

Pearl

Pearl is an optical in-line monitoring system, measuring photoluminescence spectra of thin film modules in production lines. The system is designed for measuring on CIGS based production lines. Photoluminescence spectra allow a fast detection of the effective Ga content of the absorber during the production process. A product option for CdTe absorbers is also available.

Pearl features

- in-line measurement of photoluminescence spectra of thin film modules in production lines
- real-time data evaluation and visualization
- characterization of the absorber composition during production time

Communication / integration

The system can interface to production machines using a variety of interface protocols: TCP/IP, Profibus, DeviceNet, RS232, RS 485, SECS II / GEM, OPC and others on request. Customer specific adaptations are possible. Specific software / hardware interfaces can be implemented based on 5V TTL or 24V voltage/current on request.

Typical accuracy of the measurements

PL Peak position: ± 0.5 nm
Ga-content sensitivity in CIGS: ± 0.01 GGI (molar Gallium/(Gallium + Indium) ratio)

How it works

A spot with a size of approx. 1 mm^2 on the CIGS surface is excited by an IR laser beam. On recombination of the produced electron/hole pairs, the absorber material irradiates photoluminescence light. The luminescence light is analyzed by a spectrometer. Features of the spectrum are significant for the Gallium content of the absorber and V_{oc} of the ready-made modul.

With Pearl this measurement can be performed in-line, immediately after the absorber deposition. The results can be fed back to the production machine.

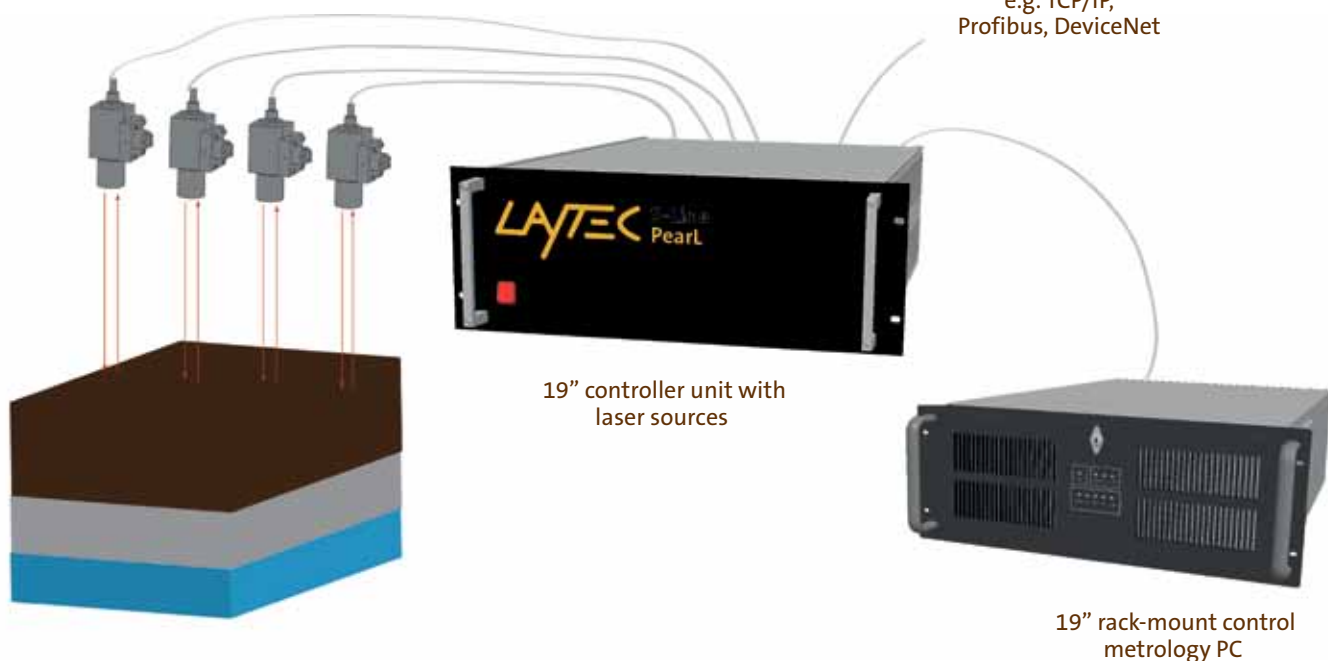


PearL standard package

up to 4 measurement heads

optical fiber connectors

machine interface
e.g. TCP/IP,
Profibus, DeviceNet



Details of the set-up:

The figure above shows the set-up of the Pearl system in a production line.

Pearl is based on LayTec's proven modular platform for in-line optical set-ups. A controller unit contains all optical and electronical components including a real-time embedded controller for highest reliability. Slim optical fibers guide the measurement light between the controller unit and the measurement positions. Miniaturized measurement heads provide optimum optical performance with low foot-print. Sophisticated automated analysis, monitoring, and storage of the data are provided by a metrology PC connected to the controller unit. Optionally, Pearl integrates with production machines and software systems by a large variety of protocols like OPC, Ethernet, ProfiBus, and others.

Mounting and adjustment units are customized to fit to the requirements of the specific production line. The device needs to be calibrated only once. This will be done during the installation.

Components

light source	laser (laser class 3b)
laser wavelength	808 nm
measurement interval	1 s

PearL standard package

Control computer (subject to technical changes)

- 19" rack mount control computer
- CPU: Pentium Core 2 Duo, min 1.66 GHz, RAM min. 1 GB
- HDD min. 160 GB, RAID 1
- DVD-writer, card reader, mouse, keyboard
- 1 Gbit/s LAN interface or better
- operating system: Windows XP pro MUI (multi language version)
- 19" TFT flat screen (monitor resolution of 1280 x 1024 or higher)

Cables

- ethernet Cat5 + TP cable
- metal shielded optical fiber between controller and optical heads
- multi-plug and power cables

Miscellaneous items

- customized mounting and adjustment unit
- manual and software CD
- trigger units for detecting incoming glass substrates (available on request)

Interfacing Option

LayTec can offer the following options:

- ProfiBus
- DeviceNet
- OPC
- Straight Wiring: connecting analog or digital signals via wire pairs as the simplest way of interfacing. Available are 24 V current loops (4-20mA) or voltages (0-10V) (only very limited information transport is possible)
- other options on request, e.g. LightBus, EtherCat, CANBus, ModBus, InterBus.

Requirements to the production line

- free optical access to the substrate at the measurement position
- distance between detection head and substrate: 190 mm. Others on request.
- distance between controller and detection head: typ. < 10 m
- Laser light beam must be shielded according to local regulations

PearL requirements

Sizes and weights of the parts

Parts	Size X x Y x Z mm	Weight, kg
detection head	154 x 108 x 152.5	2.0
controller	450 x 600 x 180	17.0
rack mount control computer (4 HE)	450 x 600 x 180	17.0
19" LCD display	410 x 20 x 420	5,5
additional: customized adjustable mounts		

Operating conditions

Component	Allowed temperature range	
	operation	storage
electronic control unit	10°C – 40°C	10°C – 60°C
control computer	10°C – 35°C	10°C – 60°C

Please note:

- device contains a class 3b laser source
- optical head and controller are fragile, avoid shock-treatment
- optical fibers must not be kinked. Min. bending radius: 150 mm
- vacuum proof design are available on request

Electrical connections / power consumption

- the mains connection (100-240 V) including extension cables has to be provided by the customer
- input voltage: 100 - 240V AC wide range
- the power supply must be equipped with grounding wire
- power consumption (typical values for 230 V operation):

Component	current / A typical	power /W typical
control computer	0.5	115
monitor	0.3	60
controller	0.5	120
sum	1.3	295

Specifications are subject to further technical development and may differ from those given in the datasheet.

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