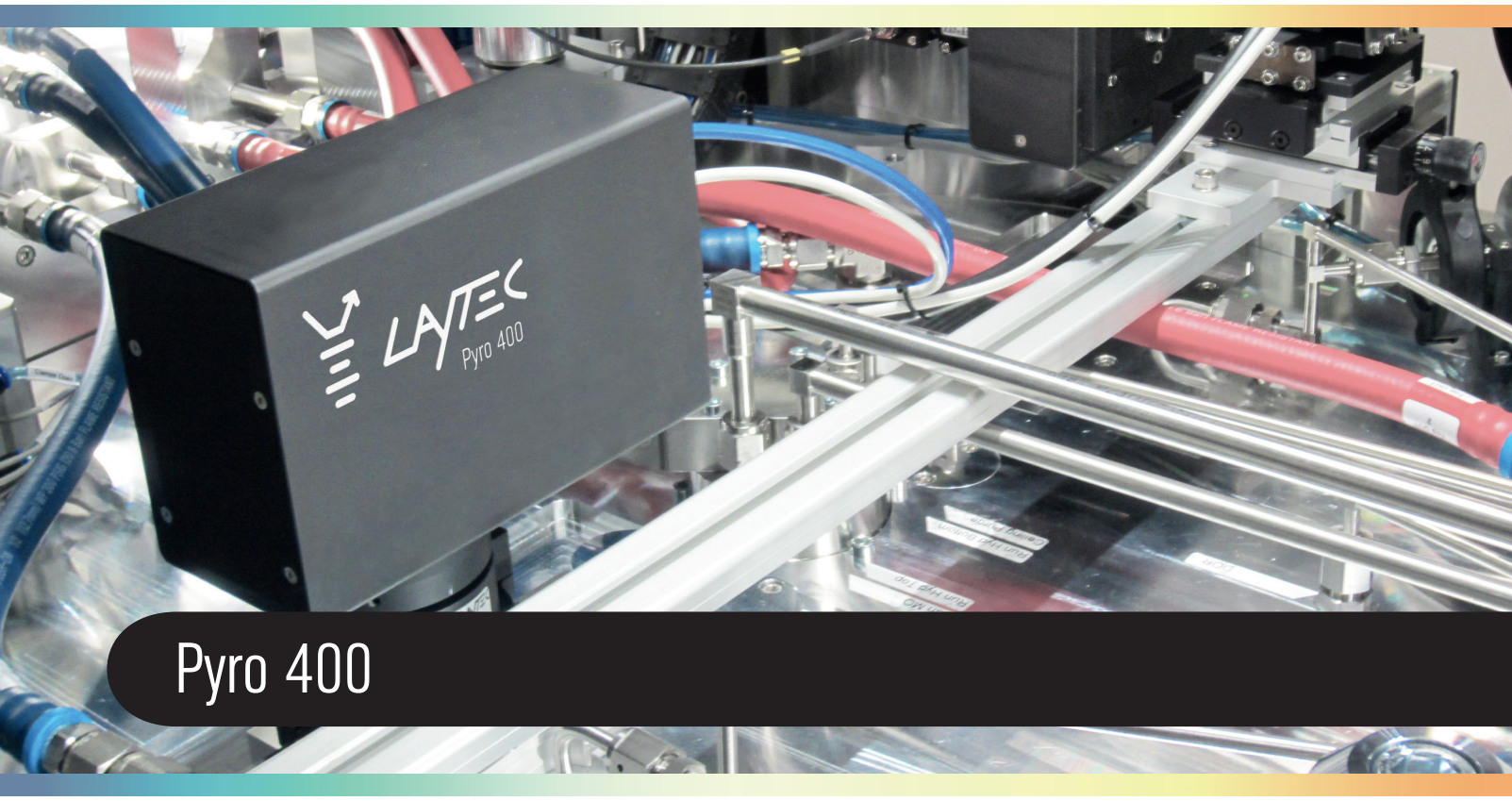


Pyro 400

LayTec's Pyro 400 is a production line in-situ metrology tool for monitoring real GaN surface temperatures in MOCVD systems. The tool measures real wafer surface temperature during GaN buffer and multiple quantum well (MQW) growth. Pyro 400 is ideal for growth optimization and temperature control in LED and laser production.

Features

Pyrometry

- Ultra violet (UV) pyrometry
- Wafer-selective measurements of the real surface temperature for GaN and SiC
- Pyrometer is calibrated against black body radiation source
- Temperature profile measurement across all wafers
- Applicable for quantum well growth in blue and green LEDs

It is recommended to install Pyro 400 in combination with EpiCurve® TT or EpiTT if a second viewport is available in order to correlate wafer temperature with pocket temperature, multi-wavelengths reflectance and curvature

Communication / Integration

- Data exchange with growth system control computer via hardware interface and / or TCP / IP protocol based software interface
- Possible remote control from growth recipe

Measurable growth parameters

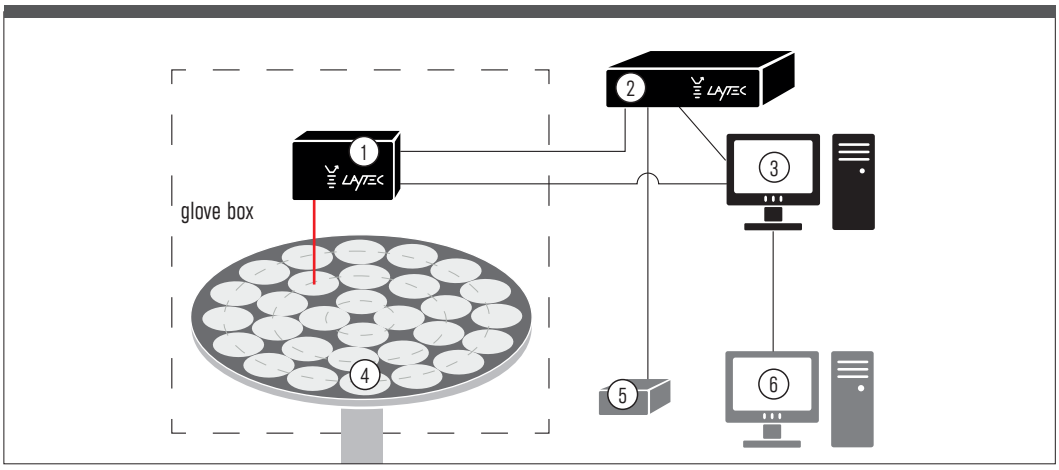
- GaN and SiC surface temperature*
- Linear temperature measurement range: 700°C to 1200°C
- Noise at 1000°C is ± 0.2 K
- Noise at 700°C is ± 1 K

* Please note, for GaN on sapphire: the minimum thickness of the GaN buffer layer for accurate Pyro 400 measurements is 750 nm at 1000°C and 2500 nm at 720°C respectively. Furthermore, the indicated noise is for standard viewport and susceptor geometry. Please note that most specifications are reactor-dependent!

Additional features

- Optimized for 24 / 7 operation in production environments
- Low maintenance

System components



Parts

1 – Optical head
2 – Electronic control unit
3 – LayTec control computer (includes: measurement PC, TFT flat screen, mouse, keyboard)
4 – Deposition system (not delivered by LayTec)
5 – Rotation encoder (optional by LayTec on request)
6 – Growth control computer (not delivered by LayTec)

Optical head

Max. rotation frequency of susceptor	20 rpm
Pyrometry wavelength	~ 400 nm
Typical sampling rate	100 Hz
Data repetition rate	1 revolution of main susceptor

Please note that most specifications are reactor-dependent!

Electronic control unit

The control unit is a standard 19” box that can be easily mounted into existing 19” racks. It is connected with the control computer and the growth system as shown in the example drawing in Section “System Components” (Part #2).

Control computer (minimum)

- 19” Rack mount control computer
- CPU: Pentium Core i5, 3 GHz, RAM 2 GB
- HDD 500 GB, RAID
- Blu-Ray Disc™-writer, mouse, keyboard
- 100 Mbit / s LAN interface or better
- Operating system: Windows embedded standard 7
- 19” TFT flat screen

Miscellaneous items

- Mounting unit
- Manual and software CD
- Additional USB license dongle
- KF 40 cable feed through
- Bootable system recovery DVD

Cables

Type	Number	Parts connected	Length (m)
9-pin power supply cable	1	Optical head - electronic control unit	10
15 pin interface cable*	1	Growth system - electronic control unit	5
RJ45 EtherCAT data cable	1 1	Electronic control unit – LayTec control computer optical head - LayTec control computer	10 10
Multi socket	1	LayTec control computer / electronic control unit – electrical power source	1.8
Power cables with localized plug connectors	2		

* Transfers the rotation trigger. When EpiTT or EpiCurve® TT is used in combination with Pyro 400, also transfers marker signals and exports analog voltages proportional to the measured temperature and reflectance.

Communication with growth system

The electronic control unit is connected to the growth system by a 15 pin interface cable (trigger pulse is mandatory). Optional LAN connection to growth control computer is available. Please note: for the LAN connection a special software interface on the growth system computer is necessary. The interface should be arranged by the customer with the manufacturer of the deposition system.

Communication features	15 pin interface cable	LAN connection
Rotation synchronous trigger pulse (once per susceptor revolution) from growth system	5 V TTL or open collector signal*	–
Start/stop signal from growth system for remote control from the recipe	5 V TTL or open** collector signal	Via TCP / IP
Up to 3 additional marker signals to indicate different growth steps and for data synchronization with the growth recipe	5 V TTL or open** collector signal	Via TCP / IP
Process temperature from thermocouple or Eurotherm for ad-vanced logging and calibration purpose	–	Via TCP / IP

* This line is mandatory for multiple wafer systems and strongly recommended for motor driven single-wafer systems.

** when Pyro 400 is used in combination with EpiTT or EpiCurve® TT.

Operating conditions

Component	Temperature range (°C)	
	Operation	Storage
Optical heads	10° – 40°C	10° – 60°C
Electronic control unit	10° – 35°C	10° – 60°C
Control computer	10° – 35°C	10° – 60°C

- Warm-up time: <15 min
- Vibrations of optical heads have to be avoided during the measurement
- Optical heads are fragile, avoid shock-treatment

Size and weight of the parts

Parts		Size: Width x Height x Depth (mm)	Weight (kg)	Comments
Optical head		191 x 80.2 x 120	1.6	
Control computer	Measurement PC	450 x 600 x 180	15	19” rack 4 U* 180 mm slot with 600 mm depth necessary
	TFT flat screen	410 x 200 x 420	5.5	19”
Electronic control unit		450 x 300 x 180	6	19” rack 4 U, 84 HP* 180 mm slot with 400 mm depth necessary

* U Rack Unit = 1.75 inches or 44 mm / HP - horizontal pitch = 1/5 inch or 5.08 mm

Electrical connections / power

- LayTec provides cables for power connection (120 V-240 V)
- Input voltage: 120 V / 240 V auto detect
- Power consumption (typical values for 230 V operation):

Component	Inrush current / A	Power / W typical	Power / W max.
Control computer	3.5	100	500
Monitor	1.5	35	40
Control unit rack	0.3	30	70
Total	5.3	165	610

Reactor requirements

- MOCVD systems with sufficiently large viewport (please contact LayTec). Examples of minimum ceiling opening: for AIXTRON G4: 6 x 12 mm, for AIXTRON G5: 8 x 18 mm
- Complete access to standard-normal-incidence viewport
- Rotation synchronous pulse, once per revolution
- For remote control: TCP/IP connection to MOCVD system
- KF40 feed-through or other feed-throughs for two cables and connectors
- Rotation frequency of susceptor: 1 to 20 rpm
- For the simultaneous usage of EpiTT or EpiCurve® TT a second optical viewport is mandatory

Availability

- Off the shelf Pyro 400 standard adaptations are available for AIXTRON Planetary MOCVD systems (G3, G4 and G5)
- Pyro 400 can be adapted to other MOCVD systems on request

Specifications are subject to further technical development and may differ from those given in the data sheet. In certain cases, performance may be limited by reactor type and/or growth conditions. Please consult our technical sales team to see how LayTec metrology can best serve your specific application.

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Knowledge is

Developed, manufactured and qualified in Germany.

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