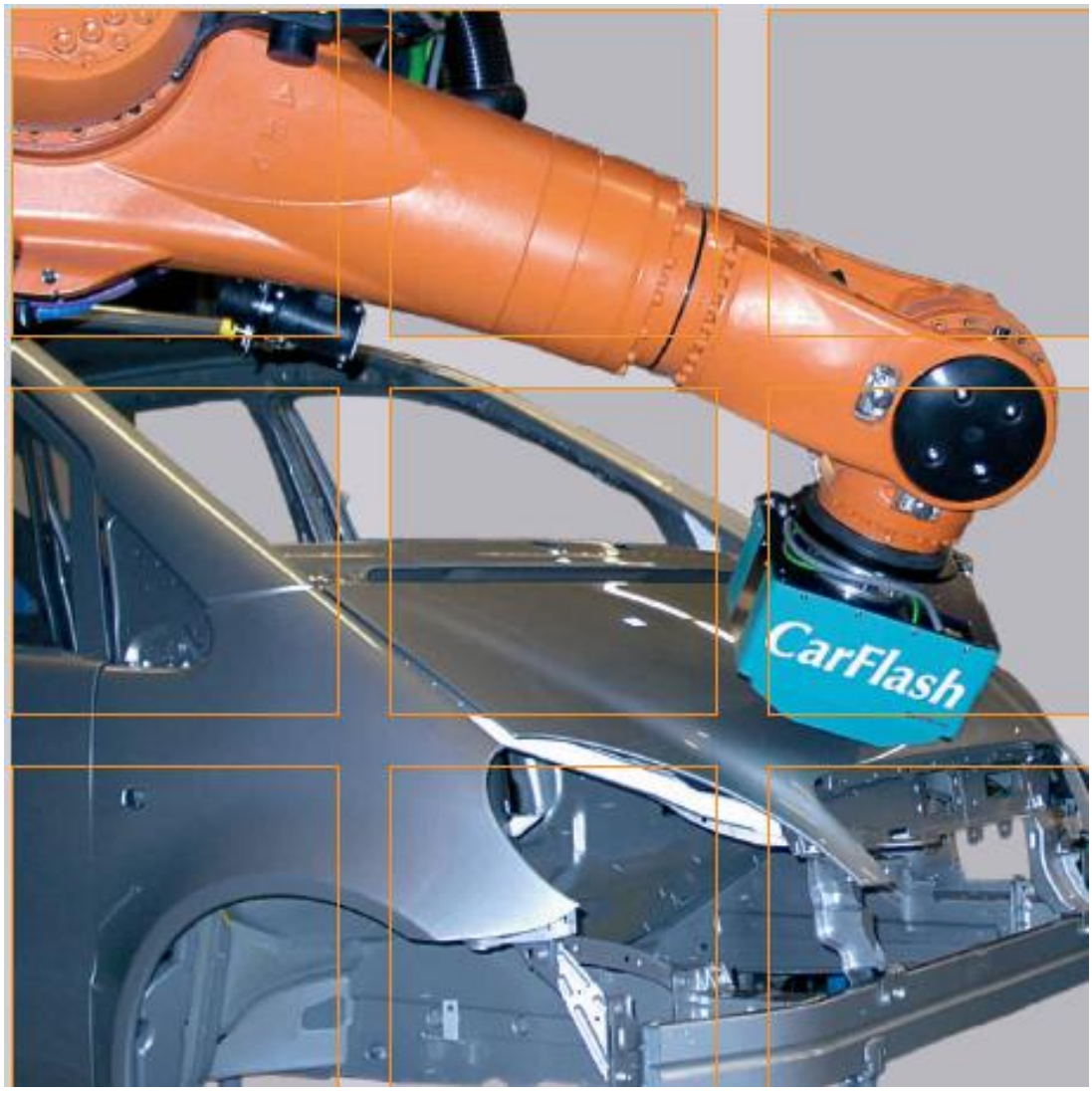
CarFlash:
On-Line Color Measurement For Automotive Effect Paints



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On-line multi-angle spectrophotometer for automated measurement of car bodies or parts with effect paint

x-rite

PANTONE®

CarFlash is a multi-angle spectrophotometer

CarFlash was developed specifically to serve the needs of the automotive industry. It is a multi-anlge spectrophotometer with an integrated Orange Peel and surface temperature measurement. The non-contact device will work automatically with industrial robot systems. Due to increased demands by buyers and increase environmental requirements for paintwork and varnishing processes as well as the need to serve new types of color effects the technologies for quality ensurances and process control have significantly gained importance. The use of variable chassis materials combined with decentralized production, and a continuous trend towards using painted add-on modules require an efficient way to ensure close color tolerances in production and assembly line. Non-contact color measurement readings can be taken on any desired surface. CarFlash can be used on plain as well as curved surfaces including mirror housings. CarFlash will guide the robot to the optimum measurement position.
Production reliability ensured with a multifunction measuring head. On-line measurements in the paint line can be taken directly after the drying process, i.e. the earliest possibility to measure color, surface temperature, and the longwave surface structure.

Cost reduction

Cost reduction due to automatic on-line measurements. The instant availability of measured data will enable a closed loop and correct the paint line settings. The rapid availability of multifunctional measurement results constitutes a significant contribution to:

- Lower energy and material consumption
- Reduced quality costs
- Optimized process condition

CarFlash front side

Four angles simultaneously

Approx. 100 mm above the measurement position, the integrated ultrasonic sensor takes control of the industrial robot and moves the measuring system to the paint or varnish surface.
Approx. 35 mm above the surface the infrared positioning device takes control and will achieve highly precise, reproducible measuring result of any shape. Color is measured simultaneously across four angles (15°, 25°, 45°, 75°) while measuring the surface temperature and Orange Peel (long value) at the same time.
The measuring system supplies highly repeatable data, which are compatible with the laboratory process implemented in the automotive industry, and corresponds with the color measuring standards. The system is also highly compatible with existing, portable multiangle instruments such as X-rite MA68 II and MS9X series.
Car Flash functions completely automatically on any color. It is designed to measure non-moving, non-vibrating objects.
The system is designed for a dust-free environment within normal working conditions at ambient temperatures of 15°C to 35°C.

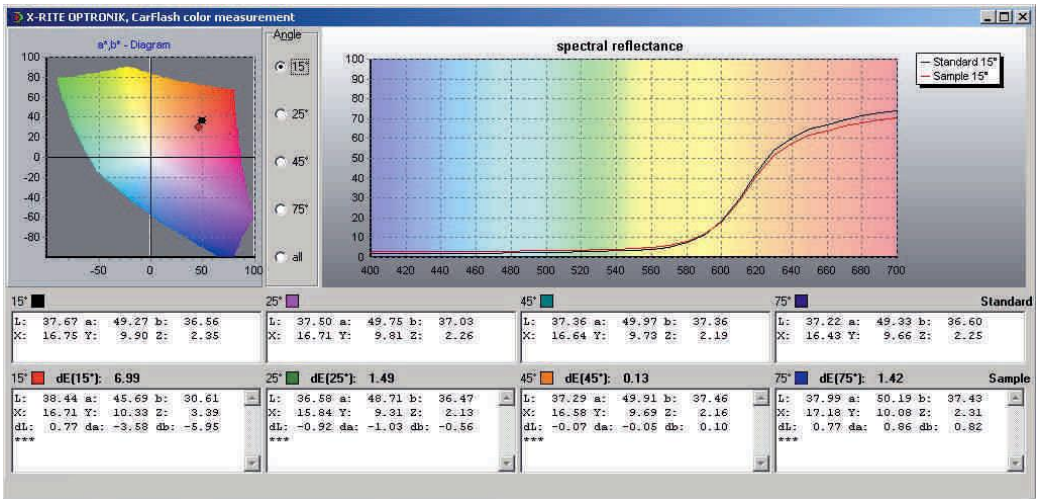
Data Processing

The CarFlash measuring device will be operated on a CarFlash computer and controlled by specific software for sequence and color control. The operating system for the measuring head and diagnostic tools are preinstalled on the CarFlash computer.

CarFlash resident software

- Graphically scrollable and zoomable display of the reflectance curves for selectable angles
- Color display for actual/nominal values across all 4 angles
- CIE L*a*b* (CIELAB) calculation with 10nm resolution
- Standard observer 10°
- Standard illuminant D65
- Automatic or manual operation

The CarFlash resident software collects all of the measured values and calculates the colorimetric data.

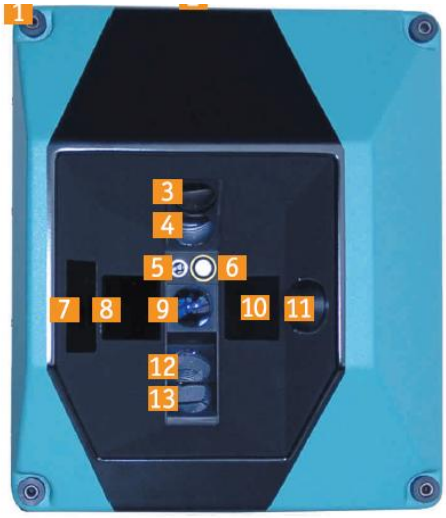


CarFlash TCP/IP interface

For the communication with the environment the CarFlash operating software is delivered with a TCP/IP interface. A command set is available to communicate via an OPC link.
The necessary interface software can be installed on the CarFlash computer.

The software processes:

- Measurement values (Orange Peel, color, surface temperature)
- Distance value for ultrasonic sensor approach
- Correction values for the robot orientation
- Status information
- Error numbers
- Calibration



1. 4 adaptors for the calibration attachment
2. Flash lamp replacement module
3. 45° lighting, Xenon flash lamp
4. 75° color receiver
5. Surface temperature measurement
6. Ultrasonic distance sensor
7. Infrared position transmitter
8. Sequence lights
9. 45° color receiver
10. Sequence sensor
11. Infrared position sensor
12. 25° color receiver
13. 15° color receiver

Technical data and functions

Non contact measurements on freeform areas	• 4-angle color measurement • Orange Peel measurement (long value) • temperature measurement
Measuring distance	35 mm
Ultrasonic distance sensors for robot approach	
Internal infrared positioning sensor for high precision measuring head alignment	
Dimensions	255 * 300 * 187 mm
Measuring angles	15°, 25°, 45°, 75°
Lighting	45°, 1 Xenon flash
Spectral range	400 - 700 nm, resolution 10 nm
Measuring area	8 x 17 mm
Position	independent
Weight	7.5 kg
Measuring range	0% - 300% reflection @ 15°
Measuring time	on average 6 to 8 seconds incl. positioning
Re-availability	on average 3 seconds after measurement
Inter-instrument-Agreement	• on BCRA set of tiles on average $\Delta E \leq 0.2$ • $\Delta E_{max} \leq 0.4$
Repeatability	on white ceramic $\Delta E < 0.10$
Orange Peel determination	• evaluating projected infrared light strips • long wave • measuring angle 24°
Position sensor (limit values)	• surface degree of gloss > 65 reflection units • range 0 < lv < 30 • radius of curvature Rx > 100 mm (convex) • surface Rv > -400 mm (concave)

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