



Rhopoint TAMS[™] Total Appearance Measurement System



Next Generation Paint Quality Instrument:

Setting New Standards in Appearance Measurement

In cooperation with Volkswagen AG & AUDI AG

Measurements that closely correlate to human perception are 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 is a new 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.

Rhopoint TAMS technology provides opportunities to improve surface finish, establish improved quality criteria and remove subjectivity in visual assessment.

DEFINES





QUALITY

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

PERCEPTION

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



CONTRAST

Contrast is related to the color 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 colors.



Reflection in a White surface C=40%



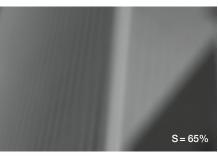
Reflection in a Black surface C= 100%

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.

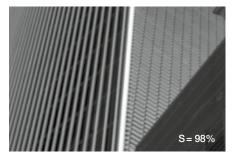




Showroom Distance view of an unsharp surface:



Close Distance view of a sharp surface:



Showroom Distance view of a sharp surface:





WAVINESS

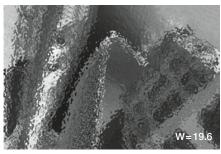
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Correlated to human perception, waviness quantifies the visible impact of surface waves to an observer at showroom distance (1.5m). The waviness of a surface is critical for determining appearance quality. Low waviness surfaces tend to be preferred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

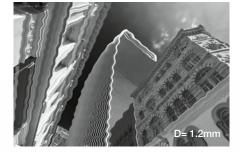
Flat surface:



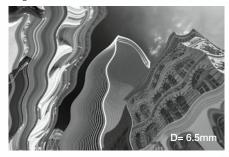
Wavy surface:



Small structure dominant surface:



Large structure dominant surface:



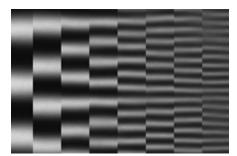


DIMENSION

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.

TAMS[™] VISION

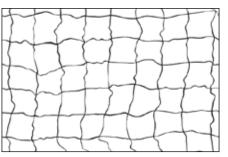
To achieve close correlation with human perception Rhopoint TAMS emulates the human evaluation of a reflective surface, changing its imaging system focus from surface to reflected image.



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.

APPLICATION OPTIONS

Rhopoint TAMS is able to capture surface data for mid gloss and high gloss surfaces offering the possibility of measuring all surfaces throughout the automotive manufacturing process - steel and aluminium, E-Coat as well as filler, base coat and top coat.

TAMS[™] CONCEPT

- **Operation Touch-screen**
- Camera sensor
- Target screen
- Focus system and actuator

appearance data

image processing

- Dual Processor: 1 GHz ARM Cortex A8 + DSP
- **RFID** module
- Removeable/rechargeable batteries
- Push & Start pressure sensitive auto-measure system





Ergonomic operation-measure entire vehicle more easily





Fast & Easy data transfer via SD card



Flexible power options - 2x removable rechargeable battery or mains operation





ARM

Easy to use with on screen menu navigation prompts

Dual focus camera operation captures all surface

Fast operation with powerful on board

Safe to use- static measurement with soft contact area

RFID

Enhanced process integration via RFID

Specifications Rhopoint TAMS™

SHARPNESS		CONTRAST	
Inits	S (%)	Units	C (%)
linimum (No visible reflection)	0	Minimum (Perfect Diffuse White)	0
laximum (Perfect mirror)	100	Maximum (Perfect Black)	100
lesolution	0.1	Resolution	0.1
Repeatability	0.1 (SD)	Repeatability	0.1 (SD)
Reproducibility	0.5 (SD)	Reproducibility	0.3 (SD)
Aeasurement Technique	Optical Transfer Function	Measurement Technique	Optical Transfer Function
WAVINESS		DIMENSION	
Jnits	W (W units)	Units	D (mm)
<i>l</i> inimum	0	Minimum	0.5
Maximum (typical)	30	Maximum (typical)	8
Resolution	0.1	Resolution	0.1
Repeatability	0.2 (SD)	Repeatability	0.1 (SD)
Reproducibility	1 (SD)	Reproducibility	0.4 (SD)
Measurement Technique	Reflected Image Line Deformation Analysis	Measurement Technique	Phase Measurement Deflectometry
Correlation	AUDI AG MDS Perception analysis	Correlation	AUDI AG MDS Perception analysis
QUALITY		HARMONY	
Jnits	Q (%)	Units	H (H units)
Vinimum	0	Minimum	0
Maximum (typical)	100	Maximum (typical)	8.9
Resolution	0.1	Resolution	0.1
Repeatability	0.2 (SD)	Repeatability	0.1 (SD)
Reproducibility	0.8 (SD)	Reproducibility	0.2 (SD)
Algorithm	Calculated using Sharpness & Waviness	Algorithm	Calculated using Waviness & Dimension
Correlation	Volkswagen AG Quality Perception Studies	Correlation	AUDI AG MDS Perception analysis
NSTRUMENT SPECIFICATION			
Menu Interface	5 Capacitive Sense buttons	Optical System	Variable Focus Machine Vision
Measurement Operation	Tactile button, capacitive sensor, push & start auto measurement system	Spatial Resolution (surface)	34µm/pixel
Measurement Time	4 Second Image Capture 4 Second Processing	Field of View (surface)	25 x 16mm
Color Screen	Full color IPS screen	Processor Specification	ARM A8 Dual core + Digital Signal Processor
Power	Removeable and rechargeable lithium polymer batteries	Production Integration	RFID TAG Reader (optional)
Dperation	Up to 5 hours/charge	Dimensions / Weight	172 x 136 x 56 mm / 950 g
Memory	>100,000 readings 8GB internal / 8GB SD card	Additional Sensors	Accelerometer, Orientation, 4 x Pressure (measurement)
Data Transfer	SD Card, USB, Ethernet	Construction	Aluminium instrument case

Instrument, Carry Case, 2 x removable & rechargeable batteries, calibration plate, AC Adapter, certificate, cleaning cloth, spare measurement baffle

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