



Thank you for purchasing this Rhopoint product.
Please read these instructions carefully before operating this product and retain them for future reference.

This instruction manual contains important information about the setup and use of your Rhopoint IQ Flex 60. It is essential that the contents be read before powering up and operating the instrument.

If this instrument is passed to other users you must ensure that the instruction manual is supplied with the instrument. If you have any questions or require additional information about the Rhopoint IQ Flex 60 please contact the Rhopoint Authorised Distributor for your region.

The technology and components used in the device are based on state-of-the art optic and electronics. As part of Rhopoint Instruments commitment to continually improving the technologies used in their products, they reserve the right to change information included in this document without prior notice.

© Copyright 2014 Rhopoint Instruments Ltd. All Rights Reserved.

Rhopoint IQ™ and Rhopoint™ are registered trademarks of Rhopoint Instruments Ltd. in the UK and other countries.

Other product and company names mentioned herein may be trademarks of their respective owner.

No portion of the software, documentation or other accompanying materials may be translated, modified, reproduced, copied or otherwise duplicated (with the exception of a backup copy), or distributed to a third party, without prior written authorization from Rhopoint Instruments Ltd.

Rhopoint Instruments Ltd.
Enviro 21 Business Park
Queensway Avenue South
St Leonards on Sea
TN38 9AG UK
Tel: +44 (0)1424 739622
Fax: +44 (0)1424 730600

Email: sales@rhopointinstruments.com
Website: www.rhopointinstruments.com

Revision C
August 2016

Contents

Storage and Handling	3
Accessories	5
Optional items	5
Functional overview	6
Power	7
Switching on the unit	7
Menu Screen	11
Batching Options	12
Setup Screen	13
Calibration Screen	15
Measurement Screen	16
Pass/Fail Setup Screen	17
Control Screen	18
Instrument Setup Screen	24
Maintenance Screen	25
Appearance Theory	28
Disadvantages of standard gloss measurement	30
Gloss	31
Haze	32
Measuring Haze with the Rhopoint IQ Flex 60	33
Haze Compensation	33
	33
Corrected haze measurement on metallic coatings	34
Distinctness of Image (DOI)	35
Reflected Image Quality (RIQ)	36
RSpec- Peak Specular Reflectance	37
Goniophotometric Profile	38
Technical Specification	40

Storage and Handling

- This instrument contains precision optics and electronics. You should avoid knocking or dropping the device as the resulting impact could cause serious damage.
- In some circumstances the optical components in the instrument could become misted as a consequence of temperature change. It is recommended that the instrument is not used until it has stabilised to ambient temperature.
- Ensure that the instrument is not exposed to moisture, chemicals or to any corrosive vapours.
- Do not interfere or place any objects inside the measuring aperture as damage to the measuring system could occur.
- The instrument housing and screen are normally resistant to a variety of solvents however it is not possible to guarantee resistance to all chemicals, therefore the surfaces of the instrument should only be cleaned using a soft, moist cloth.
- Prevent exposure of the instrument to direct sunlight for prolonged periods and to continuous humidity and condensation.

About the Rhopoint IQ Flex 60

The Rhopoint IQ Flex 60 is an advanced measuring instrument used to quantify the quality of surface appearance.

Unlike a standard glossmeter the IQ has the unique capability of measuring and detecting quality problems caused by microscopic texture in the surface that cause haze and orange peel effects which lead to poor Distinctness Of Image (DOI). These factors can seriously affect the visual impact and reflective quality of many coated, painted and polished surfaces. By measuring the quality of the reflected image it accurately profiles how light is reflected from a surface.

The instrument uses a diode array to measure the distribution of the reflected light at $+- 7.25^\circ$ from the specular angle of reflection in steps of 0.02832° .

This technology allows the instrument to calculate Gloss, Haze, DOI, RIQ and RSpec providing the user with a complete analysis of the reflective quality of the surface. Definitions of each of the parameters measured by the IQ can be found in the section "Appearance Theory" detailed later in this manual.

Accessories

The instrument is supplied as a standard package complete with all accessories required to calibrate and recharge the unit including:-

Rhopoint IQ Flex 60 Goniophotometer

Rhopoint IQ Flex 60 measuring head and remote connecting cable

BAM traceable high gloss calibration tile including certificate

Cleaning cloth for calibration tile

BAM traceable instrument certificate

USB Mains Charger with four selectable mains input connectors (UK / Europe / US / Australia)

USB PC cable

Quick Start Operating Instructions

Protective instrument carry case

Optional items

BAM traceable mirror gloss calibration tile including certificate

Functional overview



<u>Label No.</u>	<u>Function</u>
1	Measurement button
2	High Resolution Graphic Display
3	Up/Down/Left/Right Buttons
4	Operate / Enter Button
5	Calibration Tile

The instrument is controlled by pressing the relevant touch sensitive button. Functionality is dependent on whether the instrument is in menu or operate mode as detailed in the operation sections that follow.

Power

The Rhopoint IQ Flex 60 is powered by an integrated high capacity lithium ion cell.

Fully charged the instrument will operate continuously for >17 Hours or >20,000 readings.

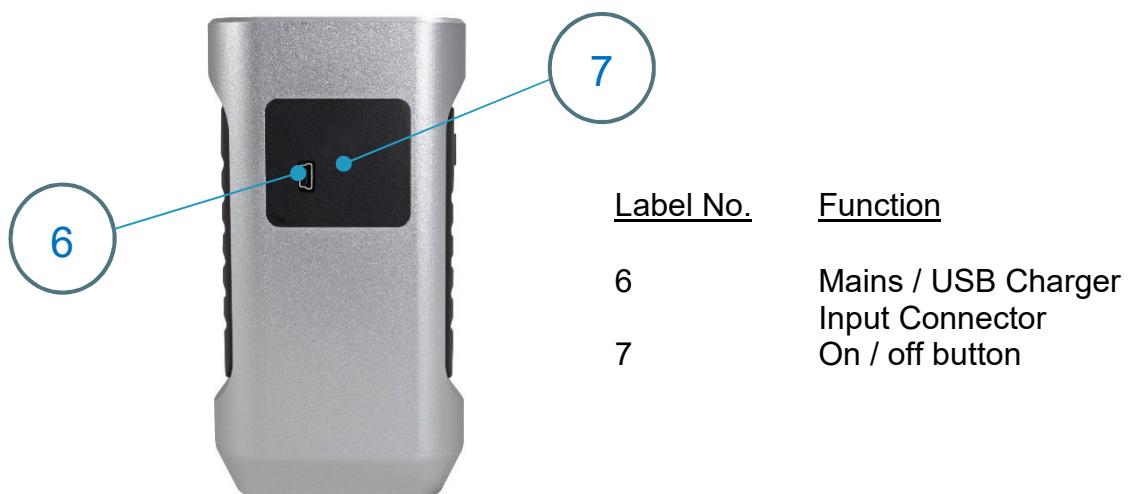
A mains powered USB charger is provided with the unit, this will fully charge the unit when connected to the units USB input (6) using the USB cable provided in under 4 hours.

Alternatively the Rhopoint IQ Flex 60 can be powered and charged using the USB cable attached to any compatible USB host (e.g. laptop etc.), however due to the lower current available from these devices, the charge time will be a minimum of 6 – 8 hours.

Do not operate the instrument whilst it is charging

Switching on the unit

To switch on the unit touch the On/Off button located at the back of the instrument near the USB socket.



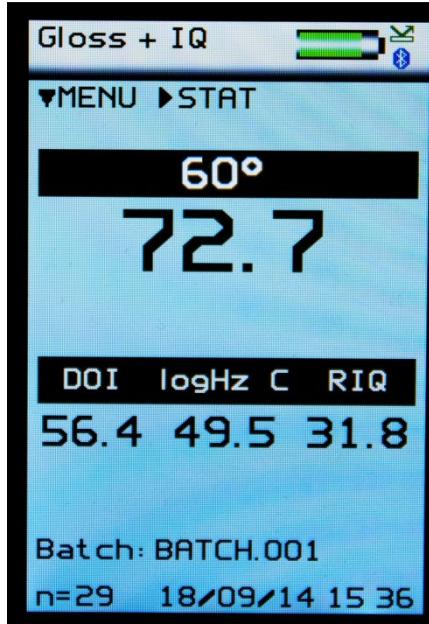
The instrument will display the Rhopoint IQ Flex 60 logo and then enter into the home screen displaying measurement parameters according to the instruments default settings or those previously configured.

Similarly the instrument can be powered off (dependent on configuration – see Instrument Setup) by pressing the On/Off button for three seconds.

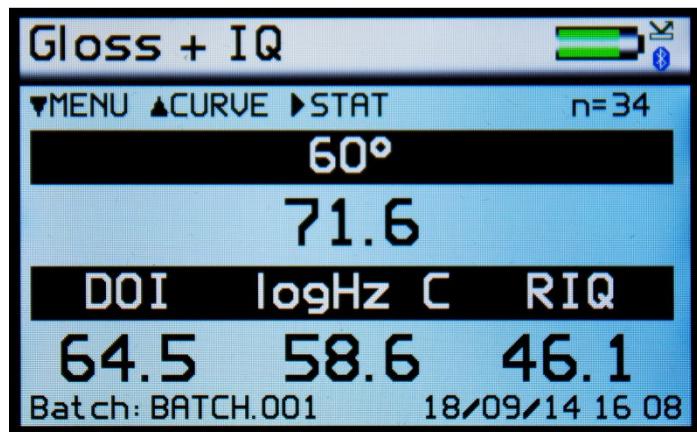
Operation

The Rhopoint IQ Flex 60 has the ability to “flip” its screens according to its measurement orientation.

It automatically displays measurement data in either portrait mode –

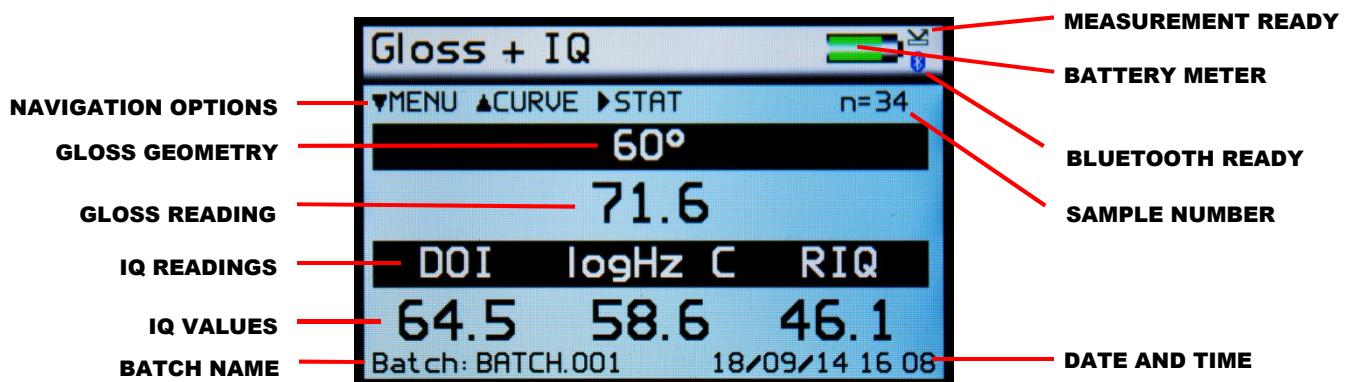


Or landscape mode -



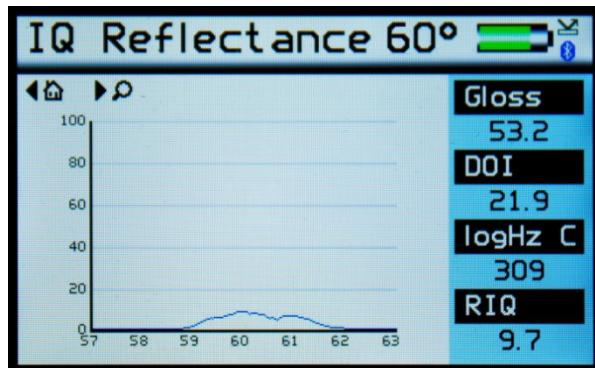
Note- Main measurement screen, statistics and main menu are available in portrait view. Other menus and graphs can only be accessed with the instrument is held in landscape orientation. The flip function is disabled when landscape only screens are shown and when an on screen prompts is visible.

With the unit switched on and initialised the instrument will display the home screen as shown below.



In this mode, measurements can be made by simply pressing the Measurement button (1) on the side of the instrument or Operate button (4) on the instrument keypad.

Pressing the Up (3) button in the home screen the graph screen will be displayed.

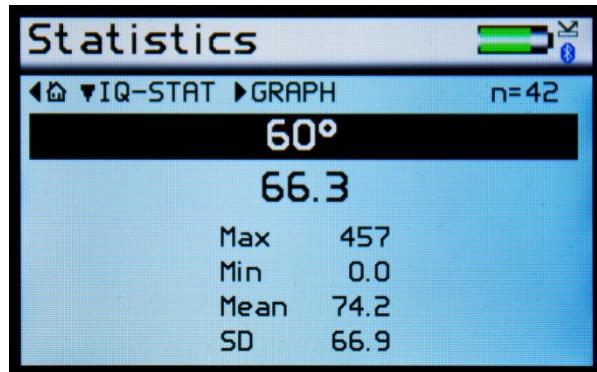


The goniophotometric profile and data for the last 60° measurement will be shown. Measurements can be taken whilst in this screen and the display will be updated.

Pressing the Left button returns the display to the home screen.

Measurements can again be taken whilst in this screen and the statistics will be updated.

Pressing the Right button in the home screen the IQ statistics screen is shown for the current batch.



Pressing the Left button returns the display to the home screen.

Pressing the Right button in the IQ statistics screen will access the IQ graph screen providing a graphical representation of the statistics data. This same screen is available for gloss statistics when in the IQ statistics screen.



Pressing the Up / Down buttons IQ data can be displayed either all together or individually.

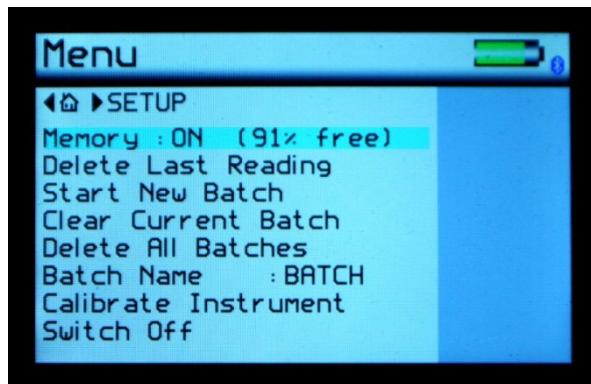
Pressing the Up button in the IQ graph screen accesses the gloss graph screen. Measurements can be taken whilst in this screen and the graph will be updated after each reading.

Pressing the Left button returns the display to the statistics screen.

Pressing the Right button the instrument returns the display to the home screen.

Menu Screen

The Menu Screen is used to quickly access often used options. Pressing the Up and Down buttons navigates through the options, pressing the Enter button selects that option.



Selectable settings in the menu screen are:-

Memory – Set to ON, enables storage and batching of measurement results. The amount of available storage memory is also displayed.

Set to OFF, disables result storage.

With Memory ON:

Delete Last Reading – Delete last measurement, no. of measurements and statistics data updated to previous values.

Start New Batch – Start new batch of readings, Batch name is incremented by 1.

Clear Current Batch – Delete entire batch of measurements for current batch.

Delete All Batches – Delete all batches and measurements stored.

Batch Name – Default name is BATCH, a maximum of 8 user defined batch names can be used as detailed in the “Batching Options” section.

Calibrate Instrument – Perform a calibration of the instrument as detailed under “Operation”.

Switch Off – Turn off the instrument.

Pressing the Left button returns the display to the home screen.

Pressing the Right button will access the Setup screen.

Batching Options

The batching feature allows the user to group measurements together in batches. Each batch has associated statistics; the data for each batch can be accessed by connecting the instrument to a PC.

The current batch name is displayed on the home screen in the bottom left corner, the sample number within that batch is shown in the top right of the screen indicated with n=(sample number).

A new batch is started using the Start New Batch option in either the Menu screen or the Data menu, note that the batch name will increment as will the 'n' indicator.

The current batch can be cleared in either the Menu screen or the Data Menu, the batch name will remain the same but the 'n' indicator will reset to zero.

Auto batch size is user defined using the Auto Batch option in the Data Menu. When the number of readings in the current batch reach the number set by the user the instrument will automatically increment the batch name and set the 'n' indicator to zero.

Viewing Batch Data

To access the stored batch information connect the instrument to a PC using the USB data cable supplied.

A new device name "IQ-METER" can be viewed and accessed via "MY COMPUTER", in this device open the DATA folder. This folder contains subfolders which contain the data for each individual saved batch. Each reading is saved as an individual comma separated value (.csv) that contains Gloss, Haze, DOI/RIQ, RSpec, Time and Date of Reading, Serial Number and Full Goniophotometric data for all 512 diode elements.

Each reading also contains the statistics for the batch up to and including that reading. To access the STATISTICS for the whole batch, the last reading in the batch should be examined.

User Defined Batch Names

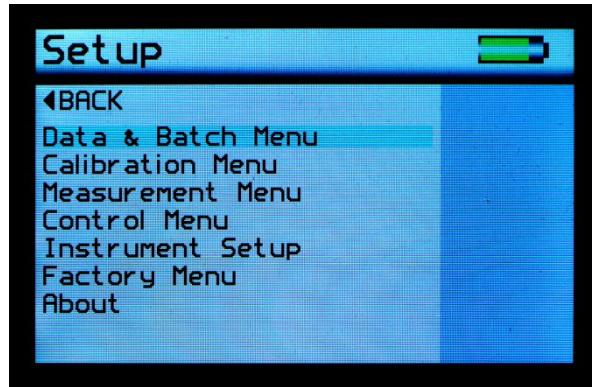
Batch names are user definable. With the instrument connected to a PC, open the folder named "CONFIG". Within this folder there is a document named "batches". This is a .csv file that can be opened in Notepad, Excel or Wordpad.

User defined names should be saved in this document each name listed on a separate line. Ensure that the final line is terminated with a carriage return.

The format of these names should only contain letters, no numbers, spaces or other characters can be used.

Once completed save the file then switch the instrument off and on again to initialize the new batch names.

Setup Screen



The Setup Screen is used to customise the instrument to the user's preference. Pressing the Up and Down buttons navigates through the options, pressing the Enter button selects that option.

Data and Batch Menu - Batch / Data options (See Data & Batch Menu Screen)

Calibration Menu - Calibration options (See Calibration Menu Screen)

Measurement Menu - Geometry setup (See Measurement Menu Screen)

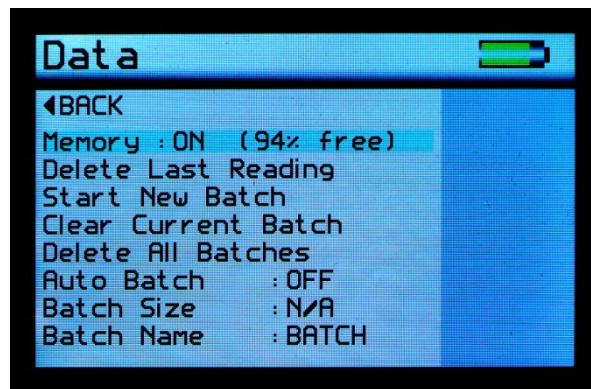
Control Menu - Bluetooth setup (See Control Menu Screen)

Instrument Setup - Language, Date / Time and Power options (Setup Menu Screen)

Factory Menu - Pin locked menu options for Rhopoint authorised service centres

Pressing the Left button returns the display to the home screen.

Data & Batch Screen



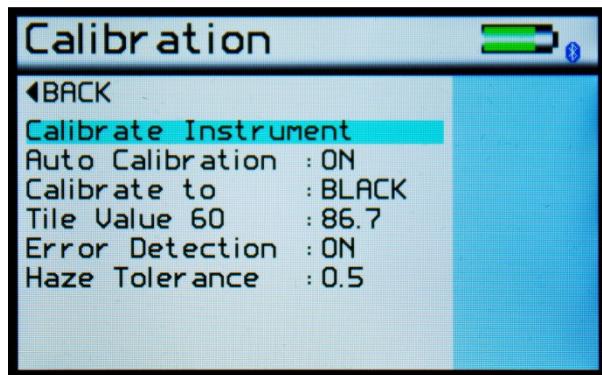
The Data Screen is similar in functionality to that of the menu screen but also allows the selection and setting of the Auto Batch size.

By selecting Auto Batch to ON the batch size can be selected between 1 - 999 by pressing the Left and Right buttons to select the relevant digit and the Up and Down buttons to increment / decrement the value. Pressing the Enter button saves the batch size.

If Batch names have been user defined, as detailed under Batching Options, selection of the Batch Name required is achieved by repeatedly pressing the Enter button with Batch Name selected.

Pressing the Left button returns the display to the home screen.

Calibration Screen



The Calibration Screen is used to setup the instrument calibration to the user's preference. Pressing the Up and Down buttons navigates through the options, pressing the Enter button selects that option.

Selectable settings in the Calibration screen are:-

Calibrate instrument - Performs an instant calibration of the instrument; a dialogue box being displayed upon completion to either "Cancel" or "Confirm".

Calibrate to - Set to Black - a traceable gloss tile is used for calibration

Set to Mirror - a traceable mirror tile is used for calibration

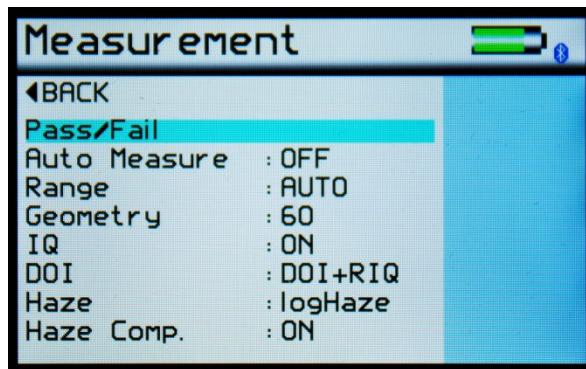
Tile Value 60 - Set the calibration values for either standard being used for calibration. Pressing the Enter button selects the value. Pressing the Left and Right buttons selects the relevant digit and the Up and Down buttons increment / decrement the value. Pressing the Enter button again saves the value.

Error Detection - Set to ON the instrument detects the condition of the calibration standard being used. If there are fingermarks or debris which cause it to fall outside the value set in Haze Tolerance an error message is displayed before calibration requesting that the tile be checked for cleanliness.

Set to OFF – Error detection is disabled, calibration is permitted irrespective of calibration standard condition.

Haze Tolerance - Set the tolerance for the standard being used for calibration. An ideal calibration standard should have zero haze, therefore setting this value anywhere between 0 – 9.9 defines the acceptable pass band. Pressing the Enter button selects the value. Pressing the Left and Right buttons selects the relevant digit and the Up and Down buttons increment / decrement the value. Pressing the Enter button again saves the value. Pressing the Left button returns the display to the home screen.

Measurement Screen



The Measurement Screen is used to configure the instruments measurement parameters to the user's preference. Pressing the Up and Down buttons navigates through the options, pressing the Enter button selects that option.

Selectable settings in the Measurement screen are:-

Pass/Fail - Displays the Pass/Fail set up screen.

Auto Measure - Enables or disables automatic measurement mode, used for monitoring surfaces for changes over a period of time. Pressing the Enter button selects the required measurement frequency of either 2, 5 or 10 seconds. When auto measure mode is activated a dialogue box is displayed after the Enter button is pressed and before the beginning of the measurement sequence indicating that it is activated. To stop auto measure simply press the Enter button once again at any time during the sequence.

Range - Selects gloss measuring range to:

Auto – Full range

Black – Standard gloss scale

Mirror - Extended scale for highly reflective materials, polished metals, requires calibration using Mirror standard.

Geometry - Displays the head geometry (60°)

IQ - Selects IQ information to be either displayed (ON) or not displayed (OFF) on screen

DOI – Selects either standard DOI (Distinctness of Image), enhanced RIQ (Reflected Image Quality) scale or Rspec (peak specular reflectance), details of which can be found in the Appearance Theory section of this manual.

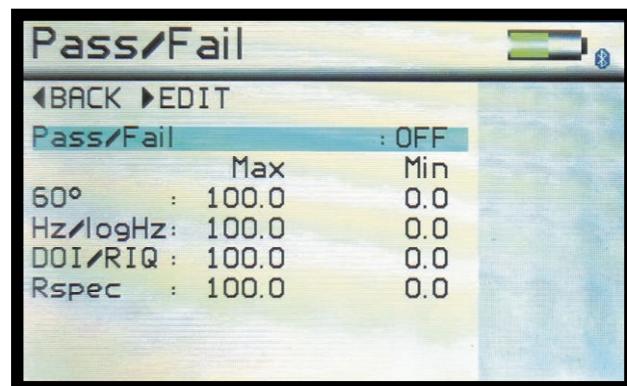
Display configurations options are: DOI & RIQ / RIQ & Rspec / DOI & Rspec

Haze – Selects either Haze or logHaze (a more sensitive measurement)

Haze Compensation - Selects either ON or OFF. Further details of Haze Compensation can be found in the Appearance Theory section of this manual.

Pressing the Left button returns the display to the home screen.

Pass/Fail Setup Screen



The Pass/Fail setup screen is used to enable/disable on-screen pass/fail indication and set min / max tolerancing.

The down key should be used to navigate to the Pass/Fail option and the center button pressed to toggle the feature on and off.

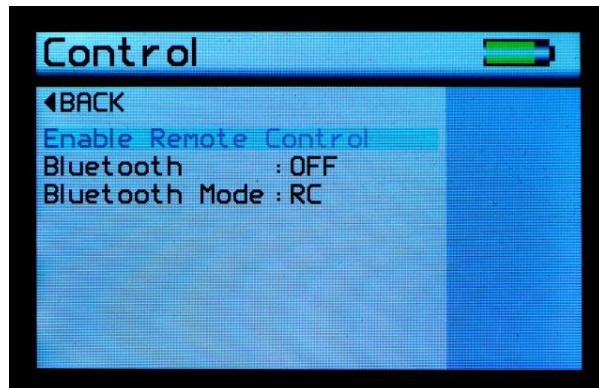
Pressing the right navigation button allows the user to edit pass & fail criteria.

Once the Pass/Fail feature is enabled, any measurement which falls between the max and min values will be considered a pass and its header text will be coloured green. Readings above the max value or below min value will be deemed a fail and header text will be coloured red. Saved data and data transmitted by Bluetooth will also contain a pass/fail field.

Select the done option to complete this process.

NB. Pass / fail is not available when DOI parameters of DOI and RIQ are selected

Control Screen



The Control Screen is used to configure the instruments Bluetooth parameters to the user's preference. Pressing the Up and Down buttons navigates through the options, pressing the Enter button selects that option.

Enable Remote Control is not presently user configurable

Selectable settings in the Control screen are:-

ID - Measurement definition header

SOF / EOF - Start / End of file markers for use in analysis software

Bluetooth – Enables or disables Bluetooth

Bluetooth Mode – Selects Bluetooth data mode:

RC – Remote Control

Data – Basic data transfer mode (transmits On-Screen Parameters – use with Data Analysis spreadsheet)

Data + - Extended data mode (transmits all goniophotometric data - use with Data+ Analysis spreadsheet)

Pressing the Left button returns the display to the home screen.

Bluetooth Communication and Pairing

The Rhopoint IQ Flex 60 has a Bluetooth function that allows readings to be instantly transmitted to a compatible PC.

60° Gloss, Haze + Log Haze, DOI/RIQ, RSPEC, Goniophotometric information, instrument serial number and service/calibration data can be instantly accessed by many PC applications including Excel, Word, Wordpad, OpenOffice or SPC packages.

Pairing Procedure



1. Switch on the Rhopoint IQ.
2. The Bluetooth icon must be visible to allow pairing.



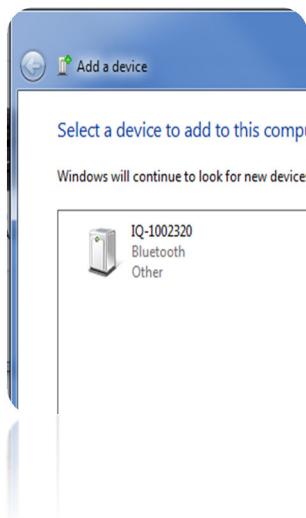
3. If the Bluetooth icon is not visible, enable it as detailed in Control Screen. Ensure that Bluetooth mode is set to either Data or Data+.



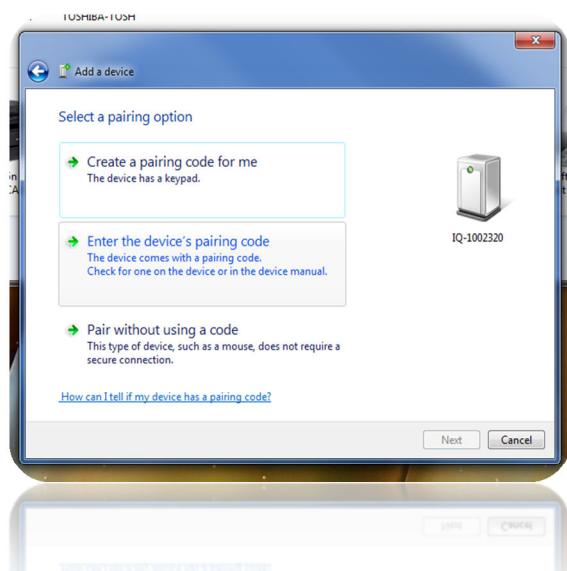
4. In Windows, go to START menu and select "Devices and Printers."



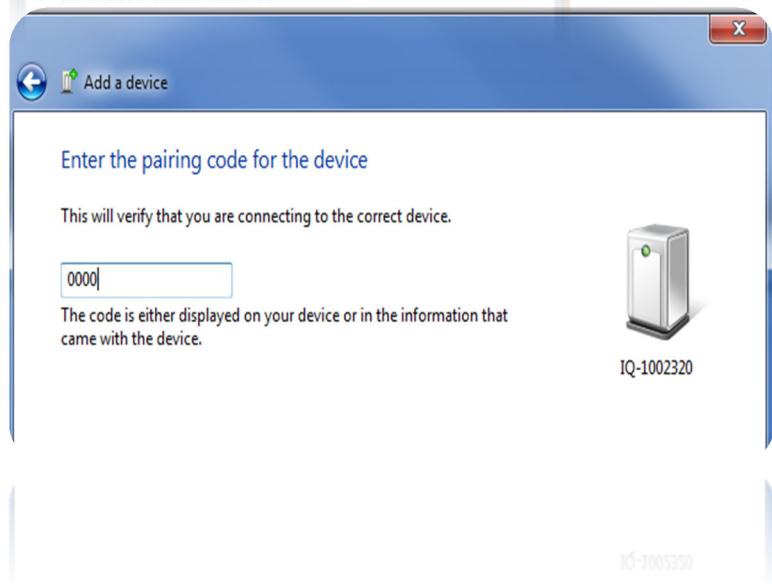
5. In Devices and Printers screen Click "Add a device"



6. Windows will now search for available Bluetooth devices, double click on the icon that corresponds to the IQ instrument.

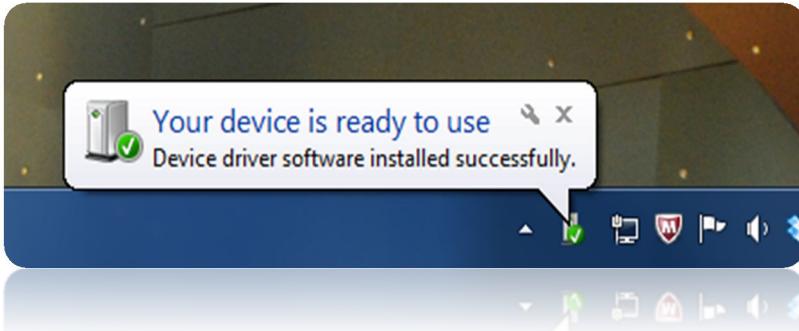


7: Click "Enter the devices pairing code" in the "Add a device" screen.



8: Enter the pairing code "0000".

Make sure the IQ remains switched on throughout this process, to disable or extend auto power off refer to instructions detailed in Instrument Setup Screen that follow.



9. The IQ is now installed on your PC and ready for connection to the Bluetooth Data Widget.

It is important to wait until windows displays the "Your device is ready to use" message before starting the data widget.

Bluetooth Data Widget Installation Instructions

The Bluetooth (BT) Data Widget software supplied with the instrument is a mini program that converts transmitted measurement data into keystrokes that are automatically input into any open PC program.

1. Install the BT Data Widget software (BTdatawidget.exe) found on the cd supplied with the instrument.



2. Check Bluetooth is switched on and that the instrument has been paired correctly



3. On the desktop click on the "Data Widget" icon to start



4. Click on the blue "refresh" arrow to search for paired IQ(s).



5. The buttons are greyed out while the DATA widget searches for SWITCHED ON IQ(s) that have been PAIRED to the PC.



6. Look in the data widget drop down box to see discovered instruments.



7. Select the instrument required.

8. Click the tick to connect the instrument.



8. The transmitter icon now appears on the IQ.
All readings will now be automatically transferred to any open windows package.
Download example EXCEL spreadsheets from Rhopoint's website.

Instrument Setup Screen



The Instrument Setup screen is used to configure the instruments basic operating environment to the user's preference. Pressing the Up and Down buttons navigates through the options, pressing the Enter button selects that option.

Selectable settings in the Instrument Setup screen are:-

Language – Set instrument language to English (default), Spanish, Italian, French, German, Chinese

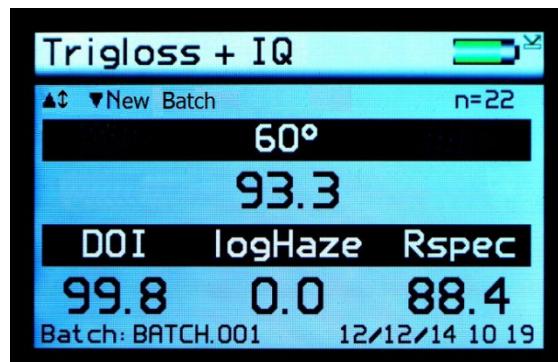
Backlight – Set screen intensity to either 20%, 40%, 60%, 80% or 100% brightness

Power Off – Set instrument to automatically power off after either 30sec, 60sec, 90 sec or 120 sec or inactivity or DISABLE this feature

Power Switch – Set On/Off button to switch the instrument ON ONLY, switch the instrument ON & OFF, or set it to ON (Fn) to operate as a Function Select button.

Selecting the Power Switch to Function Select mode provides easy access to two regularly used features, Rotate Screen and New Batch.

In the home screen, press and hold the On/Off button, the display will change as shown below-



Pressing either the Up button will rotate the screen. Only one rotation is possible each time the On/Off button is pressed.

Pressing the Down button allows a New Batch to be started, this action is either Confirmed or Cancelled by selecting the required box when prompted using the Left and Right buttons and pressing the Enter button.

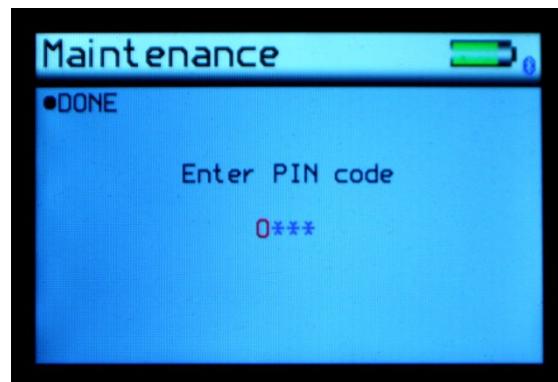
Sound – Enable or disable button press sound

USB Charge – Set the USB charge current to either 500mA or 100/500mA

Set Date & Time – Set the date and time on the instrument. Press the Down button to set time. Pressing the Left and Right buttons selects the date or time and the Up and Down buttons increment / decrement the value. Pressing the Enter button again saves the value.

Pressing the Left button returns the display to the home screen

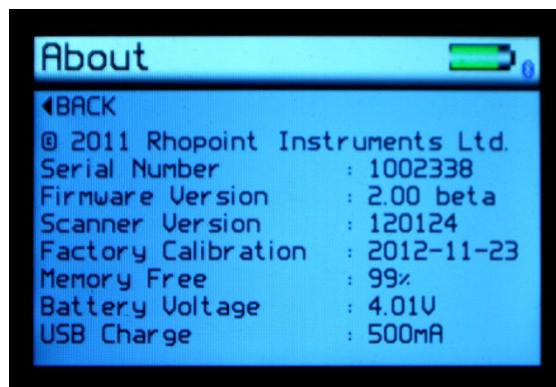
Maintenance Screen



The Maintenance screen is used by Rhopoint Approved Service Centres. It is PIN locked to prevent unauthorised access. There are no user configurable settings available.

Pressing the Enter button returns the display to the home screen

About Screen



The About screen is for information only.
It provides information relating to the instruments software, the instrument serial number and last date of Factory Calibration.
It also shows the amount of free memory available and battery power status.

Notes

Appearance Theory

Rhopoint IQ Glossmeter & Goniophotometer

Goniophotometer is derived from Greek;

Gonio – Angle,

Phos – Light,

Metron - Measure

Gloss describes the perception of a surface appearing “shiny” when light is reflected from it.

When viewing glossy surfaces it is found that a sudden increase in brightness occurs when the angle of observation equals the angle of incidence of the illuminating light. This condition is termed as specular reflection.

Unlike a glossmeter that is used to quantify the amount of light reflected from a surface, the Rhopoint IQ uses a diode array at 60° to measure the distribution of reflected light +/- 7.25° from the specular reflection angle in steps of 0.02832°.

This technology allows the instrument to calculate Gloss, Haze, Distinctness of Image, Reflected Image Quality and RSpec. These parameters inform the user not just how reflective the surface is but also provide information about its image forming qualities and smoothness of the finish.

These values are used to assess the visual impact and reflective quality of many coated, painted and polished surfaces.

Why is reflected appearance important?

A crucial factor in assessing the appearance of any manufactured product is the “glossiness” of its finish.

Gloss finishes are often used to make products visually appealing. Highly reflective, extremely smooth finishes are used to enhance the aesthetics of cars, luxury yachts and high end consumer electronics. Matt finishes are used for contrast or on furniture and architectural features.

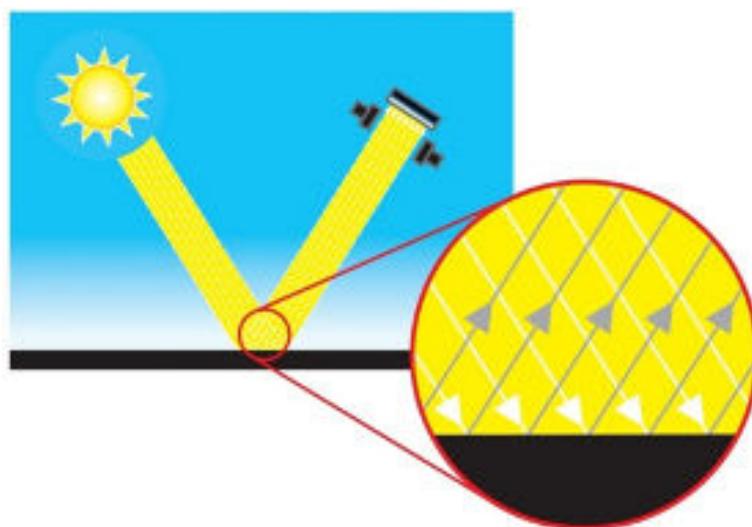
Whilst gloss measurement is the most widely used technique to assess reflective qualities, it is not sensitive to surface textures which reduce perceived quality. This means that surfaces can often have *identical gloss values* but have very different visual appearance.

The Rhopoint IQ measures standard gloss within existing standards, and uses new technology to examine in more detail the distribution effect which reduces perceived quality.

The instrument provides goniophotometric profiles, gloss, haze and distinctness of image values which can be used to assess the visual qualities of any product.

As well as assessing the visual impact of a surface, the Rhopoint IQ can also be used to identify problems associated with coating formulation and application.

Coating problems such as dry spray, orange peel, poorly dispersed or flocculated pigments, micro bubbles, resin incompatibilities and additive migration all result in reduced DOI, Haze or gloss values and therefore can be measured with this instrument.



Specular reflectance from a “perfect mirror” surface - all light is reflected in the specular direction

Disadvantages of standard gloss measurement

In 1925 Pfund described a simple method for measuring specular reflectance; this method has since been refined and standardised but the basic design for a glossmeter has remained unchanged.

The conventional glossmeter is widely used to assess the visual quality of test panels and product surfaces; however the human eye can see certain surface defects that are not detected with this instrument. This is a particular problem where measured finishes are given high gloss values but rated by observers as having a poor appearance.

The reason for differences between observed quality and measured gloss is because light entering a glossmeter is recorded as one value without the detection of variation. In the human eye the reflected image activates a compact array of light sensors known as cones, the detailed signal from these cones allows the eye to see subtle textures on a surface that are not recorded with a glossmeter.

The Rhopoint IQ Flex 60, with its array of light sensors mimics the effect of reflected light in the human eye. This detailed information allows the user to measure and control surface defects that are undetectable with a standard glossmeter.

Gloss

Gloss is the visual sensation associated with the brightness of direct light reflected in a surface. Surfaces with high reflectance are determined as glossy; less reflective surfaces are semi-gloss or matt.

Glossmeters quantify this effect by measuring light reflection from a sample at defined angles.

The Gloss Unit (GU) is defined in international standards including ISO 2813 and ASTM D523. It is determined by the amount of reflected light from a glass standard of known refractive index.

Calibration tiles supplied with Rhopoint instruments are traceable to master glass standards held at BAM (Germany).

The measurement angles most commonly used for gloss are 20°, 60° and 85°.

- The most appropriate angle should be selected dependent on the glossiness of the sample surface.
- Using the correct measurement geometry increases resolution and improves the correlation of results with human perception of quality.

To determine the correct measurement angle the surface should be assessed with the 60° geometry-

- Matt surfaces which measure below 10 GU @ 60° should be re-measured with the 85° angle.
- High gloss surfaces which measure above 70 GU @ 60° should be assessed using the 20° angle.
- The 60 degree angle is best employed on mid gloss samples 10-70 GU.

Measuring Gloss with the Rhopoint IQ Flex 60

The Rhopoint IQ Flex 60 is supplied with an ISO 17025 certified glass calibration tile traceable to a BAM reference standard.

Conventional glossmeter optics are used at 60° & 85° these fully comply with international gloss standards such as ISO 2813 and ASTM 523.

At 60° the Rhopoint IQ Flex 60 uses a diode array which measures the distribution of reflected light 52.75° – 67.25°.

The instrument does not have physical receiver apertures like a conventional glossmeter; the 60° gloss value is obtained by measuring with elements of the array which correspond to the angles specified in the standards.

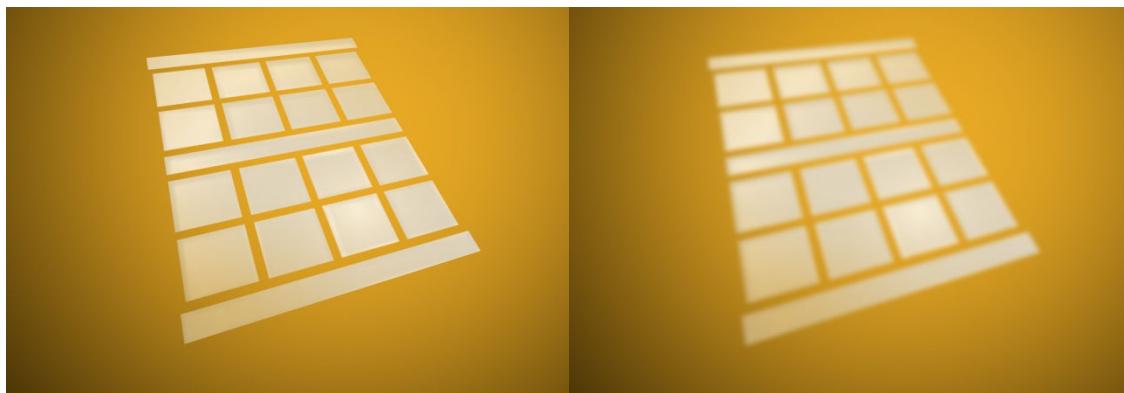
Haze

Haze describes the milky halo or bloom seen on the surface of high gloss surfaces.

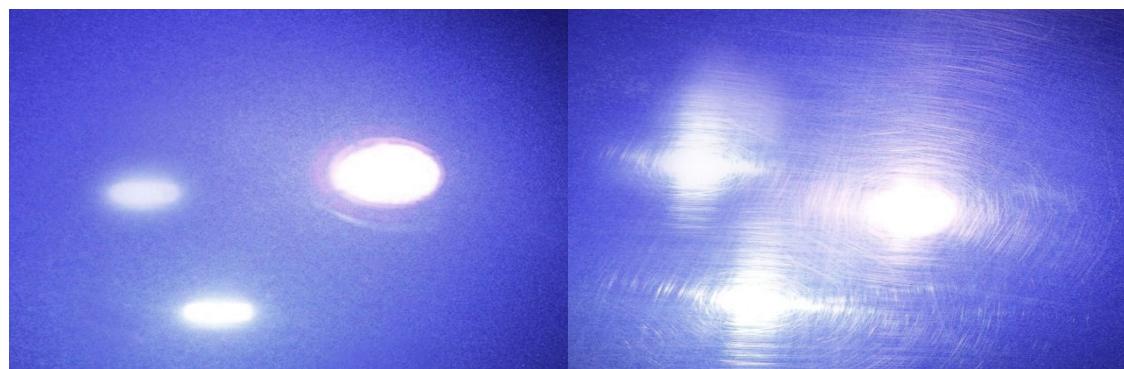
Surface haze can be problematic in most coating applications including automotive manufacture, powder coatings and other high gloss coatings. It can be attributed to a number of causes including incompatible materials in a formulation, poor dispersion and problems encountered during drying/curing/stoving.

Coatings without haze can be seen to have a deep reflection and have high reflected contrast. Those with haze exhibit a slight “milky” finish which can be seen over the highly glossy surface.

Haze is caused by microscopic surface texture which diffuses light adjacent to the main component of the reflected light.



When viewing the reflection of a strong light source in a surface with high haze the image “blooms” and has a bright halo around it.



Haze is an important measure for highly polished metals and is often associated with polishing marks and machining direction.

Gloss-haze meters are traditionally used to measure this parameter and use a standard glossmeter design with additional light stops and diodes to measure the haze component 2° either side of the specular component.

Measuring Haze with the Rhopoint IQ Flex 60

Taking reliable readings with a traditional gloss-haze meter can be difficult as the sample surface needs to be completely flat and un-textured.

The Rhopoint IQ Flex 60 automatically compensates for sample surface flatness and texturing allowing haze measurements to be taken on a much wider range of product surfaces.

Gloss Haze values are calculated using the angular tolerances described in ASTM E430. The instrument can display the natural haze value (HU) or Log Haze Value (HU_{LOG}).

When measuring haze values, higher numbers indicate a lower quality surface.

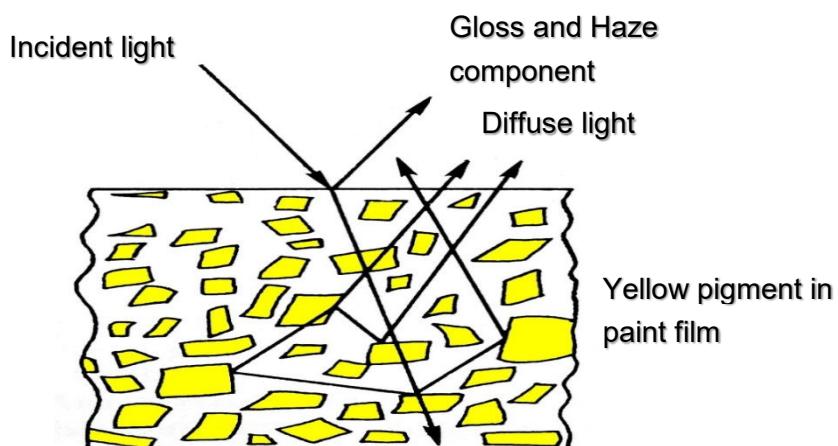
A high gloss surface with zero haze has a deep reflection image with high contrast.

Log Haze Values are commonly quoted for paints and coatings as this scale has better corroboration with human perception of surface quality.

Haze Compensation

Reflection haze is caused by micro texture on a surface which causes a small amount of light to be reflected adjacent to the gloss angle. For white surfaces, bright colours and metallics, a certain amount of diffuse light, reflected from within the material, is also present in this region.

This diffuse light exaggerates the haze signal for these surfaces causing higher than expected readings.

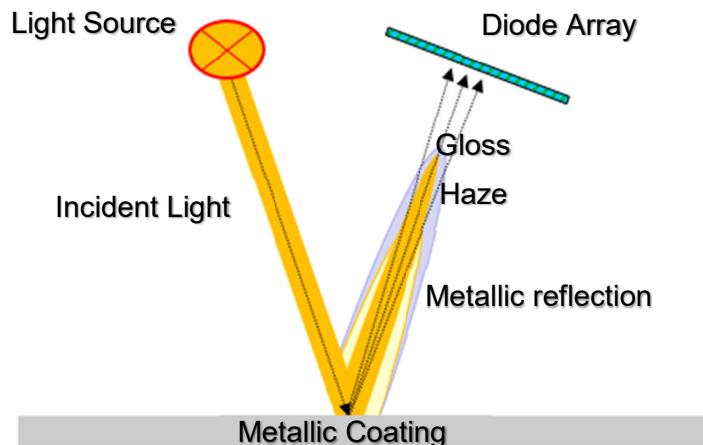


The Rhopoint IQ Flex 60 compensates for reflection from within the coating for highly reflective pigments, metallic coatings and speciality pigments, allowing the haze of any painted surface to be measured.

Corrected haze measurement on metallic coatings

For non metallic surfaces, the diffuse component is lambertian- it is equal in amplitude at all angles in relation to the sample surface. Conventional gloss-hazemeters measure diffuse reflection using a luminosity sensor positioned away from the gloss angle. Luminosity is subtracted from the haze signal allowing non metallic surfaces measured independent of their colour.

Conventional gloss-haze meters do not work correctly on metallic coatings as metallic flake within the coating reflects the light directionally around the specular angle. As little or no metallic reflection is present at the angle at which the luminosity is measured, metallic coatings and specialiy pigments have an unexpectedly high haze reading.



The Rhopoint IQ captures compensation information from a region adjacent to the haze measurement angle, this means it can be used on metallic coatings which reflect light directionally

An advantage of the IQ is that unlike a conventional instrument, compensation is calculated using a region adjacent to the haze angle. This techniques gives compatible readings on solid colours but also compensates for directional reflection from metallic coatings and speciality pigments

Distinctness of Image (DOI)

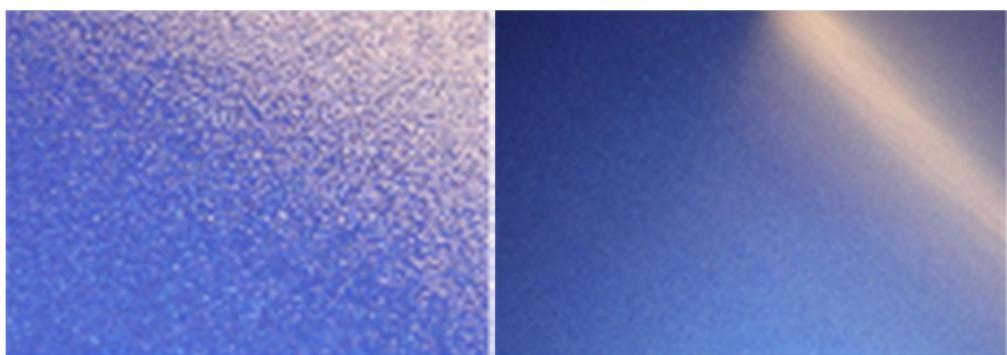
Distinctness Of Image is, as the name implies a function of the sharpness of a reflected image in a coating surface.

Two surfaces finished with similar coatings may exhibit identical gloss values but visually the quality of one coating can be seen to be very poor. Upon closer inspection the visually substandard poor coating has a highly textured dimpled appearance known as “orange peel”. When a reflected object is viewed in such a coating the image becomes fuzzy and distorted.

Orange peel, waviness, texturing, pin holing and similar effects can be problematic in many high gloss coating applications including automotive, powder coating and any other industries that requires a smooth homogenous finish. All these effects can be measured with the Rhopoint IQ Flex 60.

DOI has been measured instrumentally and subjectively in the automotive industry for many years. Instruments that measured this value in the past were bulky expensive and some had poor repeatability. DOI measurement was not common outside of automotive because of the cost of equipment was high and the demand for high quality gloss finish was not as crucial.

The Rhopoint IQ Flex 60 measures the DOI of a surface by quantifying the way a reflected measurement beam is spread and distorted around the specular angle.



Example test panels with low and high DOI values. Orange peel, texture, flow out and other key parameters can be assessed in coating applications where high gloss quality is becoming increasingly important.

The DOI value of a surface is a number between zero and one hundred; a surface that exhibits a perfect undistorted image returns a value of 100, as the value decreases the image becomes less discernible.

Reflected Image Quality (RIQ)

Reflected Image Quality is a new measurement developed by Rhopoint Instruments to provide greater sensitivity when evaluating highly reflective coatings and the specular / diffuse element of lower gloss materials.

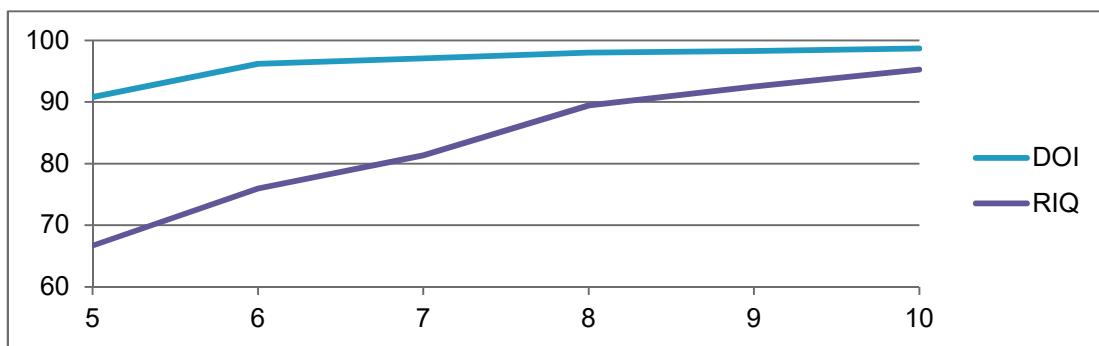
Two highly reflective surfaces that have very small changes in orange peel or texture will show very little or no change in DOI due to the way that it is calculated, but will appear quite different visually.

By reducing the sensing distance around the specular angle and measuring the reflected light and distortion around it, a much higher resolution response is achieved with greater linearity, more in line with the visual experience.



Two highly reflective panels with the same gloss values show little change in DOI but appear different.

Similarly for lower gloss materials, due to the smaller sensing distance, this measurement allows improved differentiation of the specular and diffuse elements of reflectance from the surface. As this sensing distance only allows the measurement of the amount of truly reflected light in the specular direction it is far more directionally selective.



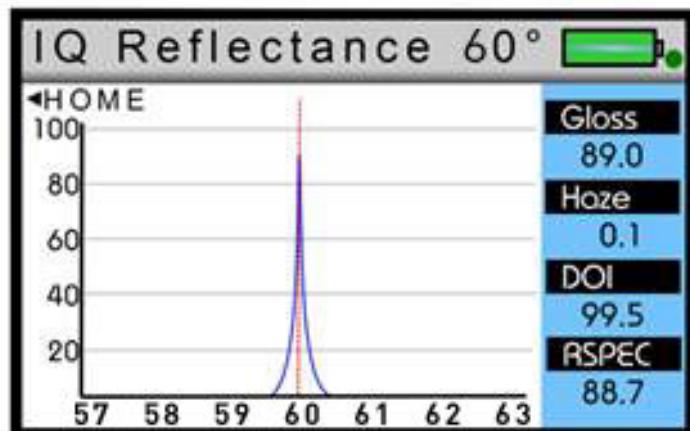
Average measurements of ACT Panels 5 – 10 show little variation when using DOI. However when using RIQ, a greater differentiation is achieved.

The RIQ value of a surface is also a number between zero and one hundred; a surface that exhibits a perfect undistorted image returns a value of 100, as the values decrease higher surface texture is present and the image sharpness reduced.

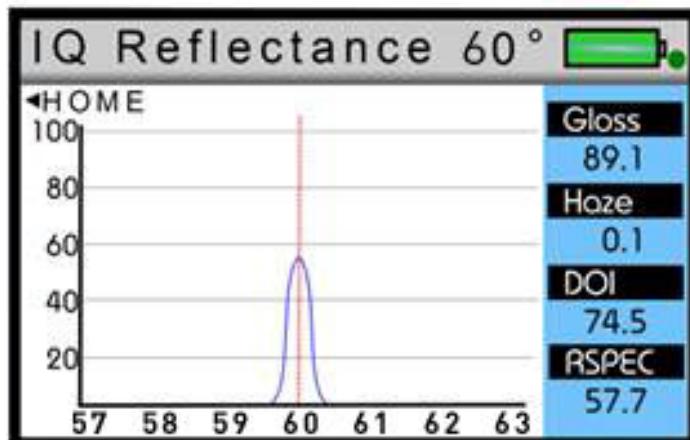
RSpec- Peak Specular Reflectance

RSpec is the peak reflectance measured over a very narrow angle in the specular direction (+/-) 0.0991°.

RSpec is very sensitive to any surface texture. Waviness or rippling on a surface acts as a concave or convex reflector deflecting light around the specular angle. When RSpec is equal to the gloss the surface is smooth, RSpec drops as texture becomes apparent.



The same paint applied to two panels, the second system has orange peel/waviness which is due to incorrect application setting on spray gun. RSPEC is shown by the red line.4



Automatic Curvature and Position compensation

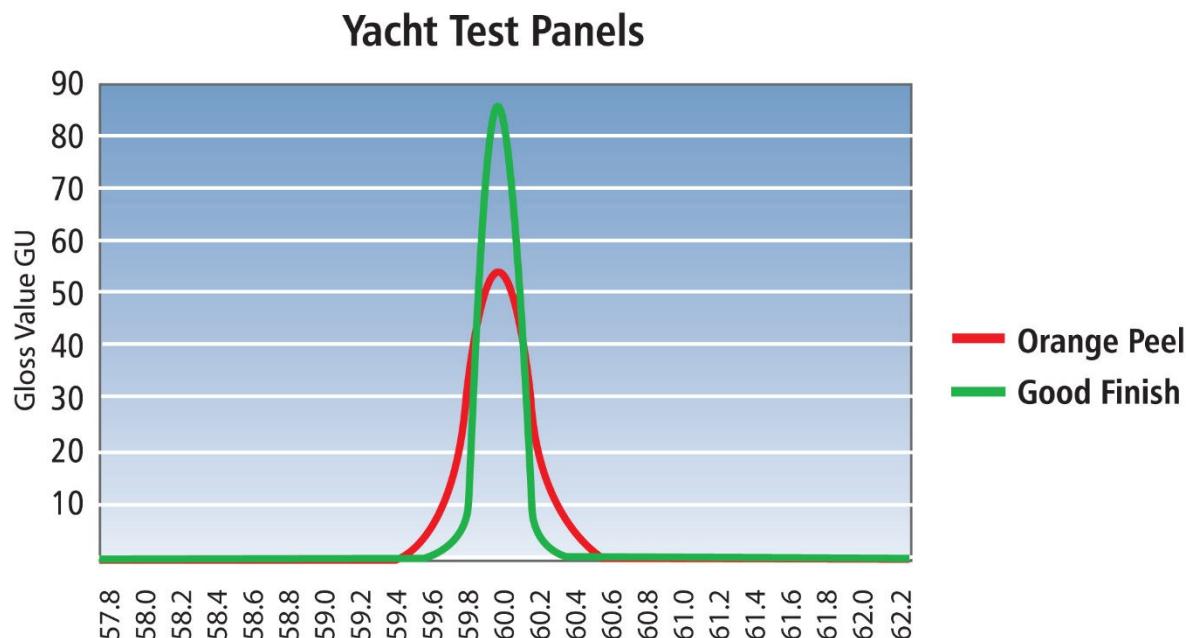
At 60° the Rhopoint IQ Flex 60 automatically compensates for curved samples or a sample measurement position that is not completely in contact with the base of the instrument. Either of these effects will cause readings errors using a standard glossmeter.

To overcome this the IQ scans the reflectance profile of the surface from 52.75° - 67.25° and identifies the angular position of RSPEC.

Gloss, Haze, DOI and RIQ values are then calculated using the RSPEC angular position as the 60° reference point.

Goniophotometric Profile

The Gloss, Haze, DOI, RIQ and RSpec values produced by the Rhopoint IQ can be used to assess the visual quality of any surface. Alternatively, if required, the full Goniophotometric curves can be downloaded to PC for a detailed understanding of specular reflectance.



Goniophotometric curve and specular indices of two painted yacht panels

This example perfectly demonstrates the need for additional appearance information than that supplied with a glossmeter, as the panels have virtually identical gloss when measured with this instrument. Visual inspection however, shows that the first panel has a very high degree of orange peel.

When measured with the Rhopoint IQ Flex 60, the instrument measures gloss identically to a standard glossmeter (87.2 GU-89.0 GU). It also quantifies the orange peel finish on the substandard coating with a low DOI reading of 84.3.

Calculating Gloss, Haze, Rspec and DOI from a Goniophotometric Profile

For the above example at 60°, the Rhopoint IQ Flex 60 calculates the Gloss value by summing the gloss values +/- 0.9° from the specular angle. These methods / tolerances are specified in ASTM D523/ISO 2813.

The RSpec value is the peak gloss value at the specular angle, 60° (+/-) 0.0991°.

Haze is measured by summing the gloss values between 57.8-59.0°, 61-62.2°, the angles described in ASTM E430.

The DOI value is a function of the slope of each curve, the sharper the gloss response, the higher the DOI value (100 DOI is a perfect reflecting surface). More detail of this method can be found in ASTM D5767.

Technical Specification

GLOSS MEASUREMENT SPECIFICATION

20 & 60° Versions Available

Resolution: 0.1 GU

STANDARDS: ISO 2813, ASTM D523, ASTM D2457, DIN 67530, JIS 8741, ISO 7668

- Verified Performance: 20 & 60°

RSPEC

Peak Specular Reflectance: 60° (+/-) 0.0991°

GLOSS CALIBRATION STANDARD

Number 0693, BAM Traceable

Uncertainty: 0.1 GU.

HAZE MEASUREMENT SPECIFICATION

Near Specular Reflectance measured at 57.8-59°, 61-62.2°

Switchable between Haze Units (HU) and Log Haze Units (LogHU)

Resolution: 0.1 HU • Repeatability: 0.2 HU • Reproducibility: 0.5 HU

DOI MEASUREMENT SPECIFICATION

Resolution: 0.1 • Repeatability: 0.2 • Reproducibility: 0.5

GONIOPHOTOMETRIC SPECIFICATION

Measurement range: 52.75° - 67.25°.

Angular Resolution: 0.02832°

Resolution: 0.1 GU

Instrument Specification

Colour Screen

- Adjustable Brightness 6 Button Touch Sensitive Interface

Construction

- All aluminium construction – enclosure, optics, standard holder
- Integrated calibration holder with in position detector

Statistical Analysis

- Max, Min, Mean, S.D.
- All measured Parameters

Graphical Analysis

- On board trend analysis
- Gloss and IQ Values

Power

- Rechargeable Lithium Ion
- >17 Hours operation
- >20,000 Readings/Charge

Operate from

- Internal Battery/USB/USB Mains Charger

Recharge Time

- USB Mains Charger 4 .5 Hrs.

Memory

- 8 MB – >999 Readings
- User definable batching

Data Transfer

- Bluetooth
- PC compatible

- USB Connection
- No software install required

Dimensions & Weight

- 65 x 140 x 50mm (H x W x D)
- 790g