RHOPOINT
INSTRUMENTS

RHOPOINT
RoboTAMS

RoboTAMS
Automated Total Appearance
Measurement System

The new standard for paint
appearance measurement

Measuring automotive paint finishes

The Rhopoint TAMS provides measurement data that closely correlates to human perception, is easier to understand and communicate

For maximum impact, an automotive paint finish must instantly produce an appealing visual sensation for the customer. This can only be achieved if the overall surface finish displays both *high quality* and *harmony*.

Rhopoint TAMS™ has become an industry standard way of quantifying appearance quality inspired by a four-year collaboration between Rhopoint, Volkswagen AG and AUDI AG. This innovative new technology models the human perception of surface appearance quality, providing new parameters that revolutionise the understanding and communication of visual appearance information.

Improved correlation and easy communication gives Rhopoint TAMS™ a major advantage over existing methods that produce complex results relying on the user to interpret the values into a real-life visual experience.

TAMS technology provides opportunities to:
• Improve surface finish
• Establish improved quality criteria
• Remove subjectivity in visual assessment

RoboTAMS: Automated Total Appearance Measurement System

TAMS measurement sensor integrates fully into an inline inspection process

RoboTAMS features:
- Fast measurement time
- Larger field of view
- Integration into any SPC
- Contactless measurements
- Communicates via ethernet protocol

All measurements made with RoboTAMS are compatible with measurements made with the Rhopoint TAMS™.

RoboTAMS is designed for top coat evaluation as part of the production line or offline measurement cell. The sensor is able to capture high resolution maps of surfaces and has the possibility to measure e-coat and raw materials.

When viewing a vehicle surface, the eye naturally adjusts focus several times. Focusing on the environment, it looks at images of reflected objects observing distortion and clarity. Focusing on the surface the eye observes waviness, texture and defects.

Movement by the viewer during observation causes the reflected environment to move across the surface. This natural action increases the perception of waviness.

The brain processes this information and formulates sensations of *quality* and *harmony*.
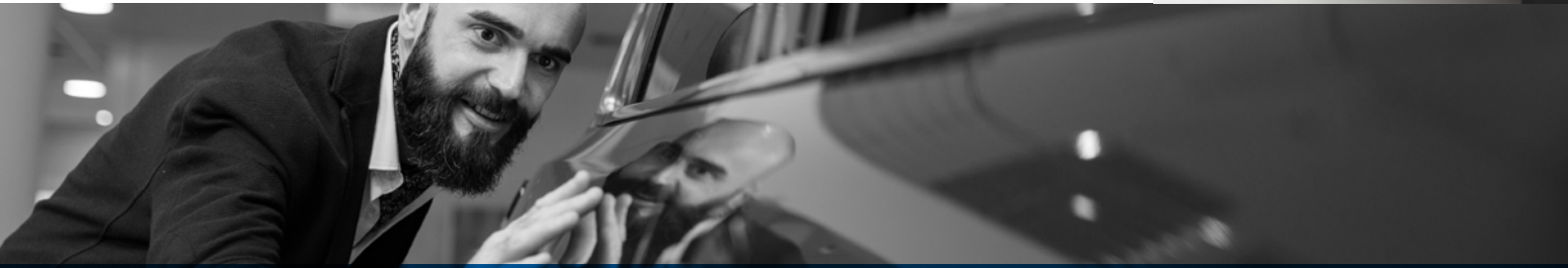
TAMS technology defines:

Quality
One single value rates the total appearance quality of a surface. 100% indicates a smooth finish with perfect image forming characteristics.

TAMS quality is calculated using waviness and sharpness values predicting the visual rating of the customer.

Harmony
Based on extensive human perception research by AUDI AG, this value indicates the acceptability of adjacent car parts. It is calculated using Waviness and Dimension parameters.

A value of >1.0 indicates parts are not similar and if viewed together will detract from overall visual quality.

TAMS Perception

Data from the TAMS vision system is processed using perception algorithms derived from extensive human perception studies.

Sharpness

Sharpness quantifies the accuracy of images reflected in the surface, 100% indicates a perfect reflection.
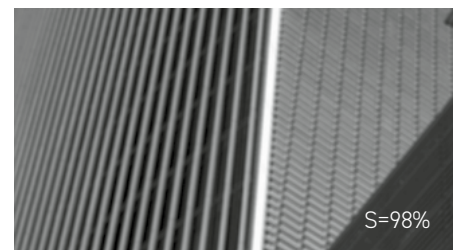
At close distances (<0.5m) SHARPNESS measures how well surface reflects fine details. At showroom viewing distance (1.5m) SHARPNESS quantifies haze and clarity.

Close Distance view of an unsharp surface:

S=65%

Close Distance view of a sharp surface:

S=98%

Showroom Distance view of an unsharp surface:

Showroom Distance view of a sharp surface:

Contrast

Contrast is related to the colour of the surface; white and metallic surfaces have low contrast, a deep black measures 100%. Contrast quantifies the visual impact of orange peel and haze effects both being more visible on high contrast dark colours.
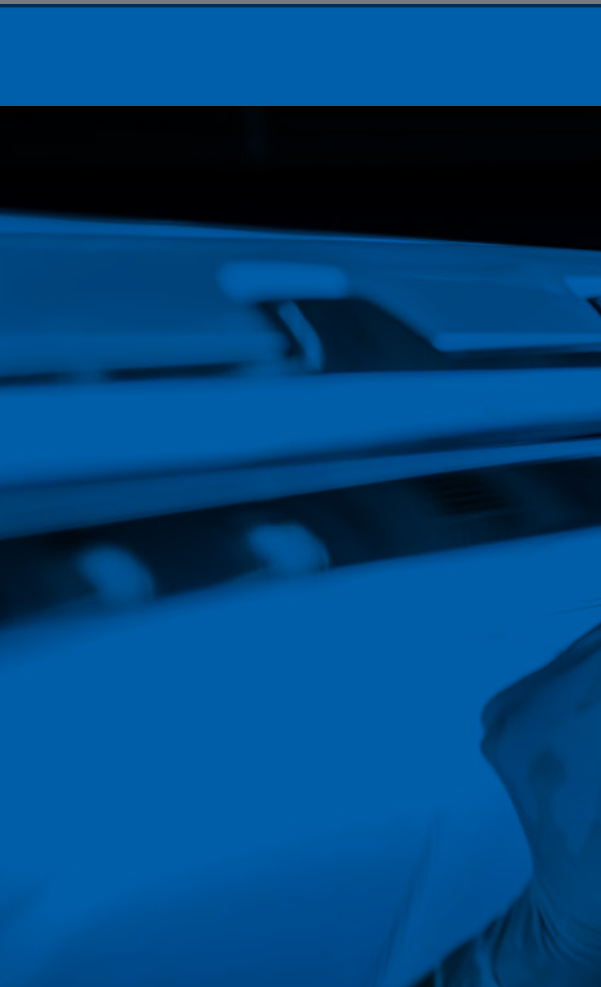
C=40%

C=100%

Reflection in a White surface
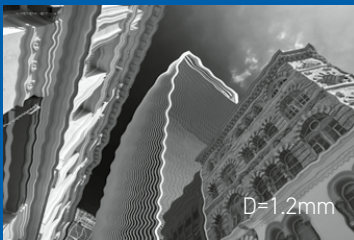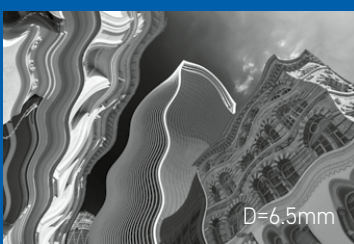
Reflection in a Black surface

Dimension

Indicates the dominant structure size perceived at showroom viewing distance. Typical values are between 1–6mm, the dominant structure size is important in determining the harmony between adjacent panels/parts.

Small structure dominant surface:

D=1.2mm

Large structure dominant surface:
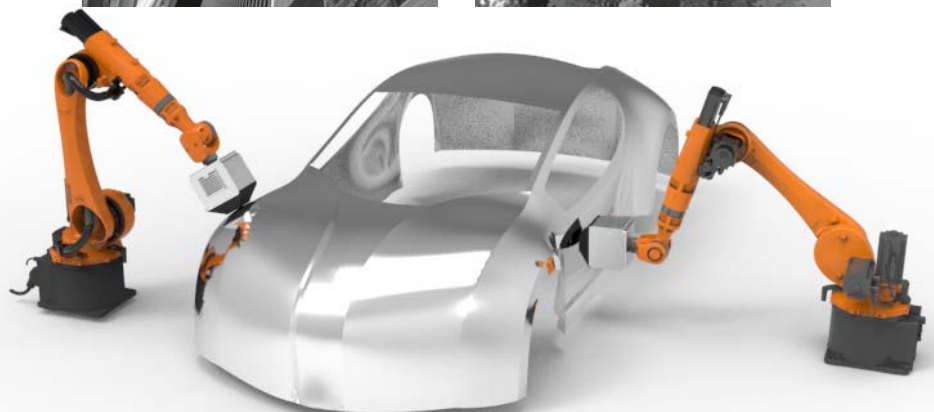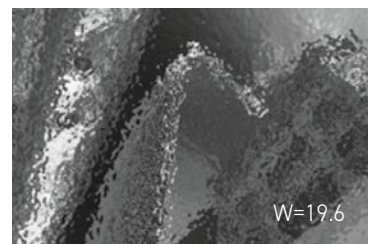

D=6.5mm

Waviness

Correlated to human perception, waviness quantifies the visible impact of surface waves to an observer at showroom distance (1.5m). The waviness of a surface is critical for determining appearance quality. Low waviness surfaces tend to be preferred by the viewer.
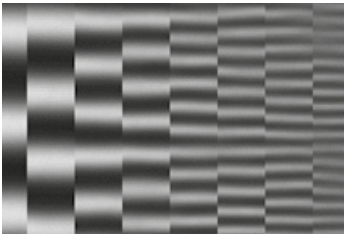
Flat surface:
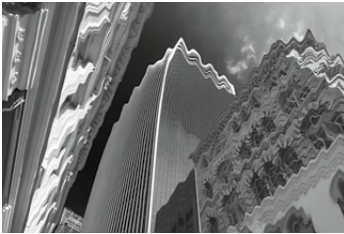

W=0

Wavy Surface:

W=19.6

TAMS Vision

To achieve close correlation with human perception, TAMS emulates the human evaluation of a reflective surface, changing its imaging system focus from surface to reflected image.
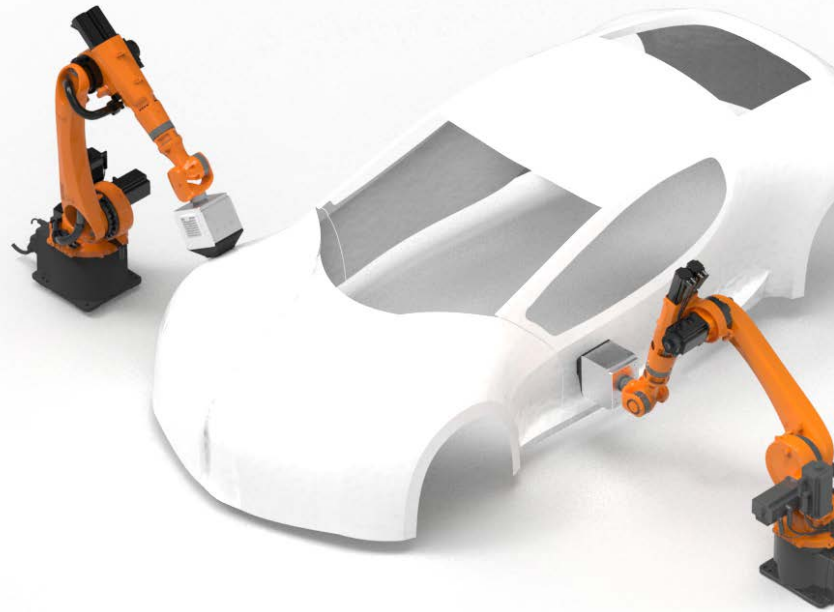

The image transfer qualities of the surface are measured and used to calculate sharpness and contrast.

Waviness is calculated by quantifying distortion in a reflected image.

Surface topography is analysed to identify the dominant structure.

Specifications

Sharpness

Units	S (%)
Minimum (No visible reflection)	0
Maximum (Perfect mirror)	100
Measurement Technique	Optical Transfer Function

Contrast

Units	C (%)
Minimum (Perfect Diffuse White)	0
Maximum (Perfect Black)	100
Measurement Technique	Optical Transfer Function

Waviness

Units	W (W units)
Minimum	0
Maximum (typical)	30
Measurement Technique	Reflected Image Line Deformation Analysis
Correlation	AUDI AG MDS Perception analysis

Dimension

Units	D (mm)
Minimum	0.5
Maximum (typical)	8
Measurement Technique	Phase Measurement Deflectometry
Correlation	AUDI AG MDS Perception analysis

Quality

Units	Q (%)
Minimum	0
Maximum (typical)	100
Algorithm	Calculated using Sharpness & Waviness
Correlation	VW AG Perception analysis

Harmony

Units	H (H units)
Minimum	0
Maximum (typical)	8.9
Algorithm	Calculated using Waviness & Dimension
Correlation	AUDI AG MDS Perception analysis

Measurement sensor

Fully enclosed unit with integrated capture and analysis	✓
Measurement area	50 x 60mm FOV (field of view)
Compatible results	with Rhopoint TAMS™
Capture time	<2 seconds
Spatial resolution	32µm / pixel
Results output	.CSV
Positioning error detection	✓
Calibration station for instrument check and focus setting.	✓
In-built optical component contamination reduction system	✓

Power and Connectivity

Connection	LAN Ethernet
Flexible connection options	✓
Power	24 Volts (max current 3 Amps)
Range of robot mounting options	✓

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All images are for illustrative purposes only