ETA™

Process Evaluation and Quality Assurance by Spectral Measurement

SST/CSS/TCM

Knowledge is your strongest tool

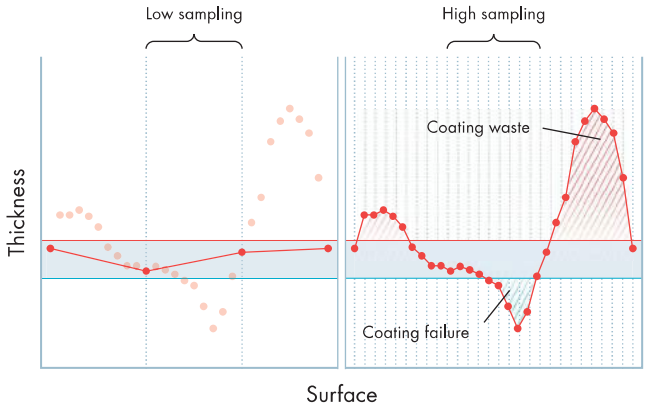
Effective quality assurance is the key to achieving high quality while ensuring cost-effective production.

This is especially true in industries that utilize coatings, where variations in coating thickness or uniformity can lead not only to product quality failure, but also to increased cost through ineffective use of raw materials.

Process knowledge through speed and sampling

The only truly reliable answer is comprehensive testing. But this must be accomplished in a way that does not slow down or add unacceptable costs to production.

Since 1991 NXT, formerly a subsidiary of AudioDev and originally established as ETA-Optik GmbH , has developed and manufactured spectrometric measurement solutions for in-dustrial and laboratory applications. We provide comprehensive, cost-eff ective quality assurance solutions to leading developers and manufacturers in industries ranging from fl at panel displays, precision glass and semiconductors to packaging and coating for consumer products.



Reliable quality assurance requires good knowledge of coating distribution. ETA systems provide the speed needed for fast yet comprehensive measurement and elimination of raw material waste as well as coating failure.

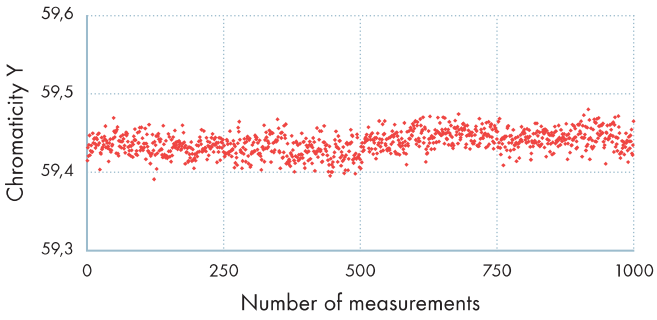
Our key technologies and components are developed and manufactured in-house by a team of skilled engineers. We aim to supply customers with state-of-the-art solutions for demanding measurement tasks. The combination of excellent technical performance, close customer contact from development onwards, and a strong worldwide sales and service network, make ETA is the best choice to boost your production efficiency with systematic testing that secures good results.

Reliable results require accuracy and stability

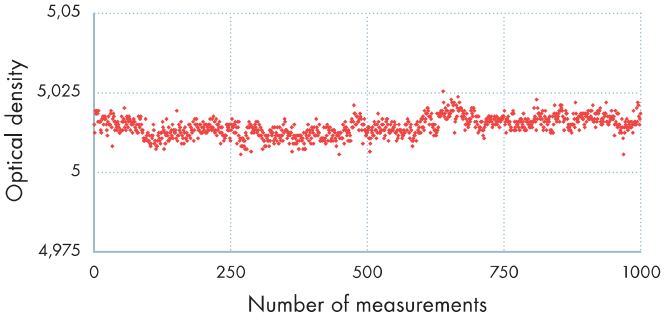
ETA spectral measurement systems are produced according to our very high standards. Each individual spectrometer is calibrated using traceable standard lamps for spectral calibration. All emitted atomic lines must be precisely reproduced by every single spectrometer.

Photometric accuracy for refl ectance, transmittance and absorbance measurements is given by using a variety of traceable reference standards such as silicon, precision glass and optical fi lters.

Accuracy and measurement stability are equally important. Our systems are designed to operate in both static and dynamic environments. For inline applications, this is critical. High measurement speed and high tolerance of sample position-variation (e.g. tilt and height) are ideal for demanding process monitoring.



Stability of a chromaticity measurement – Y (xyY) – for 1,000 successive measurements at the same position.



Stability of an absorbance measurement for 1,000 successive measurements at the same position.

The ETA concept

We supply the measurement excellence needed for true quality assurance. Fast measurements and stable optical geometries guarantee accurate, comprehensive process feedback.

The mainstream ETA spectral measurement products presented here are the ETA-SST and ETA-CSS for laboratory applications, and the ETA-TCM for comprehensive inline quality assurance. Together, or separately, they provide developers and manufacturers with comprehensive measurement tools for a range of applications:

FLAT PANEL DISPLAYS
ETA systems help you control production quality and stability. For color filter production for example, chromaticity and layer thickness are key parameters to monitor. Using ETA-TCM inline measurement, coating homogeneity is monitored sheet after sheet. This ensures that potential coater problems are detected immediately, allowing direct countermeasures by the operator. Result: yield increase and better insight into weak links in your production chain.

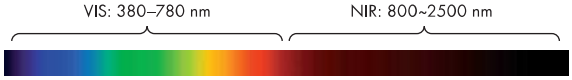
ARCHITECTURAL GLASS AND PRECISION OPTICS
Do you want to bring your coating processes to perfection? ETA systems will give you detailed insight into the quality of anti-reflective coatings, full- as well as semi-reflectors and filters. A variety of systems for reflectance and transmittance measurements are available for inline and offline use.

Layer thickness and color measurement require measurement systems operating in a suitable spectral range.

For color measurement, a spectrum of at least 400–700 nm must be covered, In general, the standard visible (VIS) wavelength range of 380–780 nm is used.

For layer thickness measurement, we differentiate between transparent and (partly) absorbing coatings:

- Transparent or thin coatings, such as lacquer layers and varnishes, are best served by a spectrometer operating in the VIS range.
- For absorbing and/or thick coatings, such as color photo resists and paint, a spectrometer operating in the near-infrared (NIR) range is the best solution.



(This spectrum is for illustrative purposes only, and is not proportional.)

PLASTICS
If you produce plastic foils for packaging materials and electronic applications, stable product quality is guaranteed by full inline monitoring with ETA-TCM, to control the thickness, transmittance or color of the materials. ETA systems are available for foil thickness measurement from extremely thin to very thick.

PACKAGING
To be cost-effective and profitable, plastic foil production for the very competitive packaging industry must achieve maximum process output and minimum raw material waste – while delivering uniform product and coating thickness. With ETA-TCM inline monitoring and control, you can achieve all these objectives simultaneously.

PAINT
Can manufacturers can save enormous quantities of paint and varnish with detailed knowledge of their coating process. Never spend a drop of paint too much anymore! Any paint or varnish on metal or plastic can be measured – either in the laboratory or inline.

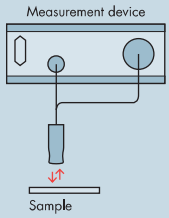
ETA SYSTEMS
- Are versatile and can be used for a wide variety of applications!
- Offer you the speed, stability and accuracy needed for reliable inline process monitoring!
- Help you to boost your production efficiency!
- Save raw materials!
- Are industry-proven and widely used by trend-setting companies!
- Come with excellent support!

ETA-SST

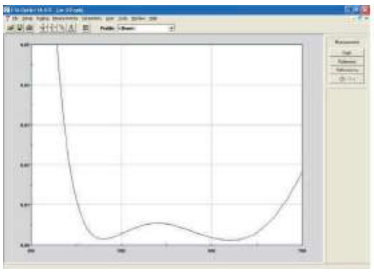
Reflectance & thickness measurement systems for laboratory applications

ETA-SST is a system for measurement of spectral reflectance and layer thickness. Its small size and easy-to-use operating software make this system an excellent choice for laboratory applications and small-scale quality control procedures.

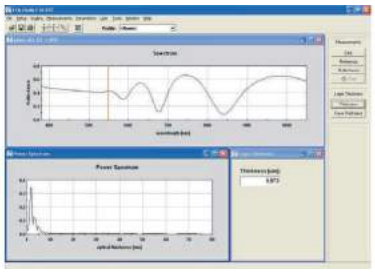
SYSTEM CONFIGURATION
- 380–1050 nm or 850–1700 nm spectrometer
- HL50 halogen light source
- Y-fiber optic cable + measuring head
- ETA-STC spectral evaluation software



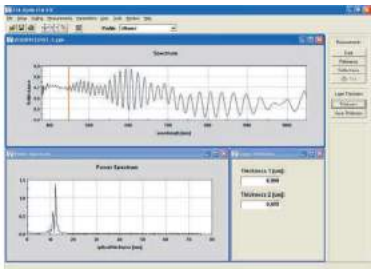
Application examples



REFLECTANCE
- Reflection measurement of anti-reflective (AR) coatings for the glass industry
- Reflection measurement of bare glass for manufacturers of precision optics



SINGLE-LAYER THICKNESS
- Thickness measurement of materials for semiconductor applications
- Thickness measurement of paint and photo-resist materials



DUAL-LAYER THICKNESS
- Thickness measurement of primer + hardcoat for automotive applications
- Thickness measurement of plastic stacks for packaging applications

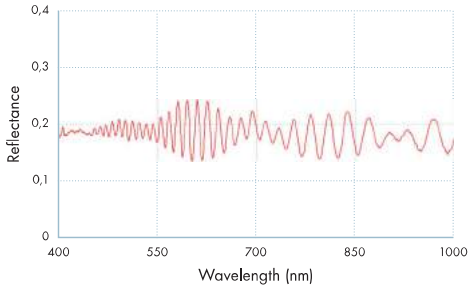
System specifications

	380-1050	850-1700
MEASUREMENT		
Thickness range*	0.1–20 µm	1–30 µm
Thickness accuracy	± 0.01 µm (0.1–1 µm range) ± 0.04 µm (1–20 µm range)	± 0.1 µm
Thickness repeatability	3σ < 0.001 µm (0.1–1 µm range) 3σ < 0.005 µm (1–20 µm range)	3σ < 0.005 µm
SPECTROMETER		
Detector	High linear Si line sensor	High linear InGaAs line sensor
Number of pixels	512	256
Wavelength range	380–1050 nm	850–1700 nm
Theoretical resolution	1.3 nm	3.3 nm
Optical resolution	5.2 nm	3.3 nm
Wavelength accuracy	± 0.5 nm	± 1 nm
Digitalisation	16-bit	16-bit
Polychromator unit	Transmission holographic diffraction grating	Transmission holographic diffraction grating
Polychromator f-number	f/2.8	f/2.8
Scan time	> 6 ms	> 0.01 ms
Fiber connection	SMA 905	SMA 905
Communication	RS232 / USB / Ethernet	RS232 / USB / Ethernet
LIGHT SOURCE		
Illumination type	Halogen light	
Wavelength	Polychromatic / 3000 K color temperature	
Lifetime	> 2000 hours	
Shutter	Integrated mechanical shutter for automatic dark current measurement	
HOUSING		
Dimensions (W x D x H)	471 x 317 x 156 mm ± 1 mm	
Power supply	100–240 V AC / 50–60 Hz (auto range)	
FIBER OPTIC CABLES		
Type	Y-Fiber	
Core diameter	400 µm	
Length	2–10 m	
Cover	Premium Grade stainless steel tubing	
Fiber connection	SMA 905	
Short term bending radius	> 100 mm	
Long term bending radius	> 200~250 mm	
MEASURING HEADS		
Dimensions (ϕ x L)	24 X 59 mm ± 0.1 mm	
Receiver / illumination	Working distance = 5–25 mm	
SOFTWARE		
Measurement functions	Spectral reflectance / thickness measurement	
PC requirements	Windows® 7 / 8 / 10, 8 GB RAM, >500 GB HDD	

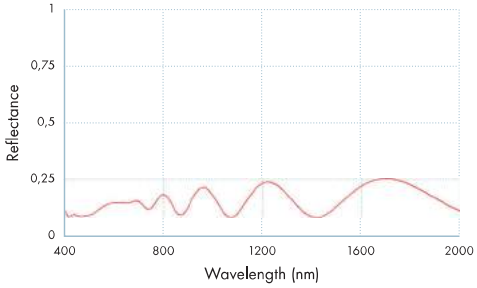
* Based on common layer types. Contact us for more information about your specific layer structures.

** Based on curve fit methods. Using stack fit methods, thicknesses down to 20 nm can be measured with TCM systems for stack fit.

Measurement examples



Reflectance of primer and hardcoating.



Reflectance of RGB photo-resist.

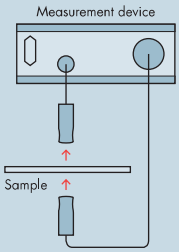
ETA-CSS

Transmittance & color measurement systems for laboratory applications

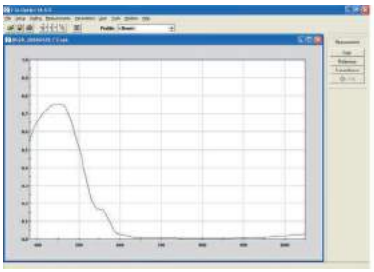
The ETA-CSS system measures spectral transmittance and color. Like the SST, its compact size and easy-to-use operating software make the ETA-CSS an excellent choice for laboratory applications and small-scale quality control procedures.

SYSTEM CONFIGURATION

- 380–780 nm or 380–1050 nm spectrometer
- HL50 halogen light source
- Mono-fiber optic cables + measuring heads
- ETA-STC spectral evaluation software

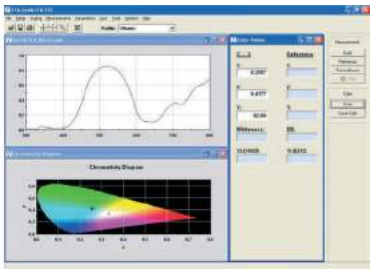


Application examples



TRANSMITTANCE

- Transmission measurement of anti-reflective (AR) coatings for precision optics
- Transmission measurement of plastic foils and films for packaging and displays



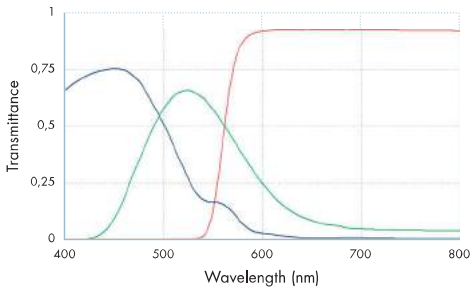
COLOR

- Color measurement of coating materials for architectural applications
- Color measurement of photo-resist materials for filter and display applications

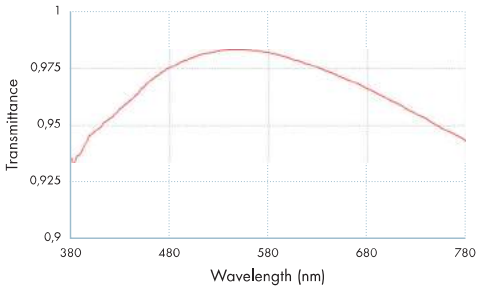
System specifications

	380-780	380-1050
MEASUREMENT		
Chromaticity accuracy (xyY)	x,y ± 0.002 Y ± 0.5	x,y ± 0.002 Y ± 0.5
Chromaticity repeatability (xyY)	x,y 3σ < 0.001 Y 3σ < 0.1	x,y 3σ < 0.001 Y 3σ < 0.1
SPECTROMETER		
Detector	High linear Si line sensor	High linear Si line sensor
Number of pixels	512	512
Wavelength range	380–780 nm	380–1050 nm
Theoretical resolution	0.8 nm	1.3 nm
Optical resolution	3.1 nm	5.2 nm
Wavelength accuracy	± 0.5 nm	± 0.5 nm
Digitalisation	16-bit	16-bit
Polychromator unit	Transmission holographic diffraction grating	Transmission holographic diffraction grating
Polychromator f-number	f/2.8	f/2.8
Scan time	> 6 ms	> 6 ms
Fiber connection	SMA 905	SMA 905
Communication	RS232 / USB / Ethernet	RS232 / USB / Ethernet
LIGHT SOURCE		
Illumination type	Halogen light	
Wavelength	Polychromatic / 3000 K color temperature	
Lifetime	> 2000 hours	
Shutter	Integrated mechanical shutter for automatic dark current measurement	
HOUSING		
Dimensions (W x D x H)	471 x 317 x 156 mm ± 1 mm	
Power supply	100–240 V AC / 50–60 Hz (auto range)	
FIBER OPTIC CABLES		
Type	Mono-Fibers	
Core diameter	400 µm	
Length	2–10 m	
Cover	Premium Grade stainless steel tubing	
Fiber connection	SMA 905	
Short term bending radius	> 100 mm	
Long term bending radius	> 200~250 mm	
MEASURING HEADS		
Dimensions (ϕ x L)	24 X 42 mm ± 0.1 mm	
Receiver	Working distance = 45 mm ± 1 mm	
Illumination	Working distance = 10–100 mm	
SOFTWARE		
Measurement functions	Spectral transmittance / color evaluation	
PC requirements	Windows® 7 / 8 / 10, 8 GB RAM, >500 GB HDD	

Measurement examples



Transmittance of RGB filter glass.



Transmittance of AR-coated glass.

ETA-TCM

Advanced monitoring systems for complete inline process- and production control

ETA-TCM is an advanced spectral measurement system used for production control and complete inline process monitoring. Using spectral reflectance and transmittance measurements, a large variety of processes can be controlled.

Inline optical density, chromaticity and thickness measurement raises quality in flat panel display production.

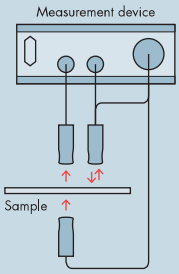
Measurement geometries are optimized for dynamic environments and vibrant sample handling. Fiber-optic cables of various lengths allow flexible integration into literally any production environment. The easy-to-use operating software enables quick and detailed insight into your production process.

ETA-TCM inline measurement systems are often incorporated into OEM production hardware, but can also be retro-fitted in order to upgrade existing production functionality.

SYSTEM CONFIGURATION
- 380–1050 nm or 850–1700 nm spectrometers
- HL50 halogen lamps
- Mono and Y fiber-optic cables
- MK measuring heads

Software:
- Trend charts
- Configurable process limits
- Data management
- Statistics
- Configurable user interface
- CIM integration possible

Measurements:
- Reflectance
- Transmittance
- Absorbance (optical density)
- Color
- Layer thickness



The above illustration is an example. A wide range of configurations is possible with ETA-TCM.

Applications

FLAT PANEL DISPLAYS
- Color filter
- Polarization film
- Plasma display
- ITO films

PACKAGING
- Plastics
- Paint

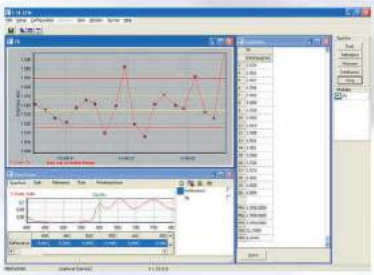
SEMICONDUCTOR
- Various films

PRECISION OPTICS
- Glass
- Mirrors
- AR coatings
- Filters

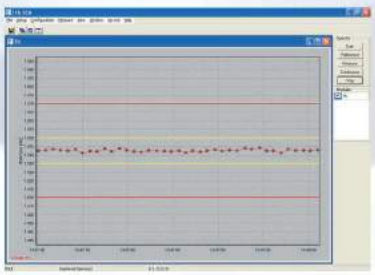
… and many more!

Measure …

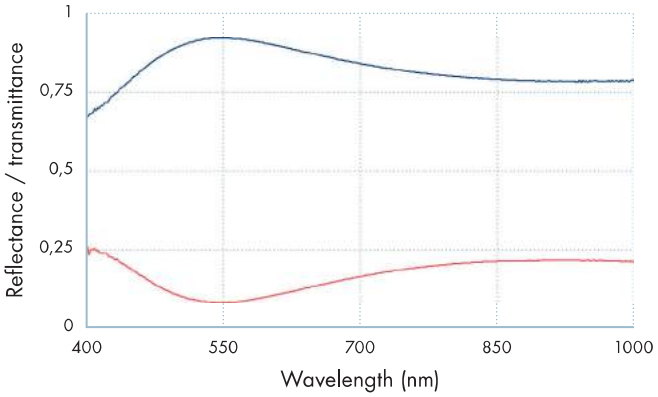
Analyze …



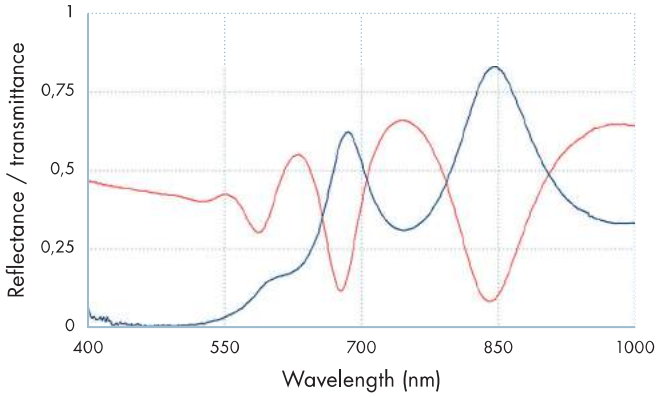
Optimize



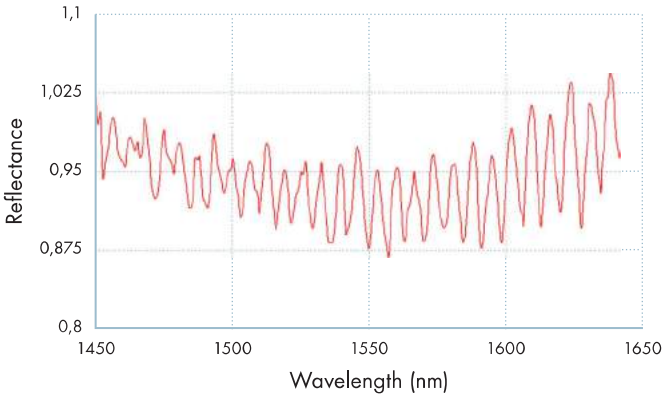
Measurement examples



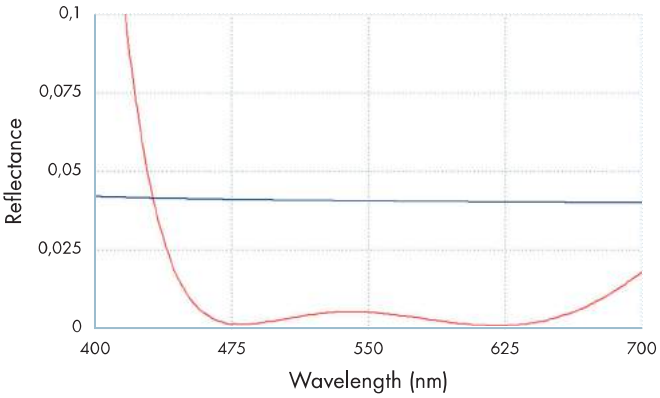
Reflectance and transmittance spectrum of ITO.



Reflectance and transmittance of amorphous silicon.



Reflectance spectrum of a 110 µm-thick plastic measured with a high resolution NIR spectrometer.



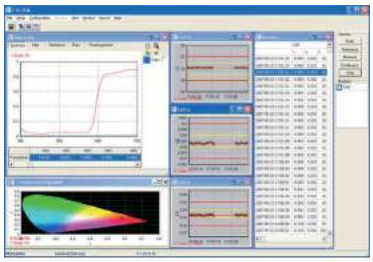
Reflectance of an AR-coated and uncoated glass.

Standard products and customized solutions: employing standard products and components, ETA systems can be combined to meet your measurement and monitoring needs.

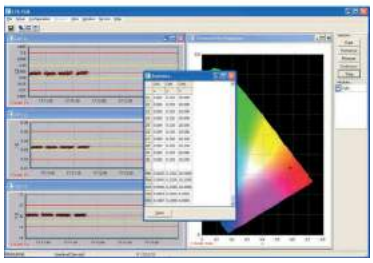
ETA-TCM for inline monitoring of transmittance & color

Example of a single-channel system.

Software



Color measurement showing transmittance, current color, color coordinate trend charts and the CIE color chart.



Popup window showing measurement statistics as minimum, maximum, average and standard deviation of the last x amount of measurements

System specifications

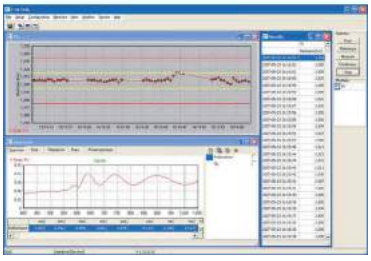
	380-780	380-1050
MEASUREMENT		
Chromaticity accuracy (xyY)	x,y ± 0.002 Y ± 0.5	x,y ± 0.002 Y ± 0.5
Chromaticity repeatability (xyY)	x,y 3σ < 0.001 Y 3σ < 0.1	x,y 3σ < 0.001 Y 3σ < 0.1
SPECTROMETER		
Detector	High linear Si line sensor	High linear Si line sensor
Number of pixels	512	512
Wavelength range	380–780 nm	380–1050 nm
Theoretical resolution	0.8 nm	1.3 nm
Optical resolution	3.1 nm	5.2 nm
Wavelength accuracy	± 0.5 nm	± 0.5 nm
Digitalisation	16-bit	16-bit
Polychromator unit	Transmission holographic diffraction grating	Transmission holographic diffraction grating
Polychromator f-number	f/2.8	f/2.8
Scan time	> 6 ms	> 6 ms
Fiber connection	SMA 905	SMA 905
Communication	RS232 / USB / Ethernet	RS232 / USB / Ethernet
LIGHT SOURCE		
Illumination type	Halogen light	
Wavelength	Polychromatic / 3000 K color temperature	
Lifetime	> 2000 hours	
Shutter	Integrated mechanical shutter for automatic dark current measurement	
HOUSING		
Dimensions (W x D x H)	471 x 317 x 156 mm ± 1 mm	
Power supply	100–240 V AC / 50–60 Hz (auto range)	
FIBER OPTIC CABLES		
Type	Mono-Fibers	
Core diameter	400 µm	
Length	2–10 m	
Cover	Premium Grade stainless steel tubing	
Fiber connection	SMA 905	
Short term bending radius	> 100 mm	
Long term bending radius	> 200~250 mm	
MEASURING HEADS		
Dimensions (ϕ x L)	24 X 42 mm ± 0.1 mm	
Receiver	Working distance = 45 mm ± 1 mm	
Illumination	Working distance = 10–100 mm	
SOFTWARE		
Measurement functions	Spectral transmittance / color evaluation / chromaticity trends / statistics / process monitoring	
PC requirements	Windows® 7 / 8 / 10, 8 GB RAM, >500 GB HDD	

ETA-TCM for inline monitoring of reflectance and thickness

Example of a single-channel system.

Software

Layer thickness measurement showing a trend chart with activated process warning and alarm limits.



Layer thickness measurement showing reflectance, current thickness and trend chart.

System specifications

	380-1050	850-1700
MEASUREMENT		
Thickness range*	0.1–20 µm	1–30 µm
Thickness accuracy	± 0.01 µm (0.1–1 µm range) ± 0.04 µm (1–20 µm range)	± 0.1 µm
Thickness repeatability	3σ < 0.001 µm (0.1–1 µm range) 3σ < 0.005 µm (1–20 µm range)	3σ < 0.005 µm
SPECTROMETER		
Detector	High linear Si line sensor	High linear InGaAs line sensor
Number of pixels	512	256
Wavelength range	380–1050 nm	850–1700 nm
Theoretical resolution	1.3 nm	3.3 nm
Optical resolution	5.2 nm	3.3 nm
Wavelength accuracy	± 0.5 nm	± 1 nm
Digitalisation	16-bit	16-bit
Polychromator unit	Transmission holographic diffraction grating	Transmission holographic diffraction grating
Polychromator f-number	f/2.8	f/2.8
Scan time	> 6 ms	> 0.01 ms
Fiber connection	SMA 905	SMA 905
Communication	RS232 / USB / Ethernet	RS232 / USB / Ethernet
LIGHT SOURCE		
Illumination type	Halogen light	
Wavelength	Polychromatic / 3000 K color temperature	
Lifetime	> 2000 hours	
Shutter	Integrated mechanical shutter for automatic dark current measurement	
HOUSING		
Dimensions (W x D x H)	471 x 317 x 156 mm ± 1 mm	
Power supply	100–240 V AC / 50–60 Hz (auto range)	
FIBER OPTIC CABLES		
Type	Y-Fibers	
Core diameter	400 µm	
Length	2–10 m	
Cover	Premium Grade stainless steel tubing	
Fiber connection	SMA 905	
Short term bending radius	> 100 mm	
Long term bending radius	> 200~250 mm	
MEASURING HEADS		
Dimensions (ϕ x L)	24 X 42 mm ± 0.1 mm	
Receiver / illumination	Working distance = 25 mm ± 1 mm	
SOFTWARE		
Measurement functions	Spectral reflectance / thickness measurement / thickness trends / statistics / process monitoring	
PC requirements	Windows® 7 / 8 / 10, 8 GB RAM, >500 GB HDD	

* Based on common layer types. Contact us for more information about your specific layer structures.

** Based on curve fit methods. Using stack fit methods, thicknesses down to 20 nm can be measured with TCM systems for stack fit.

ETA-TCM for inline monitoring of optical density

OD system with external small lamp.

Software

Measurement of OD and thickness of Black matrix resin.

Easy adjustment of the measurement hardware using adjustment quality indications.

System specifications

Optical Density	
MEASUREMENT	
OD Range	OD1-OD7
OD accuracy	± 0.5% relative for OD ≤ 6.0 ± 1.0% relative for 6.0 < OD ≤ 7
OD repeatability	3σ < 0.02 for 3.0 < OD ≤ 5.0 3σ < 0.04 for 5.0 < OD ≤ 6.0 3σ < 0.08 for 6.0 < OD ≤ 6.5 3σ < 0.12 for 6.5 < OD <7
Acceptance of sample tilt	± 5°
Acceptance of sample height	± 5mm
Measurement spot size	3mm
MEASURING UNIT	
Detector	High linear Si photo element
Digitalisation	24-bit
Dimensions (W x D x H)	48 x 146 x 23 mm ± 1 mm
Tact frequency	> 5 Hz
Typical Measurement time for high OD	0.5s / point
Communication	RS232
LIGHT SOURCE / CONTROL UNIT	
Illumination type	Monochromatic stabilized LED light source
Wavelength	617nm ± 10nm / 35nm FWHM
Lifetime	> 100.000 hours
Shutter	Integrated mechanical shutter for automatic dark current measurement
Reference	Integrated mechanical shutter with OD reference filter
Housing Dimensions (W x D x H)	471 x 317 x 166 mm ± 1 mm
Power supply	100-240 V AC / 50-60 Hz (auto range)
FIBER OPTIC CABLES	
Type	Mono-fiber
Core diameter	≤ 2.5 mm
Length	2.0 – 10.0m
Cover	Premium Grade stainless steel tubing
Fiber connection	SMA 905
Short term bending radius	> 25 mm
Long term bending radius	> 50 mm
MEASURING HEADS	
Dimensions (ϕ x l)	35 x 100 mm ± 0.1 mm (Illumination) / 35 x 90 mm ± 0.1 mm (receiver)
Receiver	Working distance = 40 mm ± 1 mm
Illumination	Working distance = 60 mm ± 1 mm
Measurement spot	≤ 3.0 mm
Ambient light	Additional covers to project the sensor against ambient light are supplied
SOFTWARE	
Measurement functions	Optical density / Thickness from OD
PC requirements	Windows® 7, 8, 10; 2 RS232 ports

Precision optics
– curved surface measurement

It is traditionally time-consuming and costly to measure anti-reflective coating on lenses or protective varnishes on curved transparent or translucent glass, because reflection from the object's back face disturbs measurement.

Not any longer! For curved surfaces (both glass and plastic), ETA offers unique non-destructive tools that quickly and accurately measure the reflection properties of coatings: the ETA-ARC and ETA-ARC-AT (for automated applications). For more information, please refer to the ETA-ARC-AT brochure or contact NXT.

Microscope-based applications

To enable detailed spot inspections, our comprehensive offline measurements systems (based on microscope technology) provide the perfect complement to inline monitoring.

Microscope-based spectral systems are ideal for flat panel display and semiconductor applications. Reflectance, transmittance and absorbance, as well as color and layer thickness, can be measured. Using a variety of objective lenses, spots well below 10µm can be inspected. An optional 'revolver' fitting several lenses allows fast and easy control of inspection spot size.

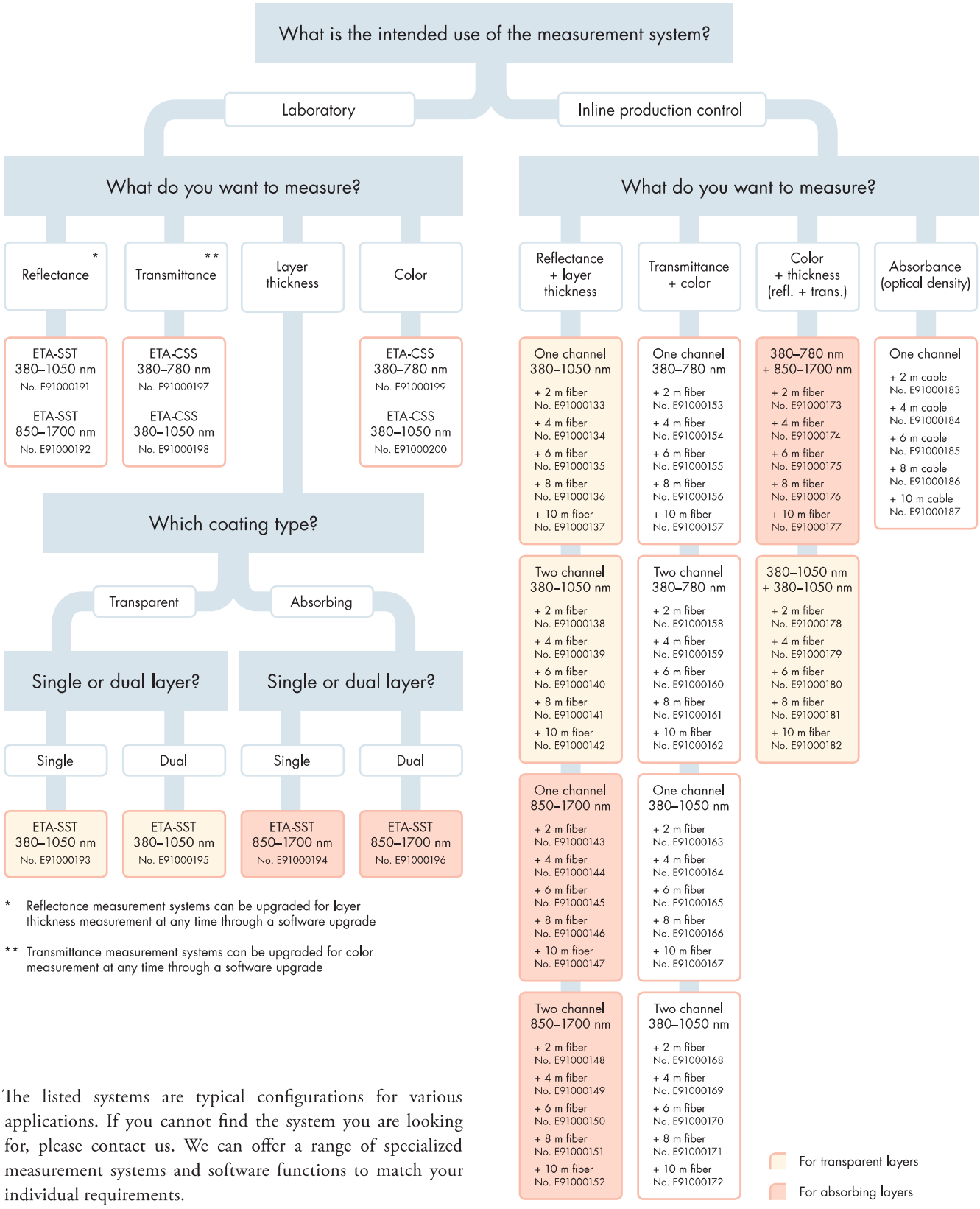
Our microscope-based system comes either as an OEM unit or fully integrated, with a mechanical stage for convenient automatic sample handling. For more information, please contact NXT.

Accessories

MK Table

The MK Table is an ideal addition when operating the SST, CSS and TCM systems in laboratory environments. It suits most measuring heads with a diameter of 24 mm, and offers mounting clamps for reflection and transmission measurement setup.

How to order ETA spectral measurement systems



* Reflectance measurement systems can be upgraded for layer thickness measurement at any time through a software upgrade

** Transmittance measurement systems can be upgraded for color measurement at any time through a software upgrade

The listed systems are typical configurations for various applications. If you cannot find the system you are looking for, please contact us. We can offer a range of specialized measurement systems and software functions to match your individual requirements.

This is NXT GmbH

NXT is a world leader in comprehensive quality assurance solutions for specialized industries. We offer high-precision analyzers, proactive customer support and training, and Test-Centers around the world.

For different industries, our ETA™, Helios and Xelas instrument families are perfect tools for protecting quality and production efficiency. With a large installed base of testers worldwide, NXT has achieved recognition as a perfect and reliable partner for optical measurements solutions.

For producers of solar cells, OLEDs, optical medias, flat panel displays, precision optics, automotive glass, consumer packaging and other thin film applications, our solutions provide comprehensive, non-destructive quality assurance that is both time- and cost-efficient.

Our headquarter is located in Heinsberg, Germany, with subsidiaries in Sweden, USA, China and Taiwan, plus a service and support network of agents worldwide. In 2016 NXT GmbH was renamed from the formerly well known AudioDev GmbH, also known as ETA-Optik GmbH before 2007.

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