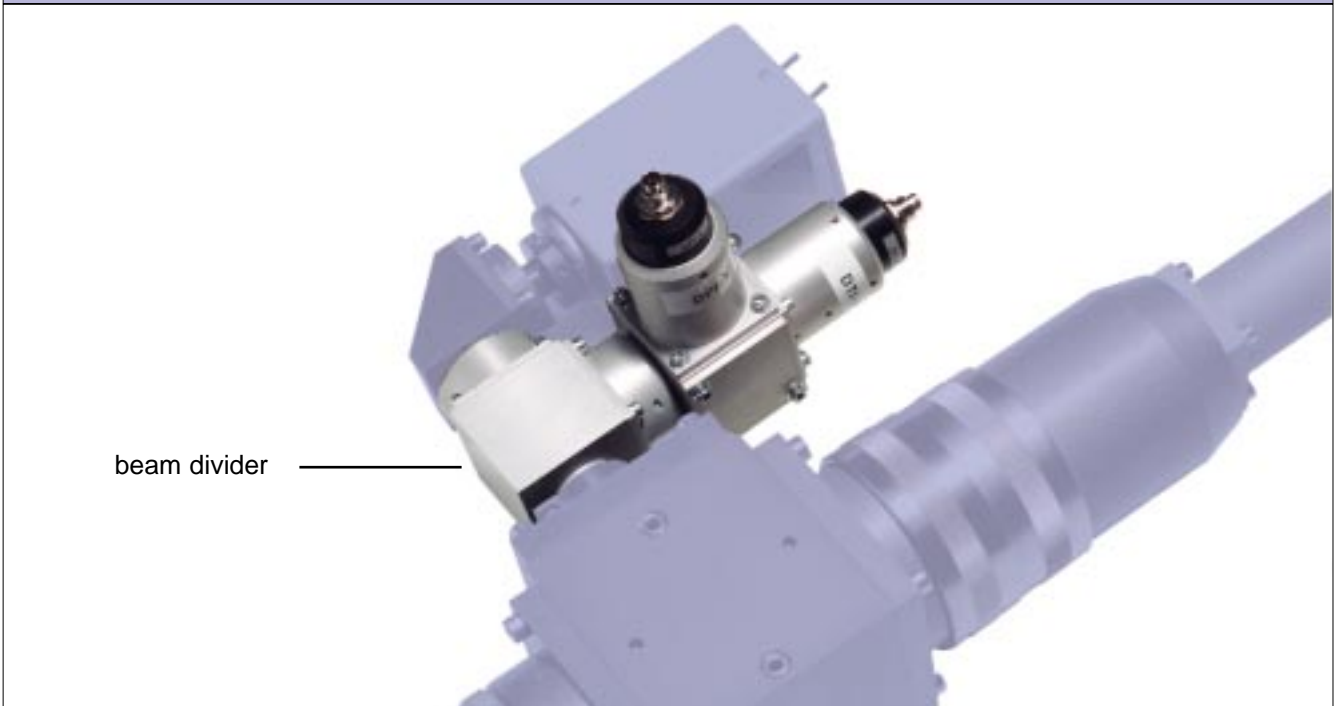


Illustration Beam Divider with attached Sensors Laser Welding Monitor LWM





Product Description

Laser welding quality is often visually controlled by the operator during or after the welding process. By using the Laser Welding Monitor LWM it is possible to determine the quality of the weld during the laser welding process.

The LWM requires baseline, audited welding samples to establish a known good operating point. This is known as process referencing. With these baseline signals the LWM evaluates the differences between the process reference and the current signals. From this the probability of a welding error can be calculated. The crossing of the set boundaries will cause the system to report an error in the welding process which in turn will be reported directly to the connected SPS.

Usable Detectors

Depending on the application the welding process can be monitored by one or several detectors. Using more than one detector improves the correlation between the weld seam quality and the achieved monitoring results. With the aid of the extra signals the behavior of a specific signal can be interpreted more effectively. That's why the number of „pseudo error message“ can be radically reduced.

Plasma Detector

The plasma detector records the emitted UV radiation of the plasma cloud with the help of analysed values of

the amplitude. But the Laser Welding Monitor LWM evaluates this information only through the summary of the signal changes based on the saved reference values. Changes of the laser power, the focal position, the shield gas supply and the volume gas flow may be identified. It can detect defects in the component parts which are being welded and identify the opening of the weld gap. It can also show whether the weld is central to the two parts being welded and will highlight any mis-positioning of the material.

Temperature Detector

The temperature of the weld seam is recorded through the temperature detector located directly behind the welding head. All changes to the heat distribution and the heat deflection in the welding work piece will influence the signal. This enables partial weldings to be identified.

Back Reflection Detector

For Nd:YAG welding applications the gathering of the reflected laser beam from the work piece is undertaken by the back reflection detector. The back reflected signal can be directly associated with the steam capillary and so relates to the welding penetration.

If you would like any further technical information on the available sensors used with the LWM please contact us.

Technical Data		Laser Welding Monitor
wavelength range for plasma detector		
CO ₂ -laser		<400 nm
Nd:YAG-laser		<600 nm
wavelength range for back reflection detector		1064 nm
wavelength range for temperature detector		1100 nm - 1800 nm
sampling frequency		
cw		25 Hz - 8 kHz
pw		1 kHz - 50 kHz
power supply voltage		115 / 230 V AC / 50 / 60 Hz (+- 10%)
I / O-signal level SPS		24 V DC
number of parallel processed analog inputs		max. 8
number of digital inputs		16
number of digital outputs		16
number of selectable references		max. 32
capacity of memory hard disc		max. 35.000 weldings
mass (without switchboard)		25 kg
operating temperature		5° C till 55° C



Connection Possibilities

For Nd:YAG-laser applications the detectors are fitted directly to the welding head - on the camera flange. For monitoring the welding process the internal light way will be utilised. That's why the sensors are looking at the welding spot perfectly and consequently are well protected against pollution.

For CO₂-laser applications the detectors are mounted externally on the welding head. These detectors are protected against pollution through the easily exchangeable protective window. For applications with CO₂ - or Nd:YAG-lasers different detectors are required. The detectors are connected over shielded lines with line drivers (ASLR). These lines can have a length up to 30 m.

The electrical connections between the Laser Welding Monitor LWM and the SPS is done through opto-isolated 24V digital I/O. This comprises a minimum of one release signal from the SPS and one fault signal to the SPS. It is possible to store and compare upto 32 reference work piece welds simultaneously with the weld currently in process. This will ensure that the welding

process is kept fully optimized throughout each production run. The system operator can be made aware of any problems as soon as they occur ensuring that the quality of each weld remains sound. The LWM will also reduce the amount of rejects produced by a welding system which should give cost savings due to less material being scrapped during the production cycle.

The heart of the welding monitoring LWM consists of the registration of the measured data stored on a industrial PC. On this PC the parameters are stored, and the supervision of all process signals are undertaken, by a menu-driven dialog. The system is delivered in an enclosed cabinet to protect the keyboard and monitor.

The LWM system hardware and real-time software give a powerful universal monitoring tool. Production of reject parts is minimized through this use of a constant monitoring process. Where errors have occurred the system provides total traceability of workpieces by relating the signals to part numbers and welding data.

Ordering Data		Laser Welding Monitor LWM
Product	Designation	Order Number
LWM basic platform (E)	PLWM E	P0101-105-00001
Analog-In-Board (1...4)	ZE LWM AIN	P0101-240-00001
monitor	ZE LWM VGA 15"	PBCB0-004-242KF
keyboard US	ZE LWM KEY US	PBEB0-004-243KF
Nd:YAG-detectors		
T-detector	SD LWM DTI-Y	P0101-790-00001
P-detector	SD LWM DPI-Y	P0101-560-00001
R-detector	SD LWM DRI-Y	P0101-640-00001
sensor cable	KS I-SKAB L0,6	P0101-390-00600
line driver		
ASLR 2-channel DIP, internal	ZE LWM ASLR2DI	P0101-820-00001
beam dividing cube	ZM LWM BS	P0101-630-00001
CO₂-detectors		
P-detector	SD LWM DPE-C	P0101-500-00001
P-detector	SD LWM DTFE-C	P0101-520-00001
sensor cable	KS E-ASLR2 L2	P0101-355-02000
line driver		
ASLR channel DIP, external	ZE LWM ASLR2DE	P0101-810-00001
cable	KS ASLR2-LWM L10	P0101-360-10000
cable	KS ASLR2-LWM L20	P0101-360-20000
cable	KS ASLR2-LWM L30	P0101-360-30000
cable	KS LWM-LAS L10	P0101-371-10000
cable	KS LWM-LAS L20	P0101-371-20000
cable	KS LWM-LAS L30	P0101-371-30000
electrical cabinet PC 4610	ZM LWM CAB PC 4610	P0101-180-00001

Subject to change without notice

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