

On-Line Color Measurement System ER 56 PAT

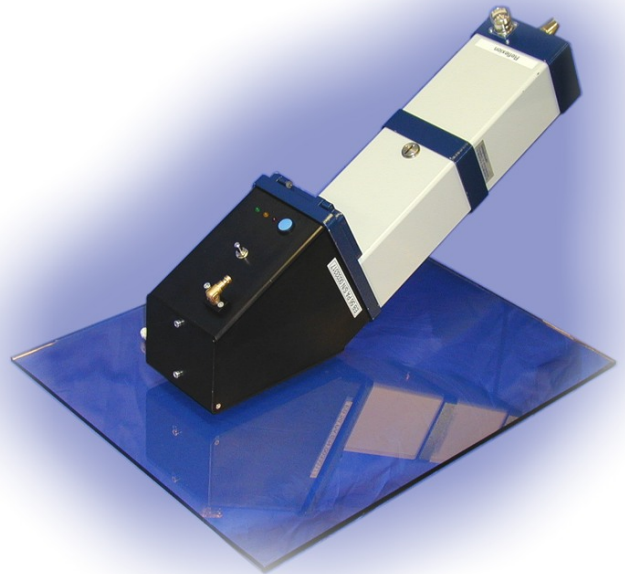
Non-contact spectral color measurement in the production of transparent samples in reflectance (15° and 60° specular), and optionally in transmission

Advantages of On-Line Color Measurement

- ✓ Possible corrections before production is out of tolerance result in reduced waste
- ✓ Continuous process monitoring, therefore early identification of disturbance (material, process, control)
- ✓ On-Line color measurement is needed for fast manual control and automatic control, resulting in stable production and faster and better color changes
- ✓ Documentation of the production (ISO 9000)

Special Advantages of ER 56 PAT

- ✓ Non-contact measurement of spectral data as well as the color in reflectance (15° and 60° specular), and optionally in transmission
- ✓ Optimum use for non-scattering samples !
- ✓ Same reflectance results as with laboratory sphere instruments specular component included (SCI)
- ✓ Excellent results with real spectral resolution of 1 nm
- ✓ Ambient light, typical variations of distance, thickness or tilting do not influence the accurate measurement results.



ER 56 PAT with glass pane

**On-Line color measurement
pays off:
Improvements in
quality and profit**

Functional description ER 56 PAT

The ER 56 PAT is a compact On-Line spectral color measurement system with special measurement geometry for specular reflectance and transmission measurement.

The sample will be measured non-contact with 10 mm distance to the instrument in reflectance and with 250 mm distance in transmission (Figure 1). For a measurement the sample will be illuminated with a white light (Xenon-flashlamp, daylight quality) for approx ca. 1 / 1000 sec. In the specular angles of 15° and 60° the reflected light will be registered sequentially and directed to a high-resolution spectrophotometer. Parallel to the sample measurement a reference measurement of the lamp is taken by a second identical spectrophotometer (dual-beam system design).

Also the optional transmission measurement is done at the same time with another measurement system on the reverse side of the sample.

In each spectrophotometer the light signal is dispersed into 401 different wavelength ranges (330 nm up to 730 nm) via a corrected, concave

grating. An integrated photo diode cell with more than 400 detectors measures the individual wavelengths. The result is a true spectral resolution of 1 nm.

The measurement signals will be amplified and digitized with high resolution. A fast processor in the measurement head processes them into corrected spectral reflectance values. From these 401 reflectance values (spectral range of 330 nm to 730 nm) all colorimetric values for any light types or standard observers can be calculated (e.g. CIELAB for D65 / 10°). The transmission measurement is made at the same area on the sample with the same principle. The automatic calibration of the instrument includes the wavelength calibration for an excellent measurement accuracy and long-time stability.

The measuring instrument is controlled by a computer (PC), to which the measurement data are transferred. Besides the RS 232 there is a RS 422 interface, allowing distances of up to 1/3 mile between the measuring system and the evaluation computer. A galvanic separation of the data interfaces guarantees stable operation in a real world production environment.

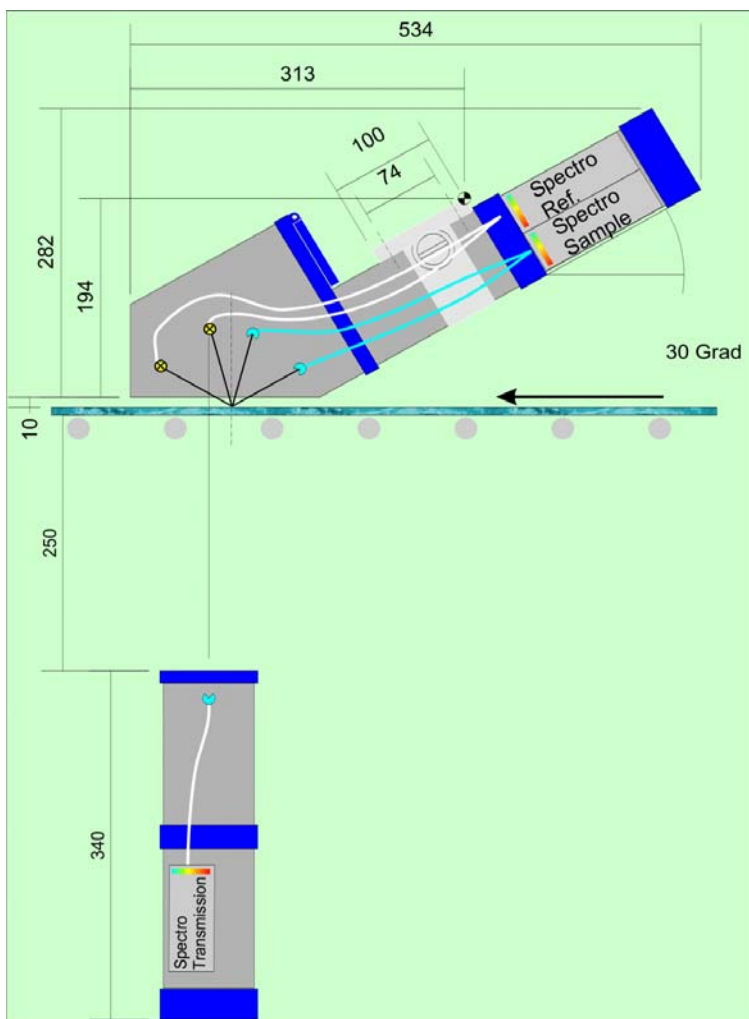


Figure 1: ER 56 PAT, Measuring distance and size

References

The color measurement system ER 56 PAT is successfully in use for the on-line measurement of

- ✓ Solar protection glass
- ✓ Low-E glass



Special advantages of the ER 56 PAT

- ◆ **Precise spectral color measurement**
 - ✓ Also critical colors and demanding applications can be measured with high quality based on the excellent spectral resolution of 1 nm.
 - ✓ The wide spectral range of the ER 56 from 330 nm to 730 nm gives excellent information.
 - ✓ The sample illumination is similar to daylight and allows very good measurement results in the whole spectral range.
 - ✓ The measurement results are very accurate and in the past only have been possible in the laboratory.
- ◆ **Automatic measurement and calibration**
 - ✓ Precise color measurement because of automatic internal calibration.
 - ✓ Absolute automatic wavelength calibration with highest precision (0,07 nm). Therefore very good long-term stability and precision.
 - ✓ 24 hours, 365 days per year automatic color measurement on the production machine.
- ◆ **Stable, accurate measurement results on the production machine**
 - ✓ Different glass thicknesses varying from 3 mm to 13 mm are covered without new adjustment of the reflectance measurement system. This is made possible by a new method of distance correction without moving parts.
 - ✓ Ambient light and motion of the sample have no effect on the accurate measurement results.
 - ✓ The instrument is robust, splashwater tight (IP65) and only need minimum maintenance because of the compact size and digital signal transmission.
 - ✓ The long life Xenon flashlamp (1 year warranty) is inexpensive.
- ◆ **Reflectance – and transmission measurement at the same sample area**
 - ✓ The simultaneous measurement gives complete data for spectral reflectance, reflectance color, spectral transmission, transmission color in the range of 330 nm to 730 nm.
 - ✓ The measurement is absolute. All samples can be measured with the same calibration.
 - ✓ If needed multiple measurement systems can be used side by side for the measurement of large samples at several locations.
- ◆ **The ER 50 product family is well proven since 1987 in hundreds of applications.**
 - ✓ It has been continuously improved and enhanced. Therefore our customers get a proven product at the newest technological level.
 - ✓ Development and production of the ER 50 family is in Germany, supported worldwide.

Turnkey color measurement system

The system ER 56 PAT typically will be designed and installed by the manufacturer as a turnkey system, complete with a customer specific measurement frame, software and PC (figure 3).

We are experts for color measurement and proven partners!

- ◆ **On-Line color measurement system**
- ◆ **Software (for PC with Windows or DOS)**
 - ✓ Quality control, documentation of production
 - ✓ Multiple displays of measurement results.
 - ✓ Synchronization of measurement with the production process.
 - ✓ Alarm signal, link to QCS systems
- ◆ **Measurement frame (customized)**
 - ✓ Measurement in the production or in the lab

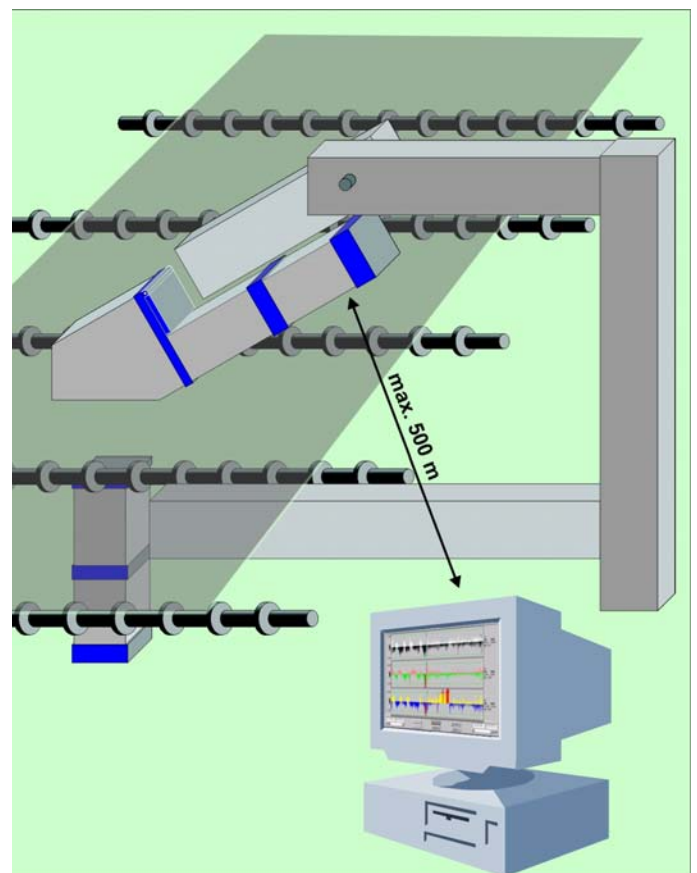


Figure 3: Color measurement coated glass

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- ✓ **Color data products (portable, benchtop, On-Line)**
- ✓ **Software for quality control, color matching and closed loop control**
- ✓ **Light booths for visual inspection**
- ✓ **Densitometers, Color management systems**

Technical data: ER 56 PA (consisting of EM 50 P, EB 56 PA, EV 50 P) and ER 56 PAT (consisting of EM 50 P, EB 56 PA, EM 50 P, EB 50 T, EV 50 P)

Measurement Head EM 50 P

Robust construction, high accuracy, built-in diagnostics with service memory (remote diagnostics).

Spectral range (UV included)	330 nm ... 730 nm
Spectral resolution (optical !)	1 nm
Absolute wavelength accuracy with internal automatic control	better than 0,1 nm
Dual-Beam (sample- and reference channel)	simultaneous
Measurement time	20 ms
Protection	IP 65, CE mark
Calibration (absolute "VW")	instrument specific mirror standard
Communication with EV 50 P	RS 232, 9600 Baud
Measurement data directly from the measurement head	
spectral data (330nm - 730nm) in steps of	measured with 1 nm, calculated for 2, 5, 10, and 20 nm

L*, a*, b*, X, Y, Z for the light types

Via the evaluation computer more data can be calculated (see software)

Illumination Head EB 56 PA

Non-contact measurement in the process, not sensitive to ambient light and distance variation

Automatic calibration and measurement, Measuring geometry 15°/-15° and 60°/-60°

Illumination	15° and 60°
Illumination light type	Xenon flashlamp, D65 approximated
Measurement	-15° and -60°
Measurement area	15°: 12 mm x 12,4 mm, elliptic 60°: 12 mm x 24 mm, elliptic
Measurement distance (Illumination Head - Sample)	16 mm
Distance range with error $dE^* < 0,2$	8 mm - 24 mm
Repetition time	20 sec typ., 5 sec min.
Reproducibility (difference measurements)	$dE^* < 0,1$ (StdDev. measurement / calibration mirror)
Inter-instrument agreement between ER 56 PA instruments	$dE^* < 0,3$ (average for typical samples)
Size incl. Measurement Head	approx. 534 mm x 282 mm x 110 mm
Weight incl. Measurement Head	approx. 5 kg
Protection	IP 54 (with measurement head), CE mark
Surrounding temperature:	50°C with cooling case EG50PL 70°C

Transmission Receiver EB 50 T

Non-contact measurement in the process, not sensitive to ambient light and distance variation

Measurement	0°
Measurement area	12 mm diameter
Measurement distance (Receiver - Sample)	250 mm
Distance range with error $dE^* < 0,15$	+ 0 mm / - 100 mm typ.
Reproducibility (difference measurements without sample)	$dE^* < 0,1$
Inter-instrument agreement between ER 54 PAT instruments	$dE^* < 0,3$ (average for typical samples)
Size incl. Measurement Head	approx. 350 x 110 x 90 mm
Weight incl. Measurement Head	approx. 3 kg
Protection	IP 54 (with measurement head), CE mark

Communication and Power Supply Unit EV 50 P

Input voltage	230V / 115V AC, +15% / -15%, 45-440 Hz
Power consumption	max. 50 VA, typ. 10 VA
Computer interface	optically isolated
RS 232	max. 10 m cable
RS 422	max. 500 m cable
Measurement Head Interface	max. 20 m cable
Size	approx. 250 x 110 x 90 mm
Weight	approx. 2,5 kg
Protection	IP 65, CE mark

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GretagMacbeth GmbH

Fraunhofer Strasse 14

D-82152 Martinsried / Munich, Germany

t: +49/89/85707-0, f: +49/89/85707-111

Shanghai Office :

t: +86(21)6448-1155, f: +86(21)6448-2468

e-mail: On-Line@GretagMacbeth.de

<http://www.Xrite.com>

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