



KONICA MINOLTA



TAMS™ Total Appearance Measurement System



Next Generation Paint Quality Instrument:
Setting New Standards in Appearance Measurement

In cooperation with Volkswagen AG & AUDI AG

Giving Shape to Ideas

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**.

TAMS™ is a new way of quantifying appearance quality inspired by a four-year collaboration between Rhpoint, 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 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** 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. 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 TAMS™ vision system is processed using perception algorithms derived from extensive human perception studies.



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.



Reflection in a White surface
C= 40%



Reflection in a Black surface
C= 100%

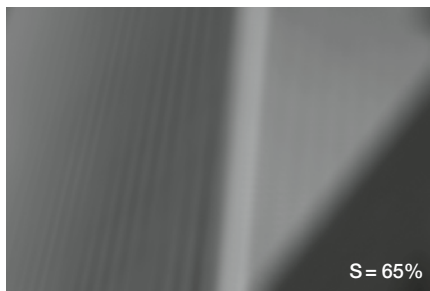


SHARPNESS

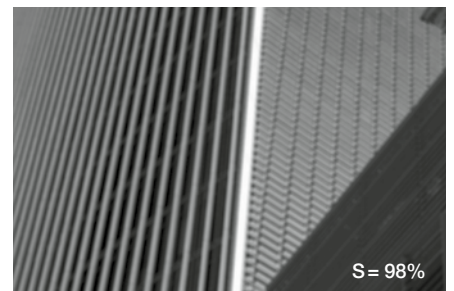
Sharpness quantifies the accuracy of images reflected in the surface, 100% indicates a perfect reflection.

At close distances (<0.5m) SHARPNESS measures how well surface reflects fine details. At showroom viewing distance (1.5m) SHARPNESS quantifies haze and clarity.

Close Distance view of an unsharp surface:



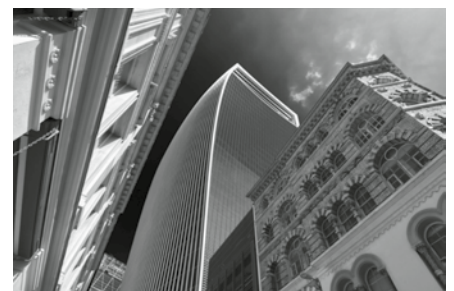
Close Distance view of a sharp surface:



Showroom Distance view of an unsharp surface:



Showroom Distance view of a sharp surface:





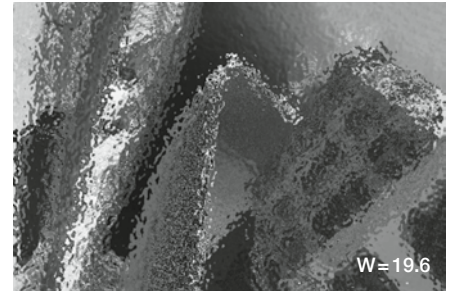
WAVINESS

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.

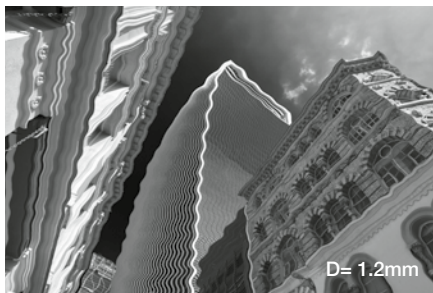
Flat surface:



Wavy Surface:



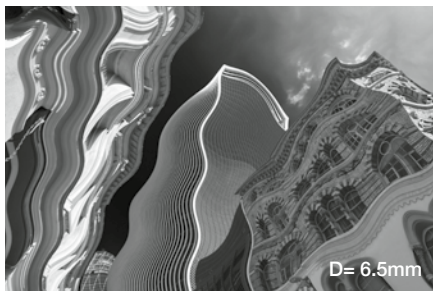
Small structure dominant surface:



DIMENSION

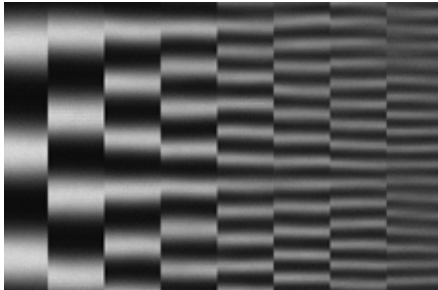
Indicates the dominant structure size perceived at showroom viewing distance. Typical values are between 1–6mm, the dominant structure size is important in determining the harmony between adjacent panels/parts.

Large structure dominant surface:



TAMS™ VISION

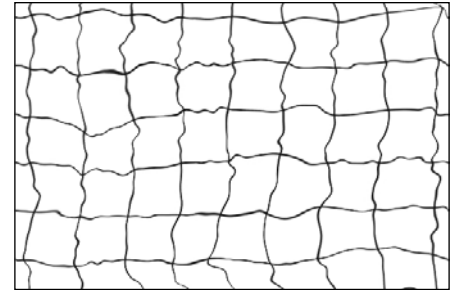
To achieve close correlation with human perception TAMS™ emulates the human evaluation of a reflective surface, changing its imaging system focus from surface to reflected image.



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.



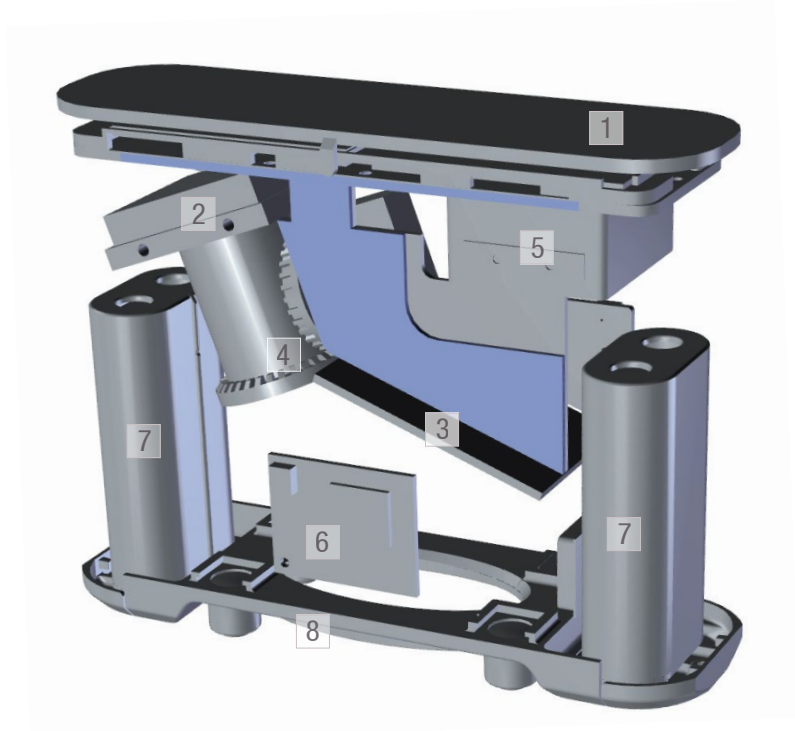
Surface topography is analysed to identify the Dominant structure.





APPLICATION OPTIONS





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

- 1 Operation Touch-screen
- 2 Camera sensor
- 3 Target screen
- 4 Focus system and actuator
- 5 Dual Processor: 1 GHz ARM Cortex A8 + DSP
- 6 RFID module
- 7 Removeable/rechargeable batteries
- 8 Push & Start pressure sensitive auto-measure system



-  Dual focus camera operation captures ALL surface appearance data
-  FAST operation with powerful on board image processing
-  Easy to use with on screen menu navigation prompts
-  SAFE to use- static measurement with soft contact area

-  ERGONOMIC operation-measure entire vehicle more easily
-  FAST & EASY data transfer via SD card
-  Flexible power options - 2x removable rechargeable battery or mains operation
-  Enhanced process integration via RFID

Specifications Rhopoint TAMS™

| SHARPNESS | |
|---------------------------------|---------------------------|
| Units | S (%) |
| Minimum (No visible reflection) | 0 |
| Maximum (Perfect mirror) | 100 |
| Resolution | 0.1 |
| Repeatability | 0.1 (SD) |
| Reproducibility | 0.5 (SD) |
| Measurement Technique | Optical Transfer Function |

| WAVINESS | |
|-----------------------|---|
| Units | W (W units) |
| Minimum | 0 |
| Maximum (typical) | 30 |
| Resolution | 0.1 |
| Repeatability | 0.2 (SD) |
| Reproducibility | 1 (SD) |
| Measurement Technique | Reflected Image Line Deformation Analysis |
| Correlation | AUDI AG MDS Perception analysis |

| QUALITY | |
|-------------------|--|
| Units | Q (%) |
| Minimum | 0 |
| Maximum (typical) | 100 |
| Resolution | 0.1 |
| Repeatability | 0.2 (SD) |
| Reproducibility | 0.8 (SD) |
| Algorithm | Calculated using Sharpness & Waviness |
| Correlation | Volkswagen AG Quality Perception Studies |

| INSTRUMENT SPECIFICATION | |
|--------------------------|---|
| Menu Interface | 5 Capacitive Sense buttons |
| Measurement Operation | Tactile button, capacitive sensor, push & start auto measurement system |
| Measurement Time | 4 Second Image Capture 4 Second Processing |
| Colour Screen | Full colour IPS screen |
| Power | Removeable and rechargeable lithium polymer batteries |
| Operation | Up to 5 hours/charge |
| Memory | >100,000 readings 8GB internal / 8GB SD card |
| Data Transfer | SD Card, USB, Ethernet |

| CONTRAST | |
|---------------------------------|---------------------------|
| Units | C (%) |
| Minimum (Perfect Diffuse White) | 0 |
| Maximum (Perfect Black) | 100 |
| Resolution | 0.1 |
| Repeatability | 0.1 (SD) |
| Reproducibility | 0.3 (SD) |
| Measurement Technique | Optical Transfer Function |

| DIMENSION | |
|-----------------------|---------------------------------|
| Units | D (mm) |
| Minimum | 0.5 |
| Maximum (typical) | 8 |
| Resolution | 0.1 |
| Repeatability | 0.1 (SD) |
| Reproducibility | 0.4 (SD) |
| Measurement Technique | Phase Measurement Deflectometry |
| Correlation | AUDI AG MDS Perception analysis |

| HARMONY | |
|-------------------|---------------------------------------|
| Units | H (H units) |
| Minimum | 0 |
| Maximum (typical) | 8.9 |
| Resolution | 0.1 |
| Repeatability | 0.1 (SD) |
| Reproducibility | 0.2 (SD) |
| Algorithm | Calculated using Waviness & Dimension |
| Correlation | AUDI AG MDS Perception analysis |

| | |
|------------------------------|--|
| Optical System | Variable Focus Machine Vision |
| Spatial Resolution (surface) | 34µm/pixel |
| Field of View (surface) | 25 x 16mm |
| Processor Specification | ARM A8 Dual core + Digital Signal Processor |
| Production Integration | RFID TAG Reader (optional) |
| Dimensions / Weight | 172 x 136 x 56 mm / 950g |
| Additional Sensors | Accelerometer, Orientation, 4 x Pressure (measurement) |
| Construction | Aluminium instrument case |

ACCESSORIES (INCLUDED)

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

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