

# On-Line Color Measurement System ERX54

Non-contact spectral color measurement in the production of transparent samples in specular reflectance and transmission, e.g. solar protection and low-E window glass

## Advantages of On-Line Color Measurement

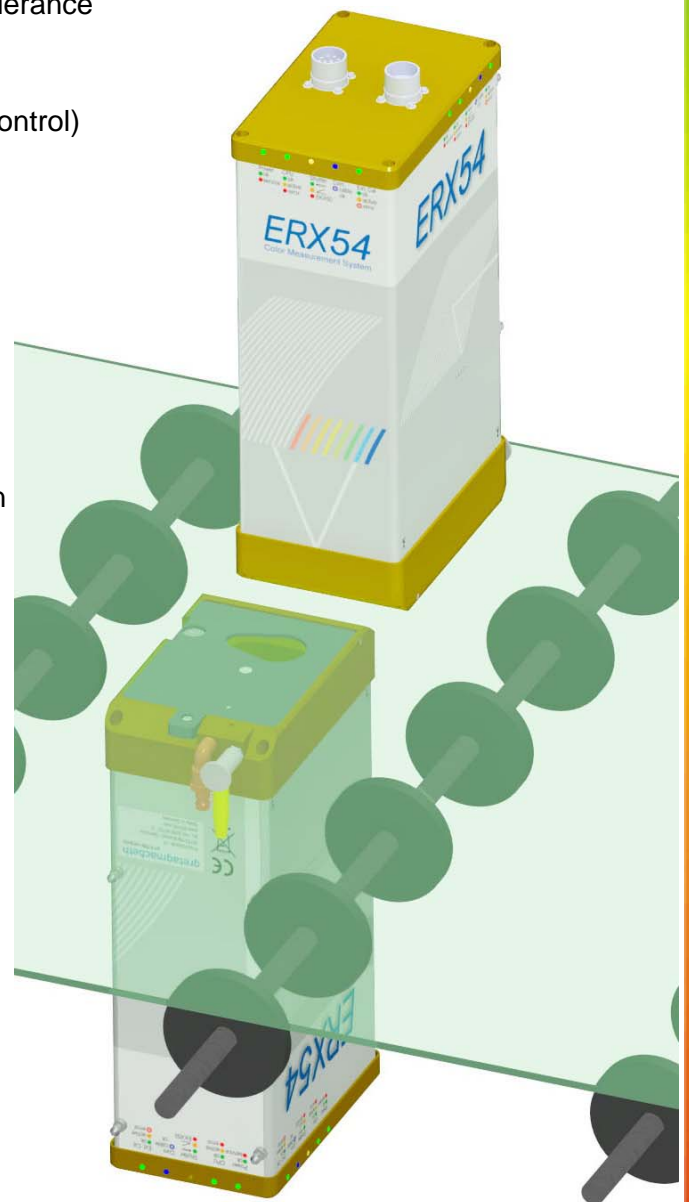
- ✓ Possible corrections before production is out of tolerance result in reduced waste
- ✓ Continuous process monitoring, therefore early identification of disturbances (material, process, control)
- ✓ On-Line color measurement is needed for fast manual control and automatic control, resulting in stable production and faster and better color changes
- ✓ Documentation of the production (ISO 9001)

## Special Advantages ERX54

- ✓ Non-contact measurement of the spectral data and color in specular reflectance and transmission
- ✓ Optimum use for non-scattering samples, e.g. solar protection and low-E window glass!
- ✓ 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

## And this is new:

- ✓ Compact style based on the well-known, proven model ER 54 PAT
- ✓ Latest in electronics and technology
- ✓ Allows higher variations in the thickness of the pane; up to 30 mm without mechanical adjustment
- ✓ Modular setup, thus even easier to service
- ✓ Much faster measurement interval
- ✓ CAN Bus for faster and more secure data transfer



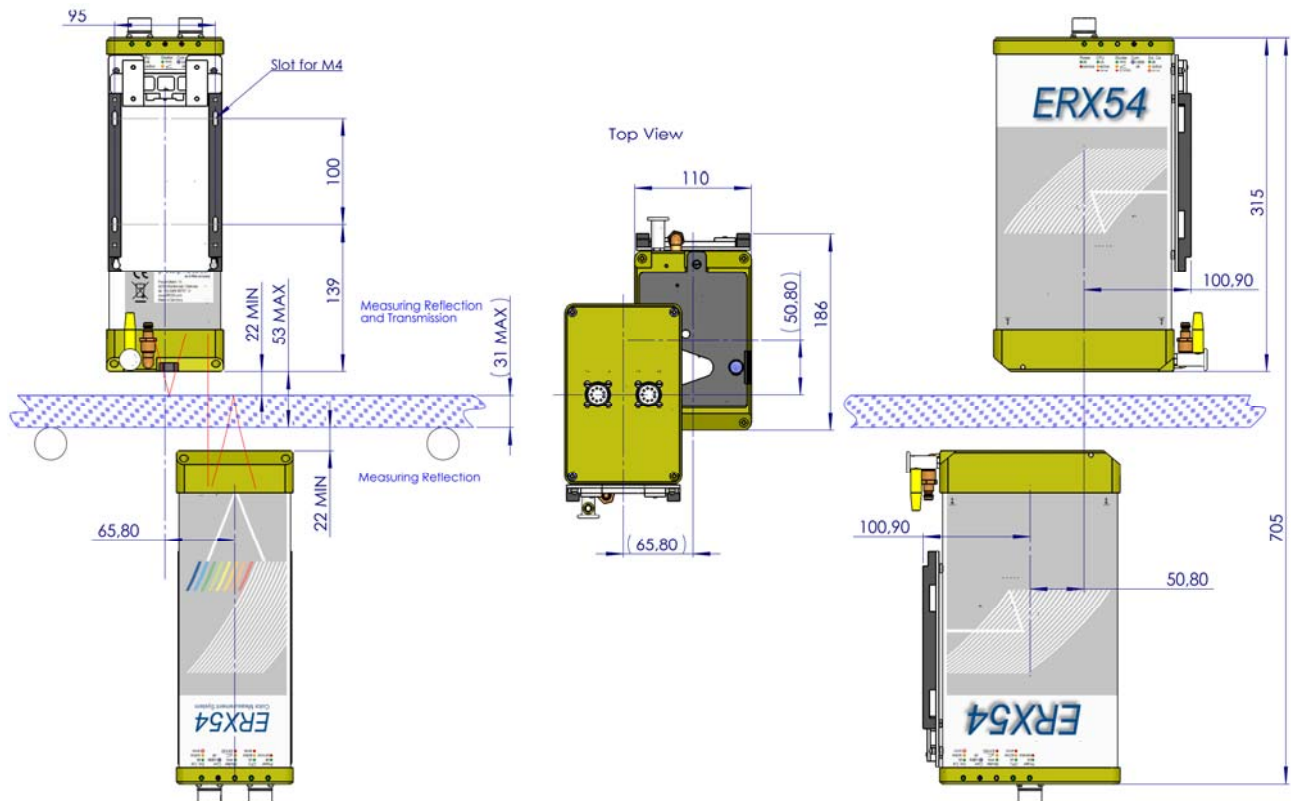
## Functional description ERX54

The ERX54 is a compact On-Line spectrophotometer with special geometry for specular reflectance and transmission measurement.

The sample will be measured non-contact in reflectance with a distance from 22 mm up to 53 mm, so samples of 0 to 31 mm can be measured without mechanical adjustment. A second head is placed on the opposite side, same distance to measure the color in reflectance of solar protection and low-E glass from the other side and also the transmission.

For a measurement a sample is illuminated by white light (Xenon flash lamp), with an angle of  $-15^\circ$  for approx. 1 / 1000 sec. Directly into specular ( $+15^\circ$ ), the reflected light is collected and guided to a high resolution spectrometer (picture 2).

Simultaneously with the sample measurement a reference measurement of the lamp will be taken with a second high resolution spectrometer (full dual-beam design).



Picture 1: Dimensions and Mounting

In both spectrometers the optical measurement signals are separated into 401 different wavelength signals via corrected holographic concave gratings, and they are measured via 401 photoelectrical sensors. The result is a true 1 nm spectral measurement resolution.

The measurement signals are amplified and digitised with high resolution. A fast processor calculates corrected spectral reflectance and transmission data.

These 401 reflectance results (from 330 nm to 730 nm) are the basis for all further colorimetric calculations for any possible illuminant and observer (e.g. CIE Lab data for illuminant D65 /  $10^\circ$  observer, or illuminant C /  $2^\circ$  observer).

The automatic internal calibration of the system also includes automatic wavelength calibration for excellent measurement accuracy and long-term stability.

Control over the color measurement system ERX54, the display and storage of measurement data, is done via CAN-bus interface by a computer (PC). The CAN bus interface allows distances between the computer and the measuring system of up to 500 m (1/3 mile). The built-in optical isolation guarantees stable operation in a real world production environment.

### References:

The spectral color measurement system ERX54 is successfully in use for the On-Line measurement of:

- ✓ Solar protection glass
- ✓ Low-E glass

## Special advantages of the ERX54

- ◆ **Precise spectral color measurement**
  - ✓ Non-contact, non destructive measurement of large glass panes possible
  - ✓ 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 ERX54 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.
- ◆ **Stable, accurate measurements on the production machine**
  - ✓ Different glass thicknesses (it can vary by up to 31 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.

- ✓ The production speed and ambient light have no influence on the accurate measurement results.
- ✓ The unit is robust, splashwater tight (IP 65) and rarely needs service thanks to the compact design.
- ✓ The long-life Xenon flash lamp (1 year warranty) is a low-price item.
- ◆ **Reflectance and transmission measurement at the same time**
  - ✓ The simultaneous measurement gives complete data for spectral reflectance, reflectance colorimetric data, spectral transmission, transmission colorimetric data 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 ER50 product family has been successfully measuring in hundreds of installations since 1987**
  - ✓ By continuous development and improvements our customers have a proven system with the latest technology.
  - ✓ The ERX54 is the fourth generation and has further improved technical specifications.
  - ✓ Development and production of the ERX54 spectrophotometer family in Germany.
  - ✓ Installations worldwide

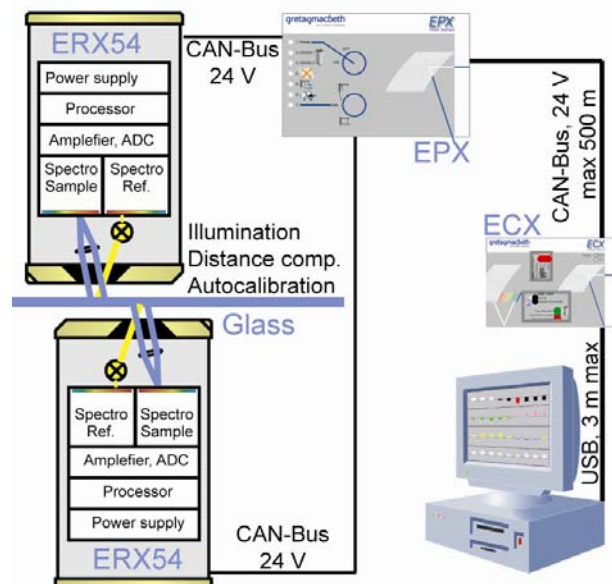
## Turnkey On-Line color measurement system

The On-Line spectrophotometer ERX54 is typically sold as turnkey system directly from the manufacturer, including software and computer (picture 2).

Support and service are available around the world.

At GretagMacbeth you find the experienced experts and proven partners for your color measurement !

- ◆ **On-Line spectrophotometer ERX50 family**
- ◆ **Software**
  - ✓ Quality control
  - ✓ Opacity and stack measurement
  - ✓ Machine interface (pane detector, stop)
  - ✓ Alarm signal
  - ✓ Link to other information systems
- ◆ **Measurement frame (customized)**
  - ✓ Measurement on the pane



Picture 2: System On-Line color measurement

## gretagmacbeth

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The GretagMacbeth group supplies:

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

## Technical Data ERX54, EPX and ECX

### Color sensor ERX54

Non-contact measurement in the process; not sensitive to ambient light; automatic calibration and measurement; specular measurement geometry  $-15^{\circ}$ : $+15^{\circ}$ , measurement in specular for non-scattering products like coated glass; robust construction; high accuracy and precision; built-in diagnostics with service memory (remote diagnostic).

Reflectance:

Illumination	$-15^{\circ}$
Measurement	$+15^{\circ}$

Transmission (only with two ERX54, one on each side of the pane):

Measurement	$0^{\circ}$
Spectral measurement range	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
Measurement area	ca. 10mm x 12 mm elliptical
Measurement distance (ERX54 to measured glass surface)	22 mm up to 53 mm
Error in $\Delta E^*$ for distance variation	distance 30 mm to 38 mm: $< 0.2 \Delta E^*$ distance 22 mm to 53 mm: $< 0.5 \Delta E^*$
Measurement interval	2 sec min.
Reproducibility (standard deviation for repeated difference measurements of a mirror)	$\Delta E^* < 0.1$
Interinstrument agreement between ERX54 systems	$\Delta E^* < 0.3$
Size	approx. 170 x 110 x 295 mm <sup>3</sup>
Weight	approx. 5 kg
Protection	IP 65, CE Mark
Calibration	instrument specific mirror
Communication with computer	CAN-Bus, with interface converter on USB
Spectral data directly from the measm. head (330nm - 730nm)	measured in steps of 1 nm
More data will be available via the computer (see evaluation programs ESWin)	
Ambient temperature:	from $0^{\circ}\text{C}$ to $60^{\circ}\text{C}$ , no condensation

### Power interface EPX

Input Voltage	115V/230V AC, +25% / -15%, 45-440 Hz
Power consumption	max. 100 VA, typ. 20 VA
Measurement head interface	max. 20 m cable
Size approx.	265 x 265 x 135 mm <sup>3</sup>
Weight approx.	2.3 kg
Protection	IP 65, CE Mark

### Computer interface ECX

Input Voltage	115V/230V AC, +25% / -15%, 45-440 Hz
Power consumption	max. 100 VA, typ. 10 VA
Interface to EPX trough CAN-Bus	max. 500 m cable
USB interface to computer	typ. 1.5 m, max. 3 m cable
Size approx.	265 x 265 x 135 mm <sup>3</sup>
Weight approx.	2.4 kg
Protection	IP 65, CE Mark

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