



EpiCurve[®] TT for AIXTRON Close Coupled Showerhead[®]

EpiCurve[®] TT is an optical in-situ sensor for epitaxial growth monitoring. It features wafer curvature measurement, emissivity corrected wafer temperature and high-accuracy reflectance measurement for growth rate analysis.

EpiCurve[®] TT features:

Curvature

- wafer selective curvature measurement with a 2-dimensional detection system

Temperature

- wafer selective true temperature measurements, pyrometer calibrated against a black body radiation source

Reflectance

- wafer selective reflectance measurements at two wavelengths: 950 nm and a customized second wavelength (405 nm or 488 nm or 633 nm or 950 nm)
- multiple position reflectance and temperature measurements in multi-wafer configurations (e.g. for comparison center to edge on the wafer)
- line scan measurements across the wafers for uniformity evaluation
- on-line wafer selective growth rate fits using virtual layer approach or alternatively oscillator fits
- recipe controlled automated growth rate fit for multi-layer structures
- optical wobble compensation included
- measurements on single and multiple wafers
- optimized for 24 h/7day operation in production environment

Communication / integration

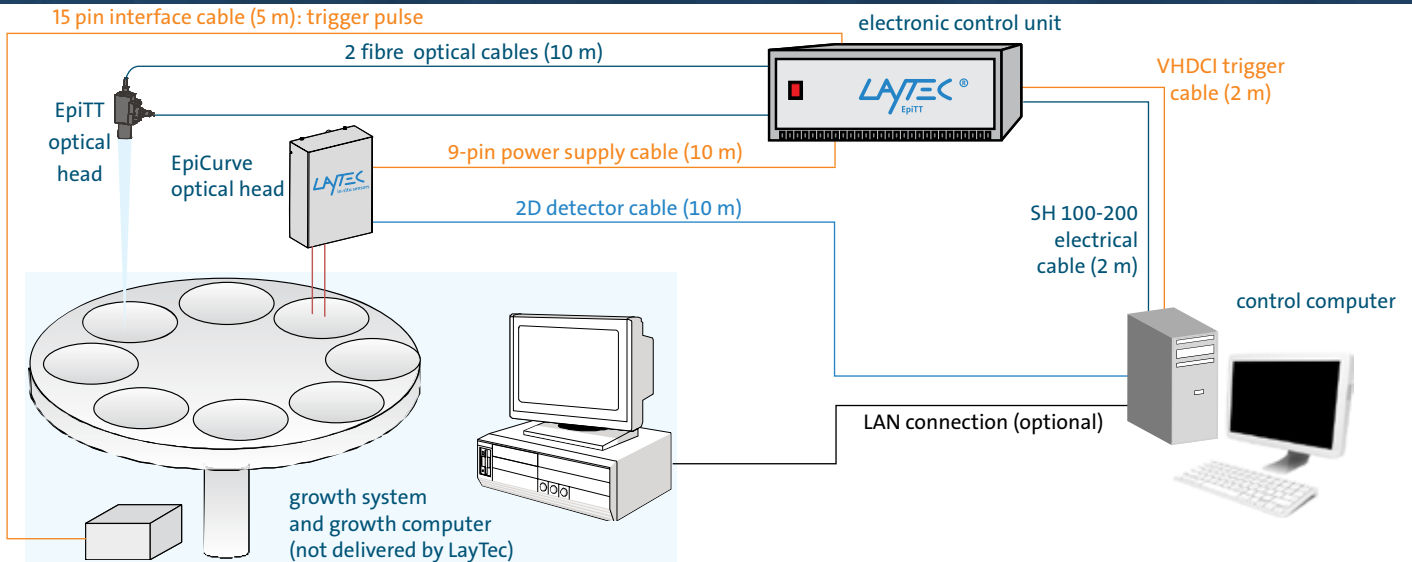
- direct communication with AIXTRON AIXact software
- data exchange with growth system control computer via hardware interface and/or TCP/IP protocol based software interface
- remote controllable from growth recipe
- heartbeat/watchdog signals for SPS integration

Measurable growth parameters

- wafer curvature 1/R: - 7000 km⁻¹ (convex) to + 750 km⁻¹ (concave), typical accuracy: ± 3 km⁻¹
- reflectance: noise typically better than ± 0.5%
- growth rate: typical accuracy better than ± 1% (down to 0.001 nm/s)
- wafer temperature: typical accuracy better than ± 1K: temperature range: 500 – 1400°C



EpiCurve® TT for AIXTRON CCS® standard package



EpiCurve® optical head for curvature measurements

light source for curvature measurement	compact 656 nm laser diode
typical life-time according to manufacturer	15.000 h
curvature (1/R) detection limits	-7000 km ⁻¹ to +750 km ⁻¹ bowing
maximum curvature (1/R) resolution	± 3 km ⁻¹
curvature sampling rate	1 point per wafer (triggered to center) and susceptor revolution, max. rate 10 Hz*

EpiTT optical head for combined reflectance and wafer temperature measurements

light source for reflectance measurement	combination of ultra high brightness LEDs
typical life-time according to manufacturer	20.000 h
reflectance measurement wavelength and bandwidth	633 nm ± 1.5 nm or 488 nm ± 5 nm or 405 nm ± 5 nm or 950 nm ± 1 nm
pyrometry wavelength and bandwidth	950 nm ± 5 nm
typical sampling rate	2...5 kHz
data repetition rate	4 revolutions of main susceptor

Electronic control unit

The control unit is a standard 19" case that can be easily mounted into existing 19" racks. It is connected with the control computer and the growth system as shown in the drawing above.

Control computer

- 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
- 100 Mbit/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)

Miscellaneous items

- reactor specific mounting and adjustment unit
- manual and software CD
- additional USB license dongle for growth rate analysis and growth rate fit on office computer
- special coated 2", 3" or 4" Al-Si eutectic wafer for temperature calibration
- curvature calibration wafers (2", 3" or 4"), one convex and one concave, characterized

* In CRIUS 30 x 2" measurements on all wafers are possible for rotation speed ≤ 75 rpm

EpiCurve® TT for AIXTRON CCS® standard package

Cables

- 2 optical fibres (10 m, optical head EpiTT <-> electronic unit), the minimum bending radius of the fiber cables is 36 cm
- 9-pin power supply cable (10 m, optical head EpiCurve® <-> electronic unit)
- 2D detector cable (10 m, optical head EpiCurve® <-> computer)
- SH 100-200 electrical cable (2 m, electronic unit <-> computer)
- optionally, a KVM extension set (cable or ethernet based extender) is available
- 15 pin interface cable (5 m, electronic unit <-> growth system): transfers the trigger and marker signals; exports analog voltages proportional to the measured temperature and reflectance (see “communication with growth system” below)
- VHDCI trigger cable (2 m, 2D detector unit <-> computer)
- multi-plug and power cables

Communication with growth system

The electronic control unit is connected with 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 growth system.

Communication features	15 pin interface cable	LAN connection
rotation synchronous trigger pulse or (once per susceptor revolution) from growth system*	5V TTL or open collector signal	–
2 digital signals to growth system indicating heartbeat and busy/error status	5V TTL or open collector signal	–
start/stop signal from growth system for remote control from the recipe	5V TTL or open collector signal	via TCP/IP
reflectance calibration signal from growth system to indicate substrate reflectance	5V TTL or open collector signal	via TCP/IP
up to 3 marker signals to indicate different growth steps and for data synchronization with the growth recipe	5V TTL or open collector signal	via TCP/IP
process temperature from thermocouple or Eurotherm for advanced logging and calibration purpose	analog voltage (0-10 V)	via TCP/IP
pyrometer temperature to growth system for export of measured temperature (uncorrected or corrected)	analog voltage** (0-10 V)	via TCP/IP (all wafers individually)
reflectance signal to growth system for export of the measured reflectance	analog voltage** (0-10 V)	via TCP/IP (all wafers individually)

EpiCurve® TT size and weight

Parts	Size X x Y x Z mm	Weight, kg
optical curvature head EpiCurve®	150 x 203 x 66	2.0
optical head EpiTT	50 x 100 x 150	0.5
control unit (19" rack 4 HE, 84 TE)	450 x 300 x 180	8.0
rack mount control computer (4 HE)	450 x 600 x 180	17.0
19" LCD display	410 x 20 x 420	5,5
mounting and adjustment unit	reactor specific	reactor specific

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

** in multi-wafer systems only averaged data or data from one specified wafer can be transferred

EpiCurve® TT for AIXTRON CCS® requirements

Requirements to the growth system

- 2 standard normal-incidence optical view ports on the same wafer ring: one 3° tilted view port for curvature and one for EpiTT head (reflectance and temperature measurement)
- rotation synchronous trigger pulse from rotation axis, one pulse per revolution (TTL or open collector)
- for remote control hardware and/or LAN connection between MOCVD system and EpiCurve® TT (to be arranged with Aixtron Ltd.)
- feed-throughs for two fibers, 2D detector cable and EpiCurve® optical head power supply cable min Ø: 40 mm (feed-through plate for KF40 recommended and available)

Operating conditions

Component	Allowed temperature range	
	operation	storage
optical head	10°C – 50°C	10°C – 60°C
electronic control unit	10°C – 35°C	10°C – 60°C
control computer	10°C – 35°C	10°C – 60°C

- vibrations of optical head have to be avoided during the measurement
- optical head is fragile, avoid shock-treatment
- warm-up time: <15 min

EpiCurve® TT electrical connections / power consumption

- the main connection (100–240 V) including extension cables to the control unit has to be provided by the customer
- input voltage: 100 / 240 V auto detect
- the power supply must be equipped with grounding wire
- power consumption (typical values for 230 V operation):

Component	current / A	power / W	power / W
		typical	max.
control computer	3.5	134	500
monitor	1.5	26	40
control unit rack	0.3	35	70
total	5.3	195	610

EpiCurve® TT is available for:

- AIXTRON CCS® 3x2", 6x2", 19x2" and CRIUS (30x2"/31x2") and other wafer sizes
- AIXTRON Planetary® MOCVD systems only (except 24 x 2" configuration, see Datasheet for EpiCurve® TT for AIXTRON Planetary®)
- various other MOCVD and MBE systems

For AIXTRON CCS® systems we offer additionally a high resolution version with extended curvature resolution (see datasheet EpiCurve® TT High Resolution).

All existing EpiTTs can be upgraded to EpiCurve® TT on-site!

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

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