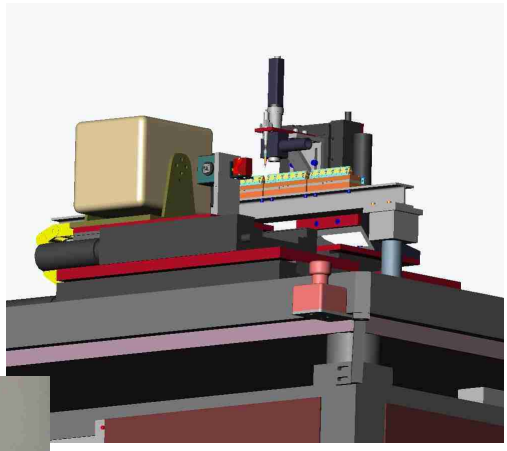
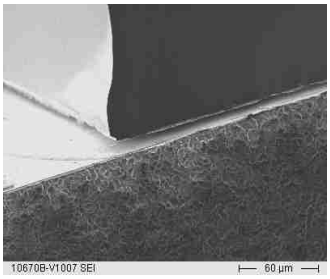
EOCS

ELECTRO OPTICAL CHARACTERISATION SYSTEM





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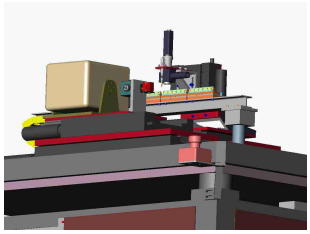
1 GENERAL DESCRIPTION



The EOCS is a fully automated, high performance, reliable and flexible measurement system to characterize and test edge emitting laser diode bars in an efficient way.

The system measures front and back optical power and voltage as a function of current, threshold, kink, horizontal and vertical far fields and optical spectrum.

The system is easy to use. The laser bars to be tested are loaded and unloaded on an external (manual or automated) loading station on dedicated test chucks which will then be transferred to the EOCS. Depending on actual size in the order of 20 bars corresponding to typically 1'000 diodes can be loaded on the EOCS simultaneously which results in a testing autonomy of about four hours without required intervention of an operator.

The measurement data together with the individual chip-ID is locally stored and regularly and automatically transferred through an Ethernet connection to a database on the network. 100% traceability of the measurement data for each laser diode is guaranteed independent from the used EOCS system by allocating each laser diode bar to the individual chuck-ID at the loading station which is also integrated in the process software.

The size of the equipment is 1.5 m x 1 m x 1.8 m (L x W x H). It requires 220 V (or 110 V), vacuum (0.8 Bar) and Ethernet connections and is designed for clean room environments (Class 10'000).

1.1 FLEXIBILITY

The EOCS is a very flexible system in various aspects. Different laser bar geometries can be tested on the same system. Only the chucks need to be adapted. Different types of lasers (pump lasers, broad area or single wavelength transmitters) with different power levels can be characterized. The testing temperature can be varied between 15°C and 80°C. The testing parameters (e.g. power levels for far field measurements) can easily be adjusted by software. Pass and fail criteria can individually be defined by software.

A modified version of the EOCS can test laser diodes soldered on submounts (chip-on-submount, CoS) instead of laser bars.

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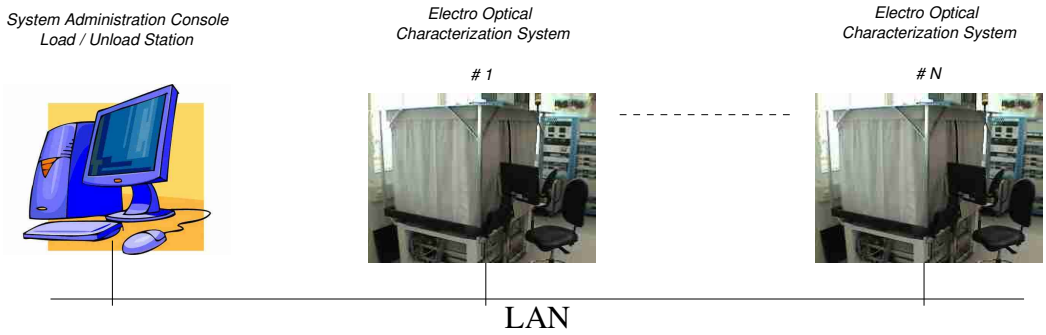
1.2 MODULARITY

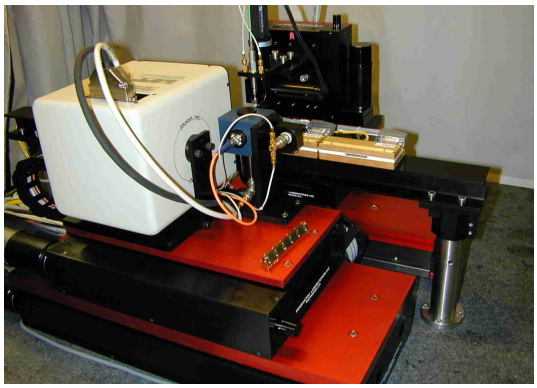
The EOCS consists of different modules for power, far field and optical spectrum measurements. The customer selects individually which modules are required to receive best performance at highest throughput and lowest cost. In addition to the electro-optical measurement modules it is also possible to integrate on request an automated optical inspection module to inspect top surface as well as front and back mirrors of the lasers diodes.

1.3 SCALABILITY

Several EOCS can easily be connected to the same network to increase test capacity and throughput.



1.4 EQUIPMENT



The system is built on a massive vibration-free granite table for highest accuracies. Reliable measurement equipment from proved vendors is integrated in the system. The EOCS includes a parameter and a spectrum analyzer, integrating spheres, a goniometric radiometer, motion controllers, temperature controllers and a vision system.

The EOCS is controlled by a reliable PC suitable for industrial environment with Windows or Linux operating system.

1.5 SAFETY STANDARDS

The EOCS is designed and built in conformance to all relevant safety standards.

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2 GENERAL SPECIFICATION

2.1 TEMPERATURE CONTROLER SPECIFICATION

Symbol	Parameter	Min	Typ	Max	Unit	Remarks
T_L	Temperature Range	15	25	80	°C	
A_T	Accuracy of Temperature Set Point	-	0.1	0.5	°C	

2.2 POWER SOURCE SPECIFICATION

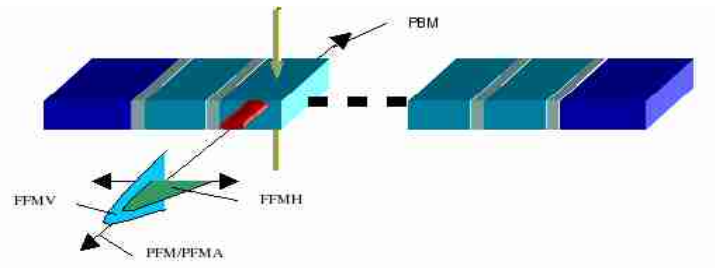
Symbol	Parameter	Min	Typ	Max	Unit	Remarks
I_{CC}	Continuous Current	0	1	10	A	higher current on request
I_{PC}	Pulsed Current	0	1	10	A	higher current on request
t_w	Pulse Width	-	0.1	1	ms	
t_{DC}	Pulse Duty Cycle		1	10	%	

2.3 DEVICE SPECIFICATION

Symbol	Parameter	Min	Typ	Max	Unit	Remarks
l_D	Device Length	0.750	3.600	10	mm	Other dimensions on request
W_D	Device Width	10	300	-	µm	Other dimensions on request
H_D	Device Height	-	150	-	µm	Other dimensions on request
n_D	Number of Devices	-	40	-	#	Other numbers on request

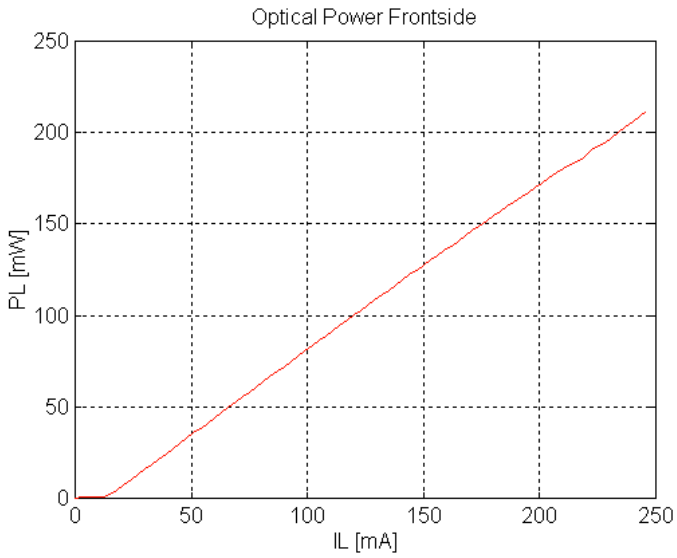
3 MEASUREMENT SPECIFICATION

The picture below shows typical parameters to characterize laser diodes. For each parameter a measurement module is available which can easily be integrated into the existing base module of the EOCS.



3.1 POWER MEASUREMENTS (PFMA, PFM, PBM)

The actual design includes three Power Measurement Modules, power front mirror, power front mirror with aperture and power back mirror. Using these three measurement capabilities it is possible to fully characterize laser diodes with respect to optical power emissions. Measuring the power front mirror with an aperture allows detecting distortions such as the kink behavior on edge emitting laser diodes. The stable, fast and accurate measurement technique is a very strong base for automated production tests.



Symbol	Parameter	Min	Typ	Max	Unit	Remarks
P_L	Optical Laser Power	-	1	10	W	higher power on request
A_{PM}	Accuracy of Power Measurement	-	0.1	0.5	% FS	
BW_{PM}	Sensor Bandwidth: DC to	-	100	-	kHz	
t_{SPM}	Time for Single Point Measurement	-	15	100	ms	single point measurement
t_{PIM}	Time for PI-Curve Measurement	-	4	-	s	curve with 300 measurement points

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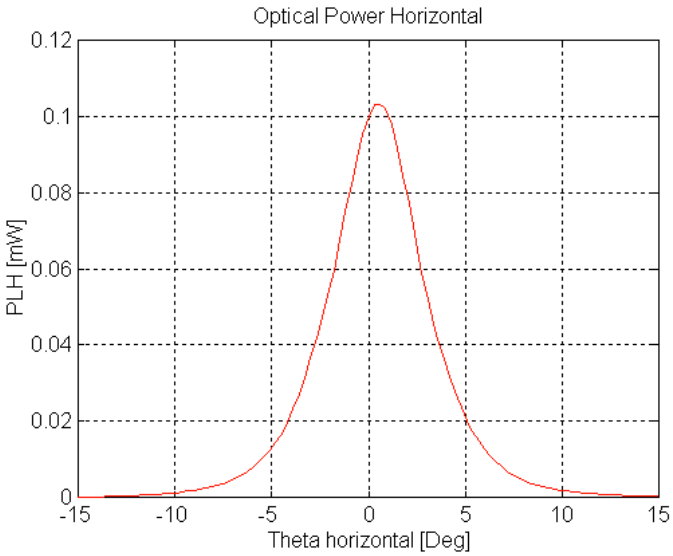
3.2 FAR FIELD MEASUREMENTS (FFM)

The Far Field Measurement Module provides the capability to measure the optical power distribution along the horizontal and/or vertical axis. If the optional 3D-Mode is enabled it is also possible to collect data for a 3D-scan to get the full 3D-distribution of the optical power.

With an accuracy of 0.05° and a single line scan time of less than 100 ms this module is again very suitable for automated production tests.



Symbol	Parameter	Min	Typ	Max	Unit	Remarks
θ_L	Far Field Measurement Angle	-72	-	72	°	
A_{FFM}	Accuracy of Far Field Measurement	-0.05	-	0.05	°	
P_{FFM}	Maximal Power of Far Field Measurements	-	-	10	W	higher power on request
λ_{FFM}	Spectral Sensitivity of Far Field Measurement	300	-	1100	nm	other wavelength on request
t_{LS}	Time for Line Scan (2D)	-	20	100	ms	
t_{FS}	Time for Full Scan (3D)	10	-	100	s	depending on number of scans

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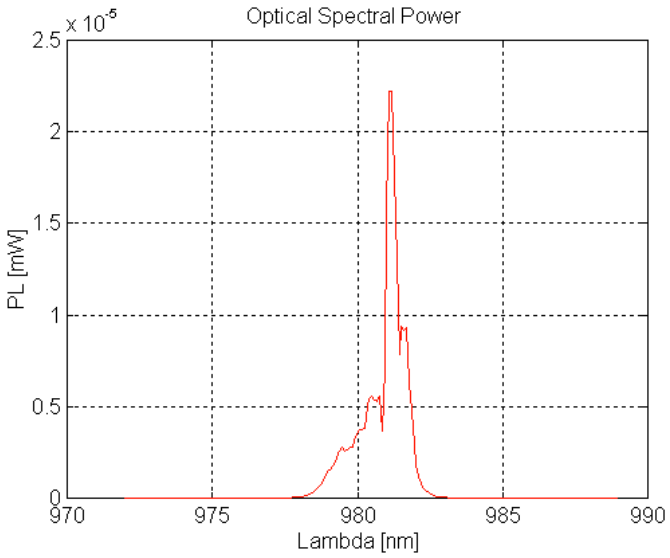
3.3 OPTICAL SPECTRUM MEASUREMENTS (OSM)

Measuring the optical spectrum provides detailed information about the epitaxy process at the beginning of the laser diode manufacturing sequence. Depending on the used measurement head laser diodes or bare epitaxial structures can be characterized.

The implemented measurement sequence starts with a fast low resolution scan within the specified wavelength range. After signal detection a high resolution scan follows to determine additional parameters such as center wavelength and bandwidth.



Symbol	Parameter	Min	Typ	Max	Unit	Remarks
λ_L	Wavelength	600	-	1700	nm	other wavelength ranges on request
A_{OSM}	Accuracy of Optical Spectrum Measurement	-	0.01	0.5	nm	depending on calibration mode
t_{OSM}	Time for Single Scan of Defined Span	-	1	3	s	depending on span width and desired resolution

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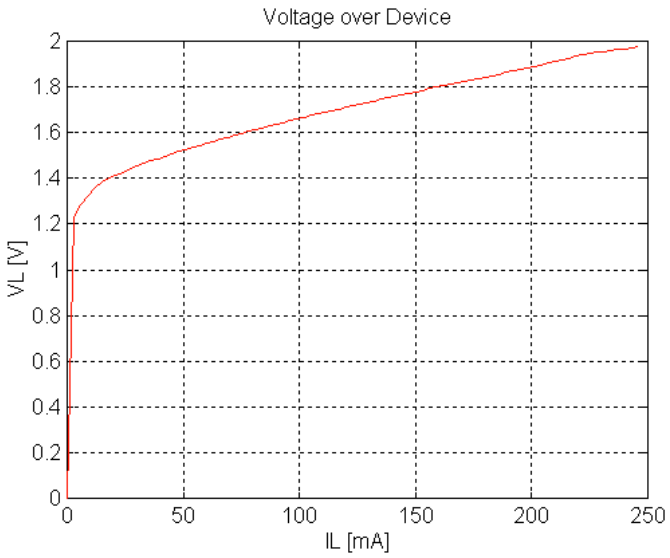
3.4 DEVICE VOLTAGE MEASUREMENTS (DVM)

The Device Voltage Measurement measures the forward voltage over the laser diode as a function of the current. This measurement can be combined with the power measurements to reduce the overall test time.



Symbol	Parameter	Min	Typ	Max	Unit	Remarks
V_L	Voltage Range	-100	-	100	V	-
A_{DVM}	Accuracy of Device Voltage Measurement	-	0.1	0.5	mV	-
t_{SPM}	Time for Single Point Measurement	-	15	100	ms	-
t_{VIM}	Time for VI-Curve Measurement	-	4	-	s	curve with 300 measurement points

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