

Optimap™ PSD 3



A revolution in surface measurement

This instruction manual contains important information about the setup and use of the Optimap3™. It is therefore essential that the contents are read before powering up and using 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 Optimap™ 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.

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

Email: sales@rhopointinstruments.com
Website: <https://www.rhopointinstruments.com>
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1 Storage and Handling

- This instrument contains precision optics and electronics. You should therefore 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 because 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 hold the instrument by the measurement aperture. No objects should be placed inside the aperture as damage to the measuring system may occur.
- The instrument housing and sample area locator are 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.

2 Instrument cleaning

It is recommended to regularly check that the internal screen is clean. Too much dust inside could affect readings and measurement results.

Nevertheless, if dust is noticed inside the instrument, it is highly recommended to gently use pressurised clean air to clean the inside of the unit.

In case dust dot would not go off, the user can also use a clean cotton swab with a little bit of alcoholic solution.

3 About the Optimap™ PSD

Optimap™ PSD – The technology

Optimap™ PSD is an advanced portable handheld instrument capable of performing fast, full field 3D surface measurements.

Using an optical measurement technique known as Phase Stepped Deflectometry (PSD) it objectively measures and characterises many aspects of surface quality including texture, waviness and local defects including orange peel, inclusions, dents, and scratches.

The instrument has a large area of measurement (65 mm x 54 mm) allowing the instrument to analyse larger structure sizes that are visible from longer distances.

A lateral resolution of 37µm and fixed reference plane also allows the device to detect surface defects that are invisible to the naked eye.

Optimap requires no movement over the surface as all measurements are made optically therefore preventing any damage during operation. Although surface contact is needed, the devices measurement port is rubberised to protect it during operation. Measurement results are displayed in graphical, image map and numeric format according to the measurement scale selected.

A wide range of surface finishes can be measured from low gloss (2.0GU@60°) to mirror finish allowing the complete characterisation of manufacturing processes from machining, moulding, and forming, through to surface preparation and final coating.

Further technical information about PSD can be found later in this manual.

4 Accessories

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

Optimap3™ PSD Instrument

Calibration tile

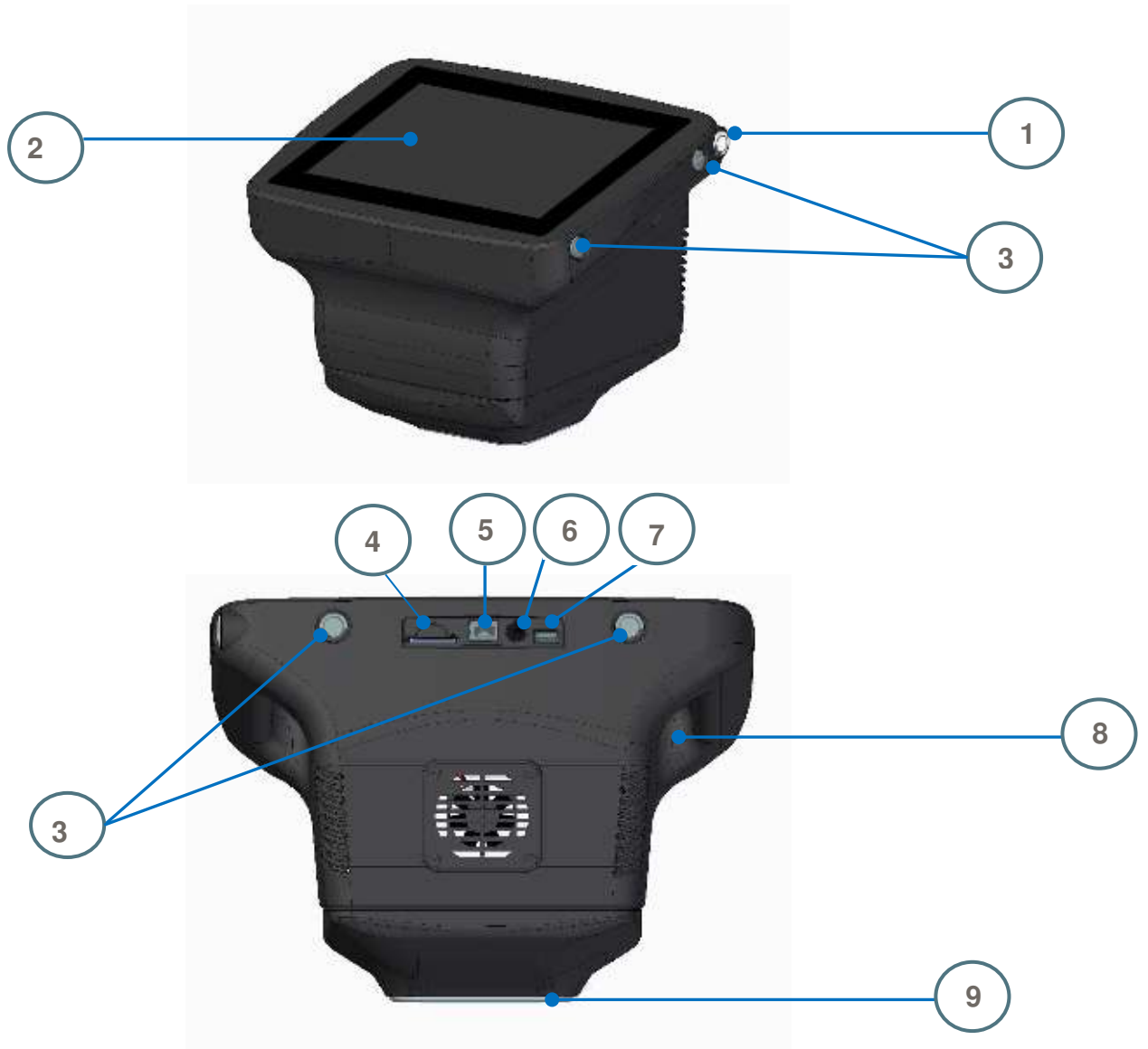
Check tile

Mains charger

SD card with software and manual.

Protective instrument carry case

5 Functional overview



| <u>Label No.</u> | <u>Function</u> |
|-------------------------|---------------------------|
| 1 | Power button |
| 2 | Touch screen display |
| 3 | Harness attachments |
| 4 | SD card slot |
| 5 | Ethernet |
| 6 | Battery charger connector |
| 7 | USB connector |
| 8 | Carry handle |
| 9 | Measurement port |

6 Power

The Optimap™ PSD is powered by an integrated high-capacity lithium ion battery.

Fully charged the instrument will operate for approx. 3 hours depending on usage.

A mains powered battery charger is provided with the unit allowing it to be fully charged, when connected to the unit's charger input (4), in under 5 hours. The instrument can also be used with the charger plugged in. The charging time will be longer if the instrument is used during charging. Battery status is shown by the indicator on the front screen (2).

Lithium-ION cells do not suffer from "memory effects" so it will not reduce the life of the battery if the charger is used to top up the battery between readings.

7 Switching on the unit

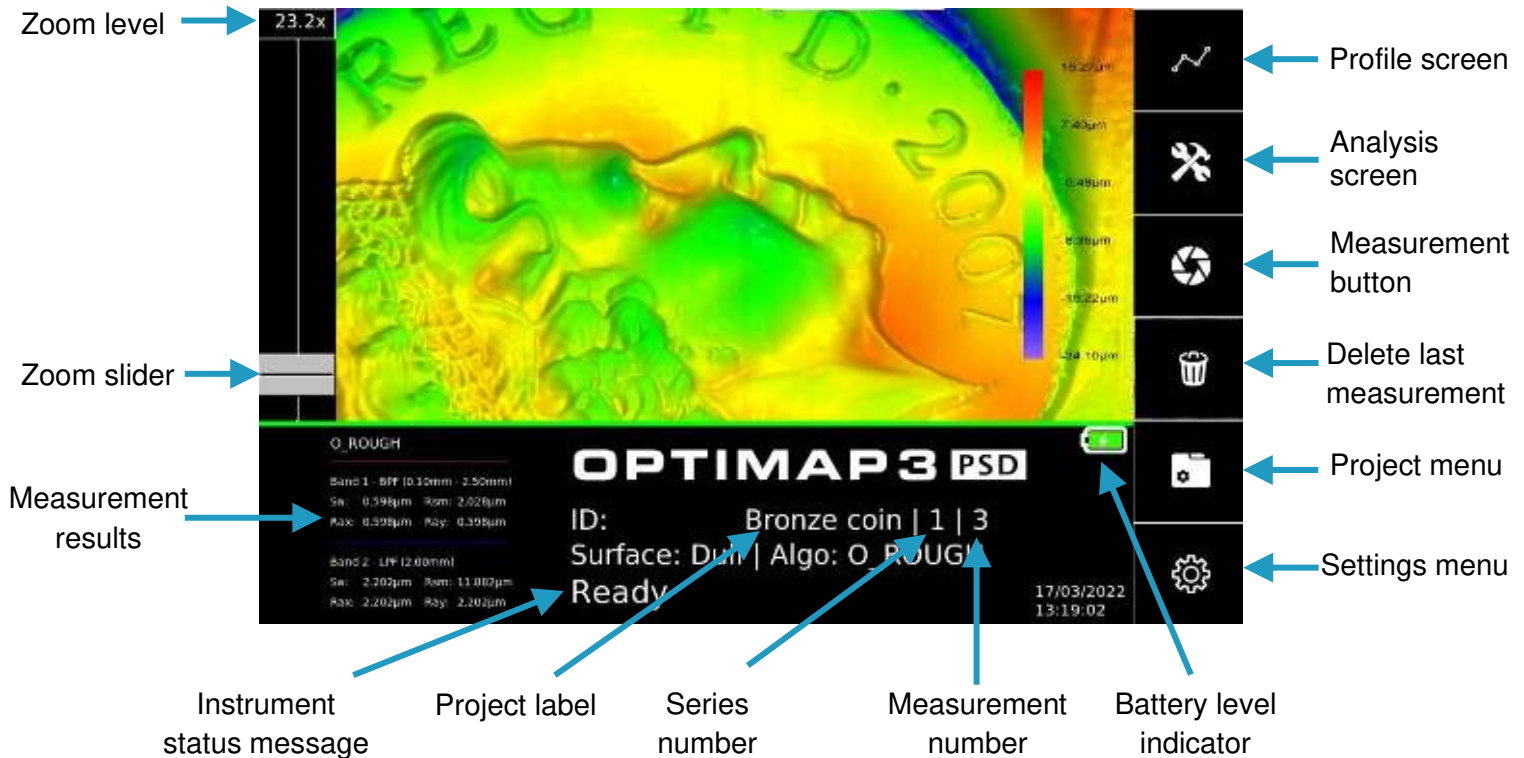
To switch Optimap on press and hold the Power button (1) found on the top right-hand side of the instrument until two audible beeps have been sounded, the second of which being longer than the first, and then release the button.

The instrument will power up and when ready will display the main measurement screen, as shown in the next section. The operation of the device is detailed in the next section.

To power the instrument off, press the Power button (1) until five audible beeps are heard. The instrument will then safely enter its power down cycle.

8 Operation

8.1 Main Screen








The touch sensitive icon-based measurement screen provides operation and setup of the device.

By pressing each of the icons or active areas shown on the screen the instrument responds in a different way according to the function.

The central window displays the last acquired or loaded map. On the right side of the window is the legend which shows the minimum and maximum values in the displayed map, as well as the heat map colours associated with them. The map can be zoomed in or out using the grey bar on the slider on the left of the screen; the zoom level is shown above the slider. The map is rotated by swiping in the direction required to rotate with one finger. The map is moved by swiping in the direction required to move the map with two separated fingers.

To the right of the measurement main screen there are six buttons to access the main features of the instrument. In order these are:

- profile screen 
- analysis screen 
- measurement button 

- delete last measurement button  or cancel button 
- project menu 
- settings menu. 

These features are described below.

Results are also displayed in numerical format in the results window at the bottom left of the screen.


At the bottom of the screen below the map image, Project Name, Series or batch number, and Measurement or count number indicators allow the storage and management of measurement results. Measurements are saved by the Optimap in a logical sequence allowing clear identification of the surface being measured.

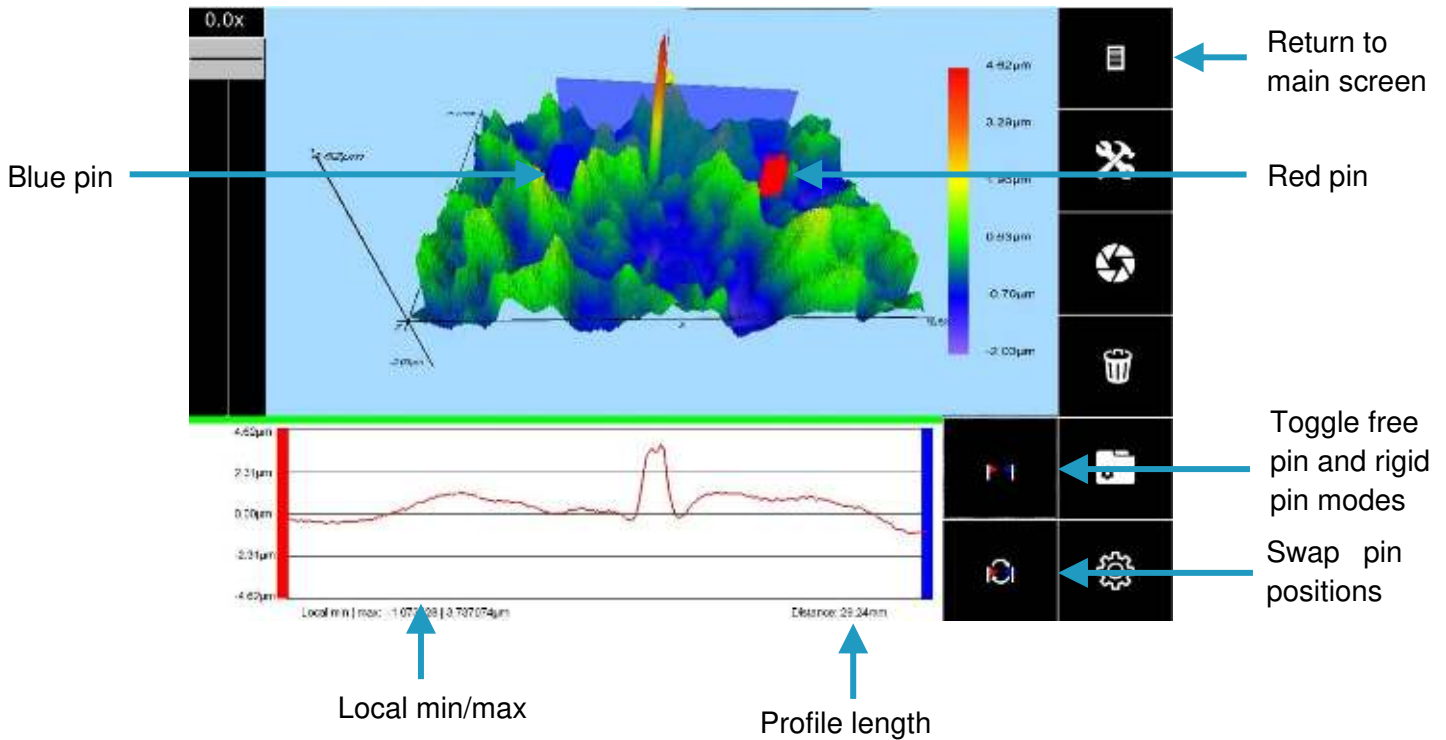
The naming method used for these will differ according to application, however it is the Project name that is the key field holding all measurement data for each series.

For example, a typical naming setup for an automotive measurement would be to use the vehicle name or model number as the Project Name and the surface to be measured, left door, right door etc as the Series. Measurements can then be made according to requirement with each being stored as a separate measurement number over the surface.



In the right of the map window of the main screen, a scale is displayed corresponding to the image displayed in the map window.

8.2 Profile Screen


The profile screen can be accessed by pressing the  button on the top right of the main screen.




The profile has two modes; either the pins can be moved independently anywhere on the map, or the length of the profile and relative positions of the pins is fixed, and the


entire profile is moved. Pressing the  button enables free pin mode and pressing  button enables the rigid profile mode.

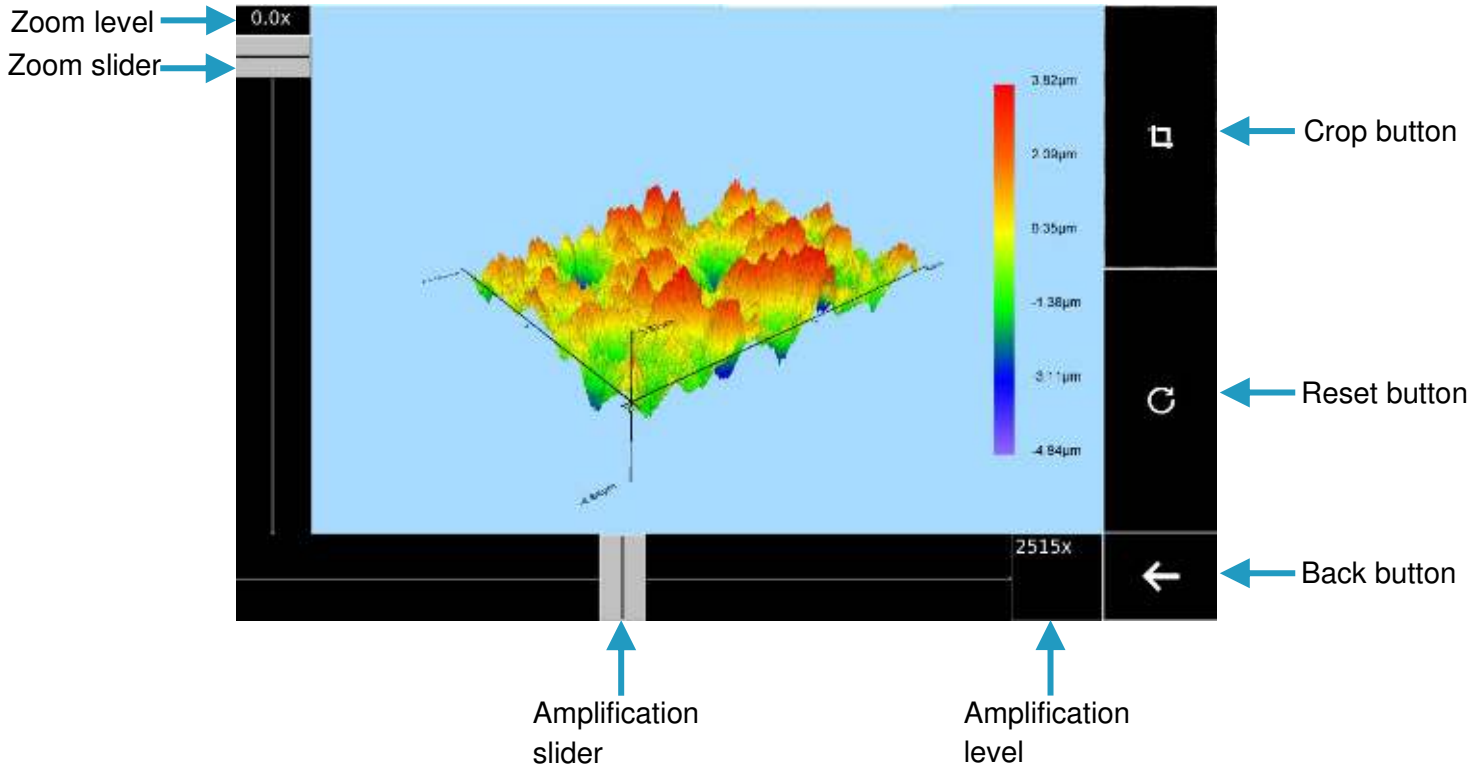
To move the entire profile or one of the pins, using the touchscreen press and hold onto the box representing the pin. Once the pin has been selected drag into place. The pins need to be selected precisely which may require some repositioning of the map to allow the best access to the pin.

Measurements can be taken from this screen to view the same profile on a new measurement by pressing the  button.



The main screen can be reached by pressing the  button or any of the other screens can be accessed directly by pressing the appropriate button.



8.3 Analysis Screen

The analysis screen is accessed by pressing the  button.




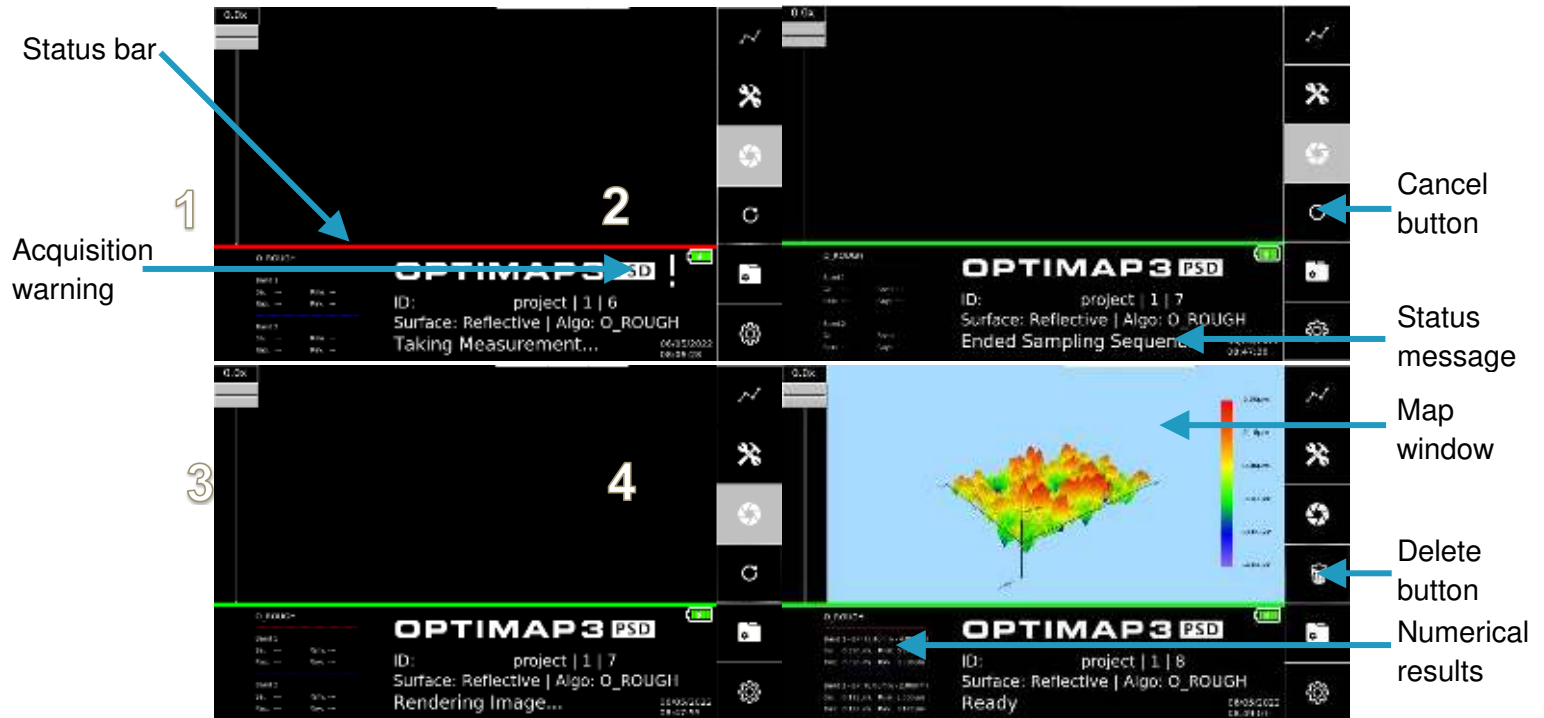
The analysis screen is used to interact with the map in more ways than the main screen allows. These include a larger window, moving and rotating the map, changing the zoom level, changing the amplification level, changing crop values, and resetting to default settings.


Pressing the  button allows the min. and max. altitude values that are shown to be changed. These values are altered by the zoom and amplification sliders which become on the left the min. value and on the bottom the max. value. The values are changed by moving the sliders and applied by pressing the save button . These cropping values will be used on all future measurements, these can be reset to default values for the current map by re-entering the crop screen.


The analysis screen can be exited by pressing the  button. The zoom level, amplification level, crop values, and map position will be kept for future measurements. To reset them back to the defaults, right for the current map, press the  button.

8.4 Measurement Screen

The measurement screen shows the steps that the main screen goes through while taking a measurement. A measurement is started by pressing the  button.




1. When the measurement button is pressed it will grey out to show that the instrument is taking a measurement. The status bar will turn red and acquisition warning (!) will show to illustrate that the instrument should not be moved while acquiring images, to be used in the calculation. The status message will show that the instrument is in the “Taking Measurement” part of the process. The only button that is active during the measurement process is the cancel measurement button , which can be pressed to cancel the measurement.
2. When the image acquisition has finished the acquisition warning will disappear and the status bar will turn green to illustrate that the instrument can now be moved while the calculation is taking place. The status message will be updated accordingly.
3. The calculation has now finished, and the 3D altitude map is being rendered to the map window.
4. The measurement is now finished. The map is displayed in the map window and graphical results, depending on the algorithm selected, are displayed in the bottom left corner. The measurement identification tracking is updated, and the status message shows “Ready”. The cancel button is replaced by the delete

last measurement button , which can be used to delete the last measurement taken if not wanted. All buttons are now active to take another

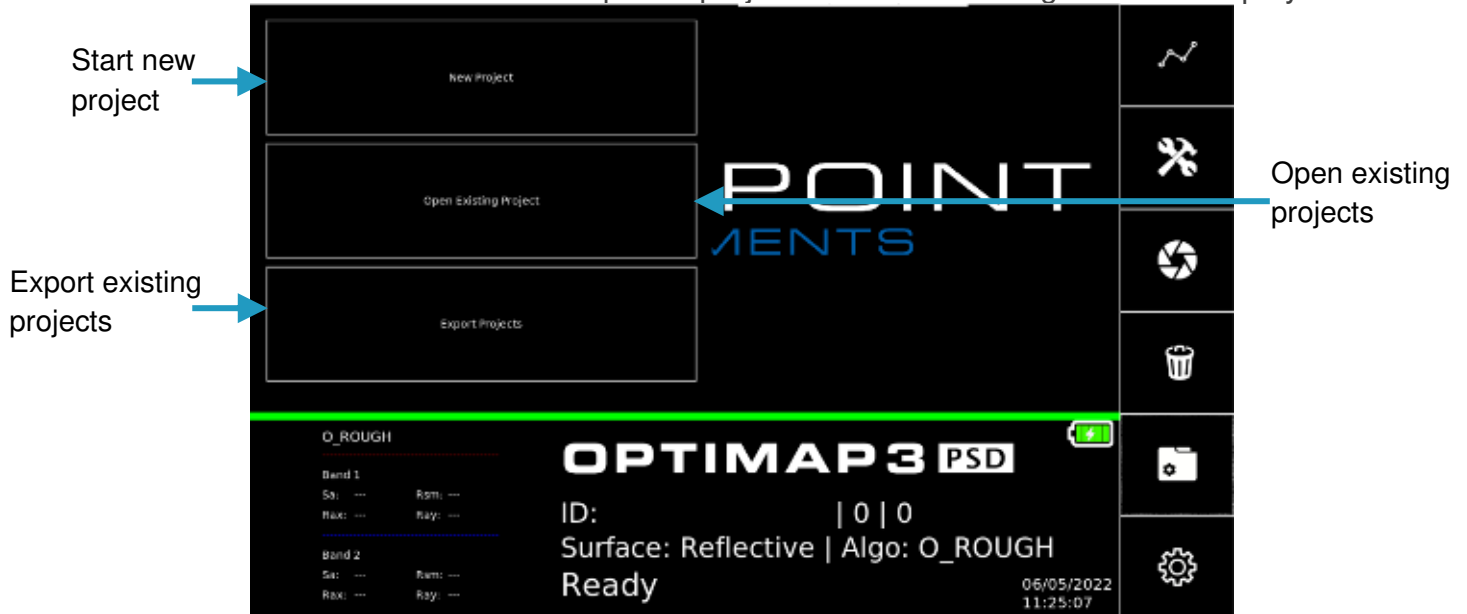
measurement, analyse the current measurement, change settings or any of the other features described in this manual.

8.5 Project Screen

Measurements are organised into projects, batches, and counts. This organisation is done in the project screen, which can be accessed with the  button. If no initial project has been created or the current project has been closed the project label will display “NO PROJECT”. In this state measurements are displayed but not saved. This mode also allows the surface type and algorithm to be changed freely.

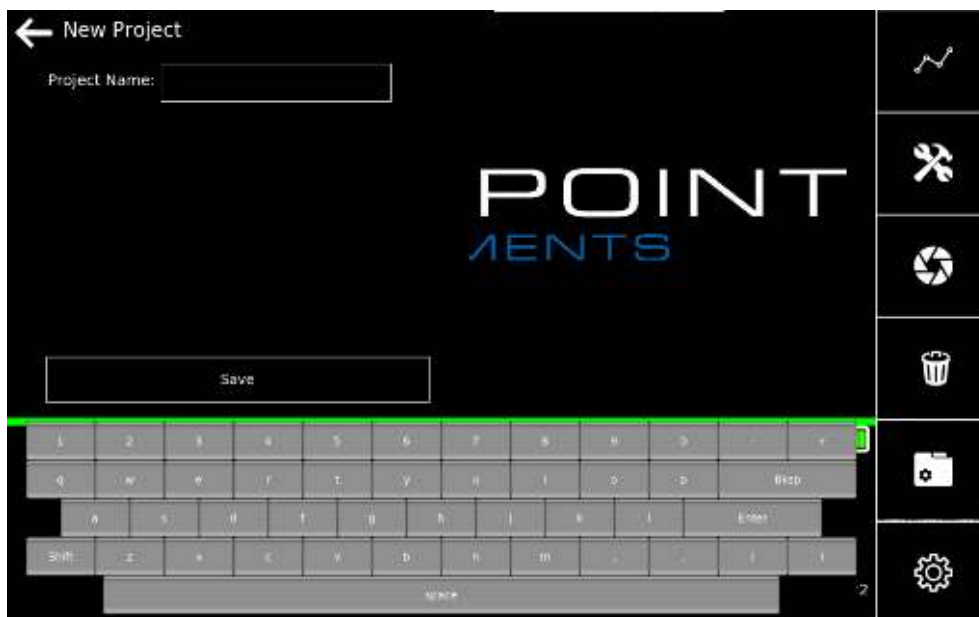
8.5.1 No Opened Project Menu

When the instrument is in an unopened project state the following screen is displayed.



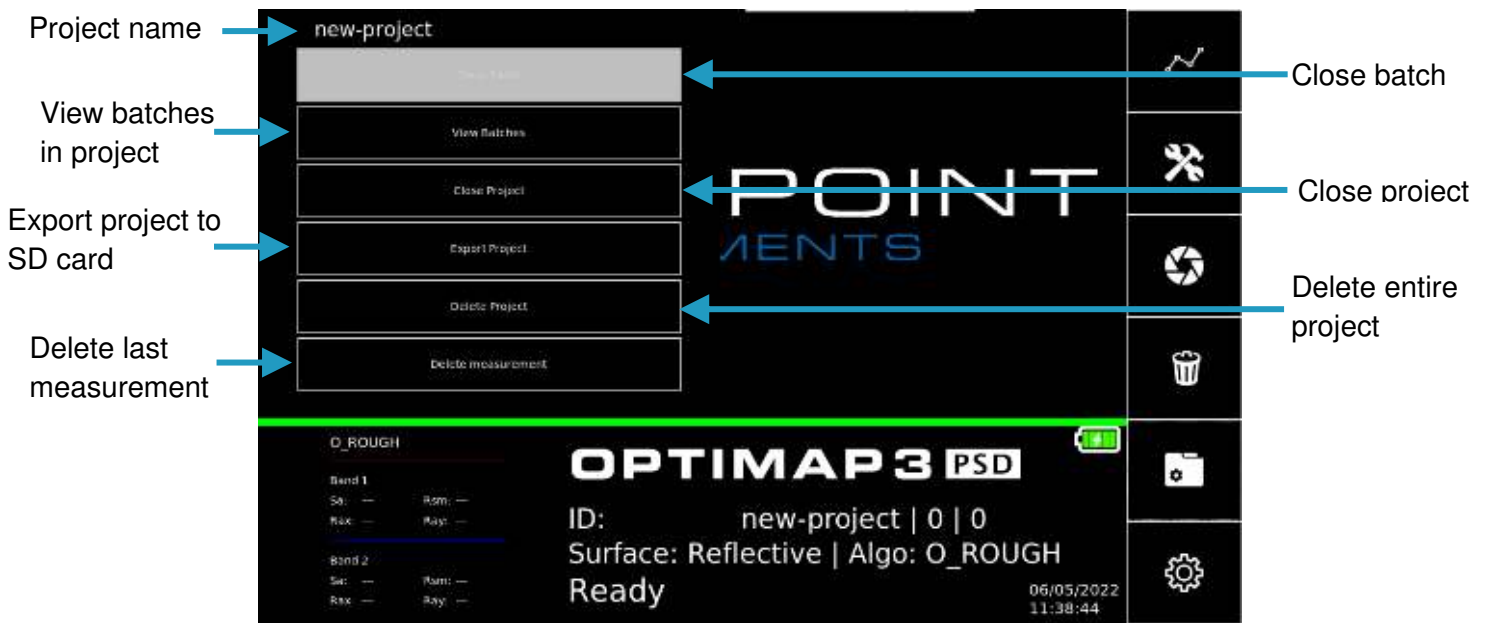
To start a new project, press the “New Project” button.

8.5.2 New Project Screen




Enter the project name using the onscreen keyboard and press save. The instrument will now enter the open project menu.

8.5.3 Project Menu



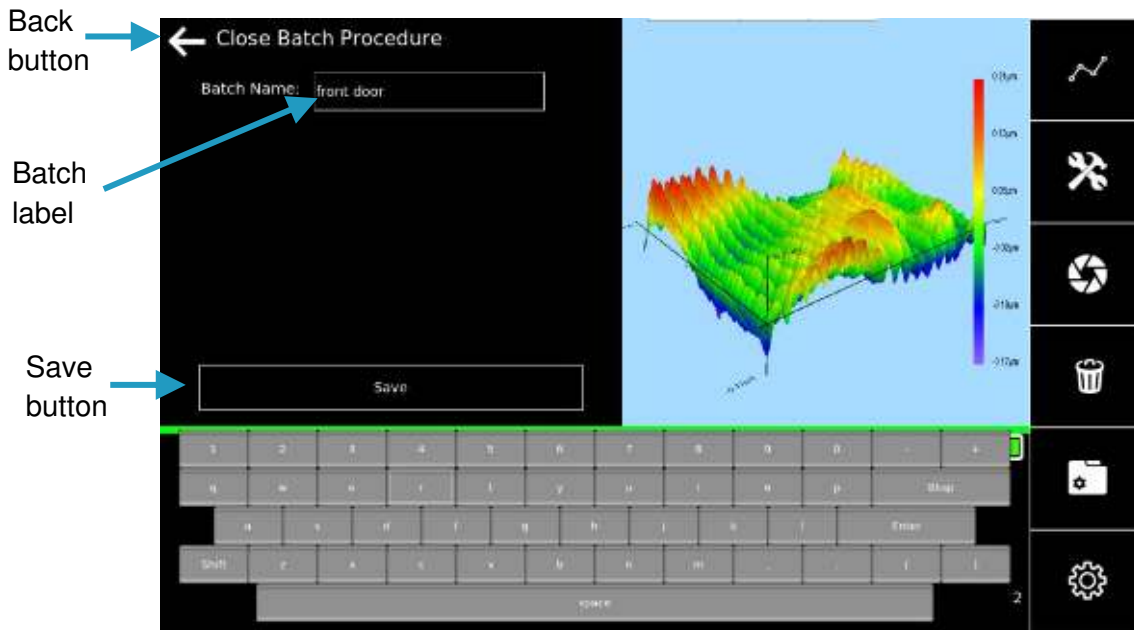
The options within the project menu are:

- Close Batch: Once the project holds measurements, associated measurements can be isolated in a batch. This screen is described in section 8.5.4.
- View Batches: This is the way to view earlier measurements. This menu is described in section 8.5.5.
- Close Project: This returns to the no opened project menu, where a new or existing project can be opened, and measurements made in free mode, and all stored projects can be exported to SD card.
- Export Project: This displays the project export menu where the measurements from the open project can be exported to SD card. This menu is described in section 8.5.6.
- Delete Project: Deletes all measurements within the open project and removes the project itself.
- Delete measurement: This performs the same process as the delete last measurement button.

The project menu can be closed by pressing the  button, to prepare and start a measurement.

8.5.4 Close Batch

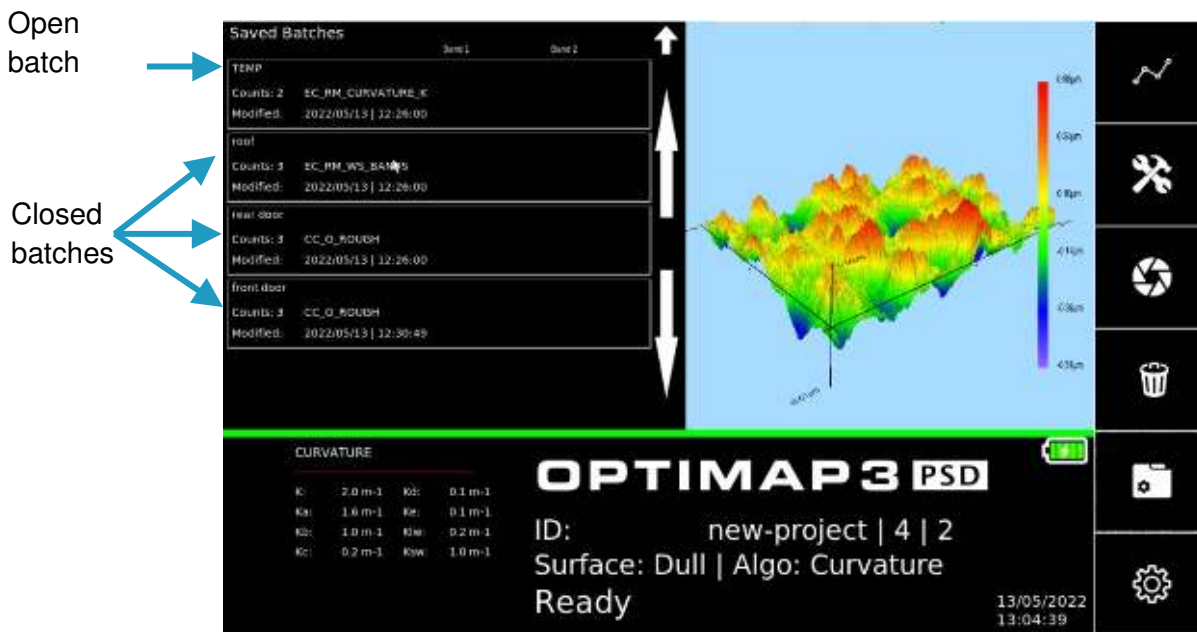
Closing the batch groups associated measurements with a recognisable name. Individual measurements are numbered in the order they are taken starting with measurement 1. Batching the group also creates an artificial measurement with values taken from the average of the measurements in that batch. The average measurement is labelled as count 0. With an open project closing the batch is the only way to allow the surface or measurement algorithm to be changed.



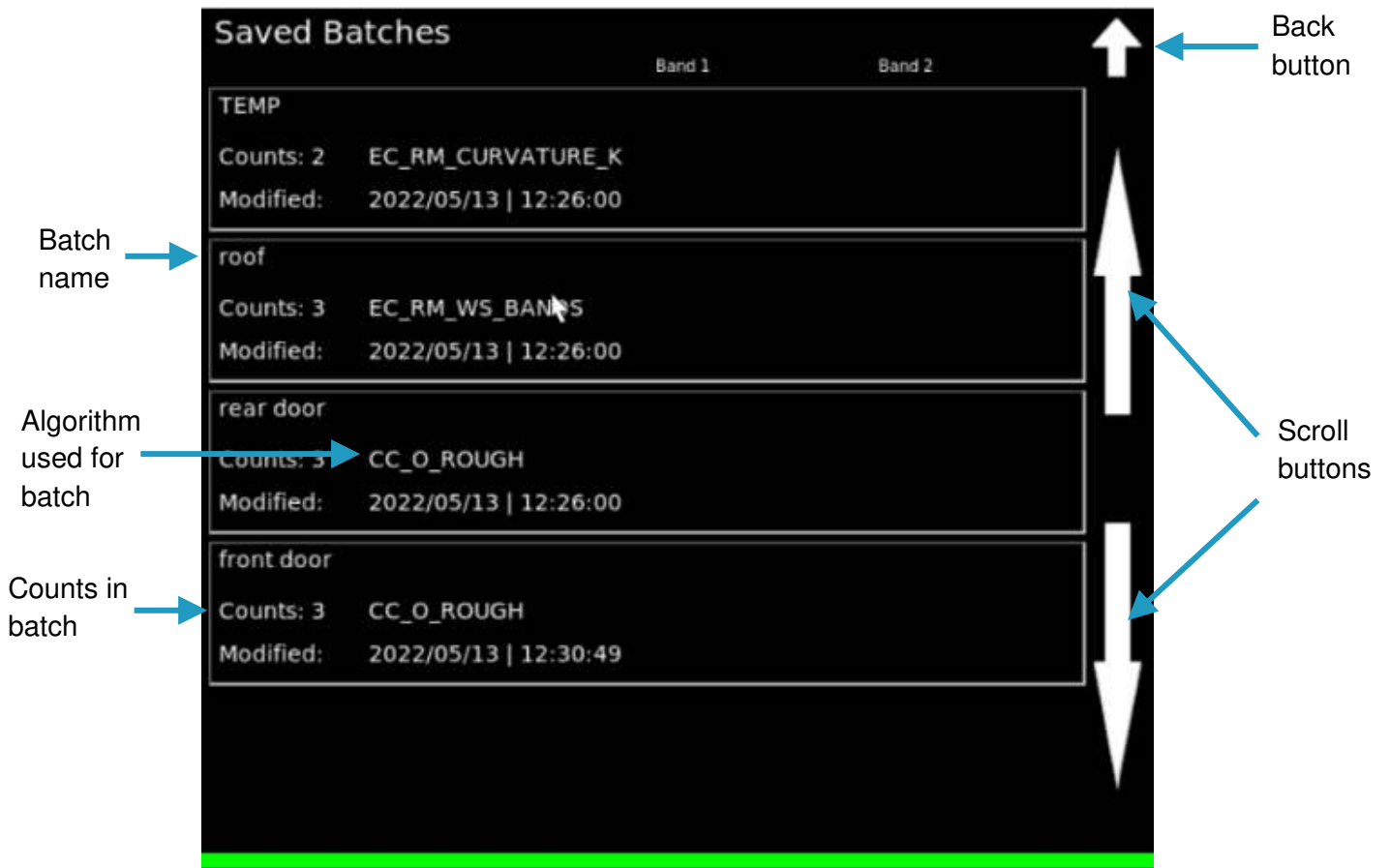
The desired name is entered using the on-screen keyboard, removing the default name of the batch number if not wanted using the “bksp” key and entering the desired name and completed by pressing the save button. Each batch within a project must have a unique name.

8.5.5 View Batches

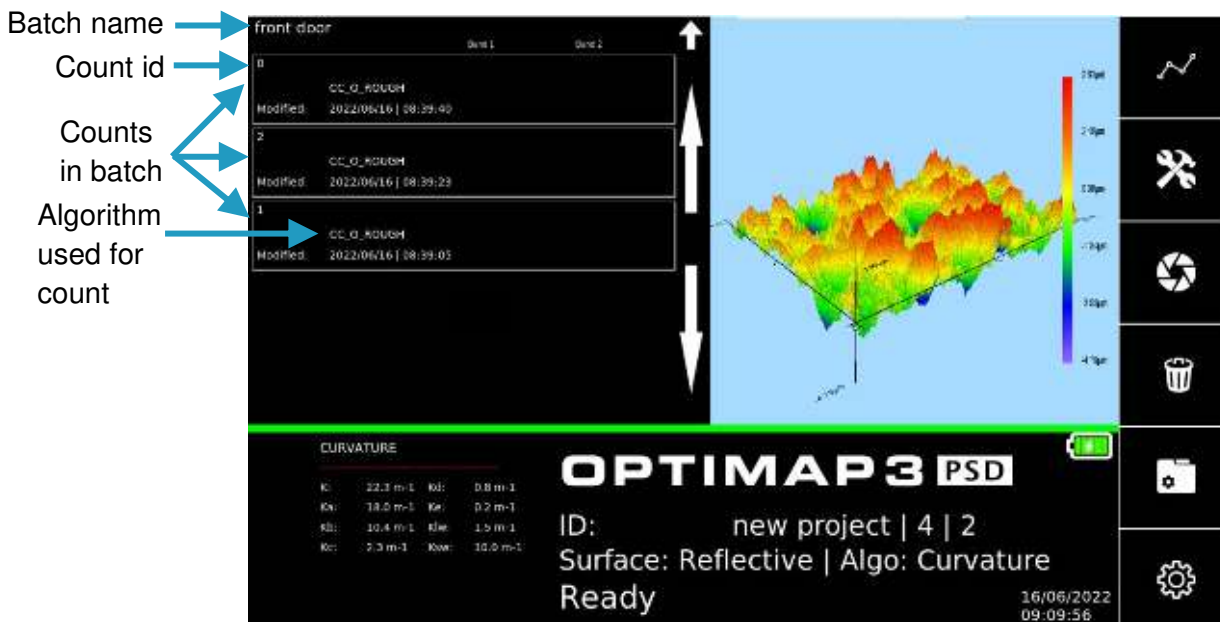
The view batches screen is the place to view previous results and load saved maps, as well as to close the current batch.



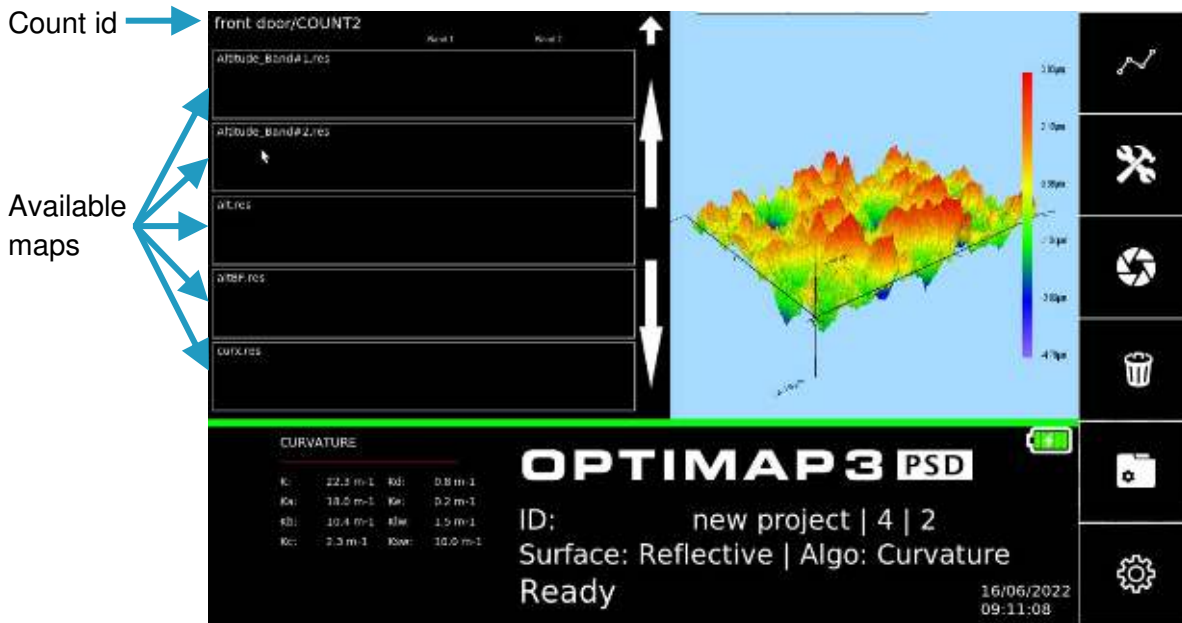
Until the latest batch is closed, from the project menu, the batch name is “TEMP”.



A batch can be further inspected by pressing on the entry.



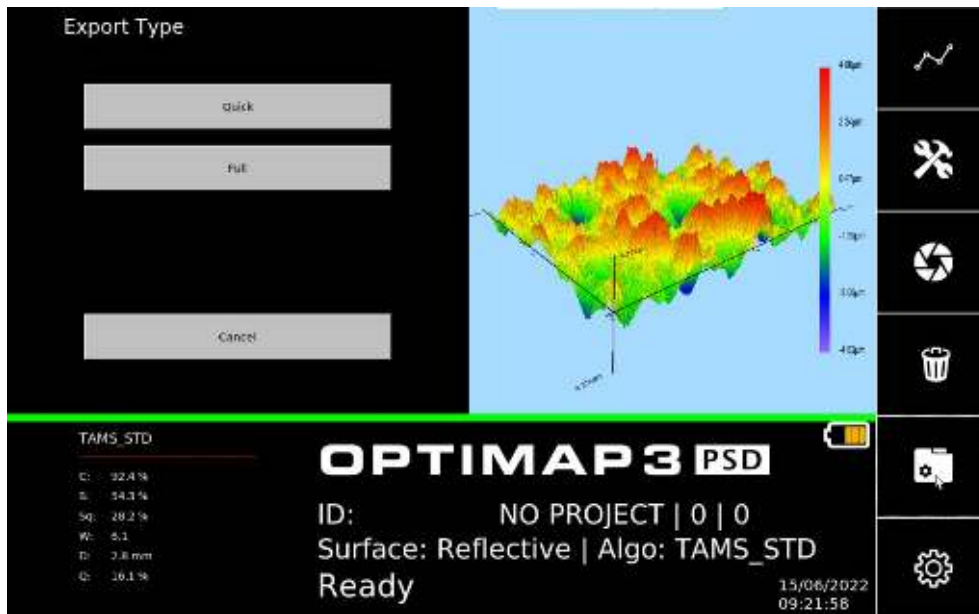
Individual counts can be viewed by pressing on the entry.



The available maps will depend on the algorithm and saving options. As count 0 is the average of the calculated parameters it contains no maps. Maps can be reviewed by pressing the entry. The rendering process can take some time, with no indication to show progress.

8.5.6 Exporting Measurements

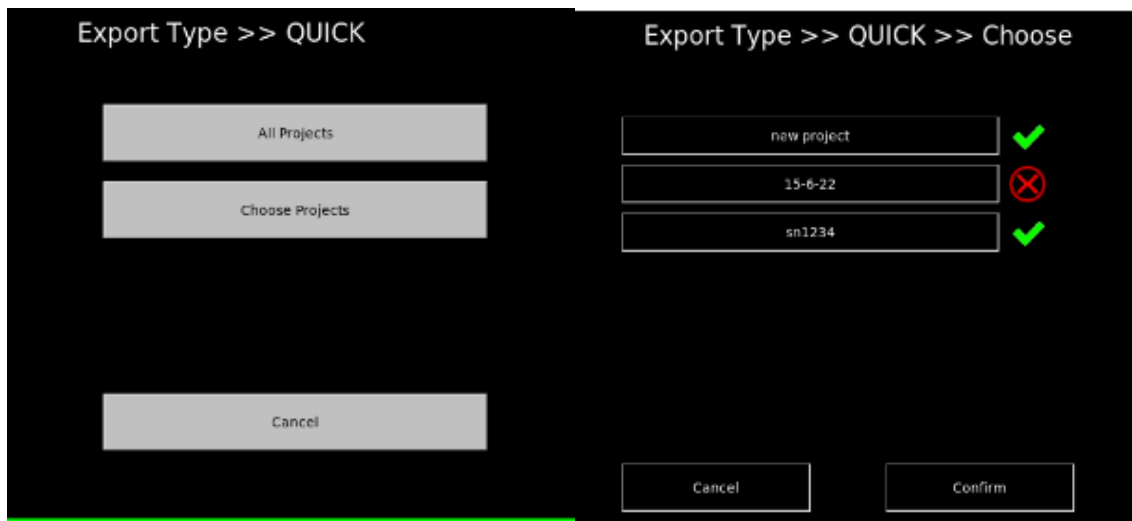
The Optimap3 is capable of transferring results onto a SD card. In this way user can analyse results on a PC and do some data post analysis. There are two ways to export measurements from the instrument. Either from within the current project or the no opened project menu. These two methods work in a similar method with the option from the no opened project menu having the extra step of choosing which projects to export.



The quick and full export types refer to the amount of information that is transferred and therefore the speed of the export.

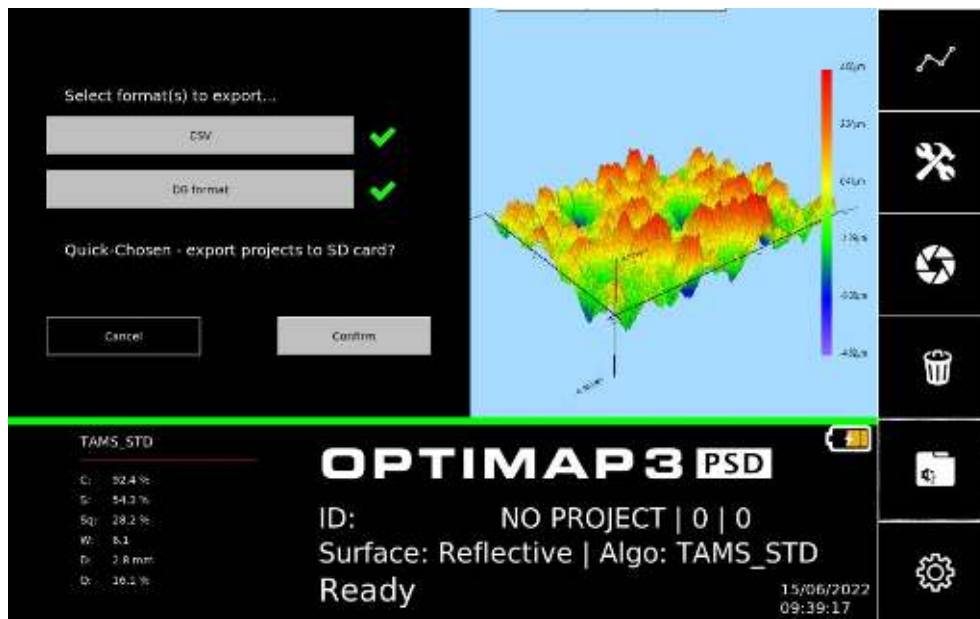
Quick transfer to SD card

The quick data export transfers the numerical results of the measurements.



If in the closed project menu chose whether to export all projects or which project to export. If choosing which projects to export at least one project must be chosen.

Chosen projects are marked with a tick and unselected projects are marked with a cross.



The numerical results can either be exported in csv or SQLite database format. This transfer mode is quicker than a full transfer because no maps are copied. On the SD card, a main export folder will be created whose name is:

YYYY-MM-DD_hh-mm-ss_OPTxxxxxxx_QUICK

YYYY-MM-DD_hh-mm-ss_OPTxxxxxxx_QUICK_ALL

where YYYY-MM-DD and hh-mm-ss refers to the date and time of the transfer action and OPTxxxxxxx refers to the instrument serial number.

The results csv files are named as a combination of surface, dull or reflective, and the measurement algorithm.

First part of the CSV structure result file:

- Serial_number

This is the serial number of the instruments used for those measurements

- Date_time

This is the date and the time at the beginning of the measurement

- Surface_type

This is the surface for this measurement. This can be dull or reflective.

- ALGO

This is the algorithm used for this measurement.

- Project

This is the name of the project that the measurement is part of.

- Batch

This is the Batch name as set by the user.

- Count

This is the measurement index inside the current batch.

- Abs

This is the absolute measurement index.

Last part of the CSV structure result file for O_ROUGH_Results:

- B1_filter_type

This is the type of the first band.

- Band#2_filter_type

This is the type of the second band.

- B1_low_limit

This is the low limit of the band 1. Single cut-off value in case of HPF or LPF.

- B1_high_limit

This is the high limit of the band 1. Not used (0) in case of HPF or LPF.

- B2_low_limit

This is the low limit of the band 2. Single cut-off value in case of HPF or LPF.

- B2_high_limit

This is the high limit of the band 2. Not used (0) in case of HPF or LPF.

- B1_Sa

This is the Sa result for the first band.

- B1_RaX

This is the RaX result for the first band.

- B1_RaY

This is the RaY result for the first band.

- B1_RsM

This is the RsM result for the first band.

- B2_Sa

This is the Sa result for the second band.

- B2_RaX

This is the RaX result for the second band.

- B2_RaY

This is the RaY result for the second band.

- B2_RsM

This is the RsM result for the second band.

Last part of the CSV structure result file for Altitude_Results:

- Sa-A

This is the Sa value from band A.

- Sa-B

This is the Sa value from band B.

- Sa-C

This is the Sa value from band C.

- Sa-D

This is the Sa value from band D.

- Sa-E

This is the Sa value from band E.

- Sa-LW

This is the Sa value from band LW.

- Sa-SW

This is the Sa value from band SW.

Last part of the CSV structure result file for Curvature_Results:

- Koverall

This is the standard deviation value from the unfiltered curvature map.

- Ka

This is the standard deviation value from band A.

- Kb

This is the standard deviation value from band B.

- Kc

This is the standard deviation value from band C.

- Kd

This is the standard deviation value from band D.

- Ke

This is the standard deviation value from band E.

- Klw

This is the standard deviation value from band LW.

- Ksw

This is the standard deviation value from band SW.

Last part of the CSV structure result file for Texture_Results:

- Toverall

This is the scaled texture value for the unfiltered curvature map.

- Ta

This is the scaled texture value for band A.

- Tb

This is the scaled texture value for band B.

- Tc

This is the scaled texture value for band C.

- Td

This is the scaled texture value for band D.

- Te

This is the scaled texture value for band E.

- Tlw

This is the scaled texture value for band LW.

- Tsw

This is the scaled texture value for band SW.

Last part of the CSV structure result file for TAMS-STD:

- Contrast

This is the contrast result.

- Sharpness

This is the Sharpness result.

- SharpnessQ

This is the adjusted sharpness using contrast correction which is used for Quality calculation.

- Waviness

This is the waviness value for C-Coat.

- Dimension

This is the dimension value (dominant structure size).

- Quality

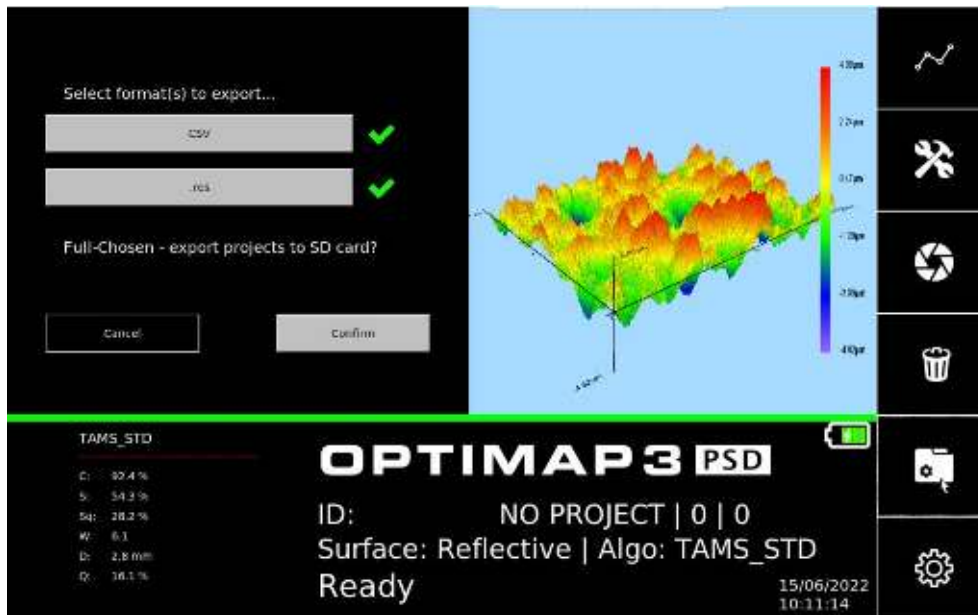
This is the Quality results.

- Harmony

This is the Harmony results for C-Coat. Harmony value is calculated using results of the current measurement and results of the reference one.

The export folder also contains folders with information about the calibration measurement, and surface and screen focus positions as well as a password protected zip folder "log.zip" for manufactures use to troubleshoot.

Full transfer to SD card




Using this option, the user will get the same output than with quick export, plus the full folder structure with BATCH and COUNT that may contain some images in case user has saved some images, or some data. Images will be *.bmp files type, and data will be *.txt type. On the SD card, a main export folder will be created whose name is:

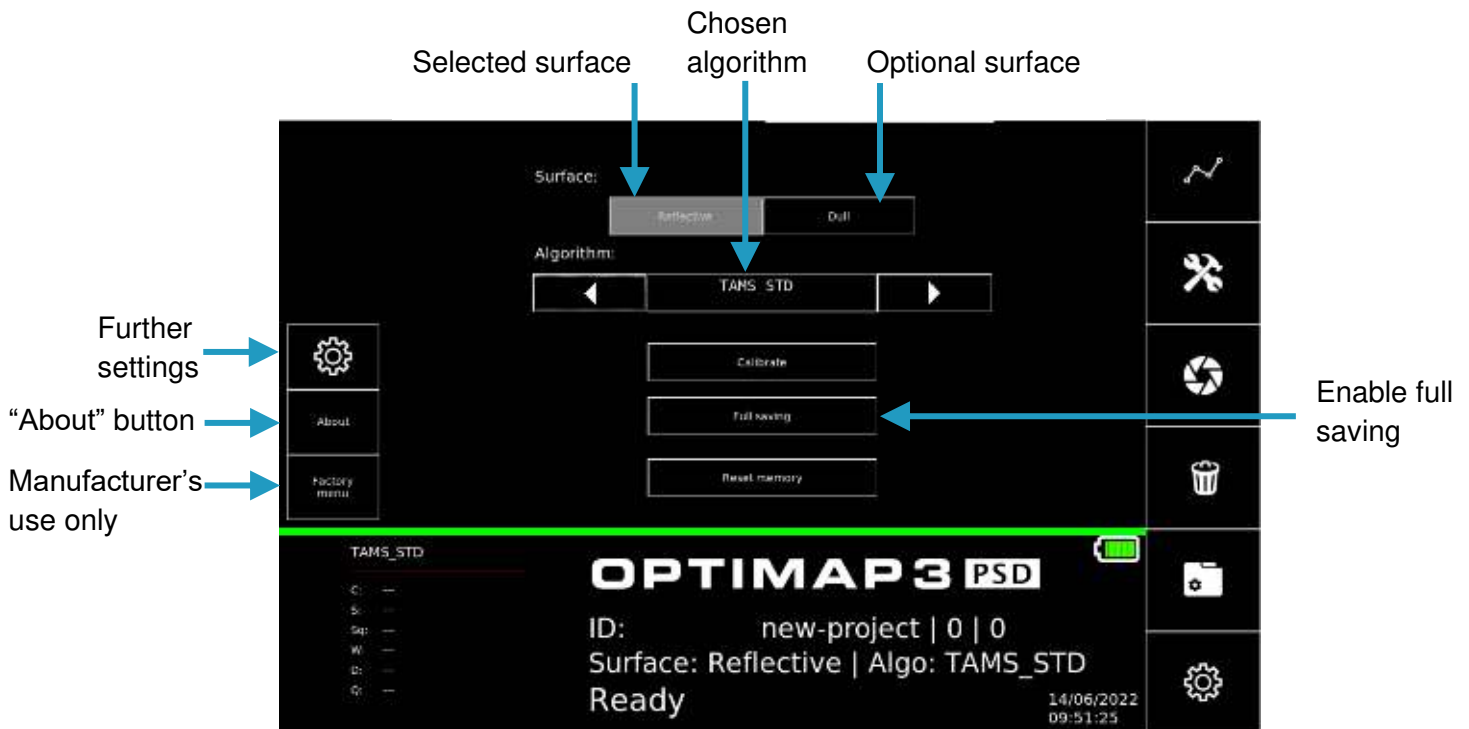
YYYY-MM-DD_hh-mm-ss_OPTxxxxxxx_FULL

YYYY-MM-DD_hh-mm-ss_OPTxxxxxxx_FULL_ALL

User may need to open the *.csv results file for each algorithm that has been used. All *.csv outputted files have got the same starting structure. The last structure part differs regarding the parameters that have been calculated.

8.6 Settings Screen

The settings menu is accessed by pressing the  button.



To allow the measurement of a wide range of surface finishes the Optimap has two optical configurations (models) available for selection – Reflective and Dull.

A reflective model is suitable for surfaces with a mid to high gloss finish (>30GU) e.g., automotive topcoats, clearcoats etc., metals, by default the Optimap will automatically select this setting.

A dull model is suitable for surfaces with a mid to low gloss finish (<30 GU) e.g., e-coats and primers

The desired surface model is chosen by pressing the named button, which will become grey and deactivated to show that it has been selected.

Unlike the Optimap2 the Optimap3 sets the exposure time of the camera for each measurement based on the reflectivity of the surface being measured, so different surfaces that fall into the same gloss range, reflective or dull, can be measured in the same batch. The surface model can also be changed during a project for samples with high differences in gloss.

The Optimap3 has a selection of different algorithms which alter the type of results that are presented. The algorithm to be used on the next measurement is shown in the algorithm box and can be changed with the left and right arrows. The reflective and dull surface models have different possible algorithms. When the surface type is

changed the algorithm resets to the default which should be changed to the required algorithm before taking a measurement.

The calibrate button functions is described in section 8.6.1.

The default saving behaviour depends on the algorithm selected but usually includes the unfiltered altitude map, any filtered map (as determined by the algorithm selection), curvature maps and slope maps. Full saving can be enabled by pressing the “Full saving” button. This will include the images taken that are used for the computation process and data that is created and used in the computation process. Saving all measurement images significantly increases the stored data size in the TAMS memory and reduces the number of measurements that can be stored, also the measurement time increases by several seconds, transfer time to the SD card is also increased.

The reset memory button removes all saved measurements so desired results should be exported first.

The O_ROUGH algorithm has additional settings that are presented when the algorithm is selected. The type of filter can be changed by pressing the button between type and the desired band.

Filter type

User can choose the desired filter type for the first band between High Pass Filter (HPF), Low Pass Filter (LPF) or Band Pass Filter (BPF). See section 10.1 to know more about O-Rough algorithm.

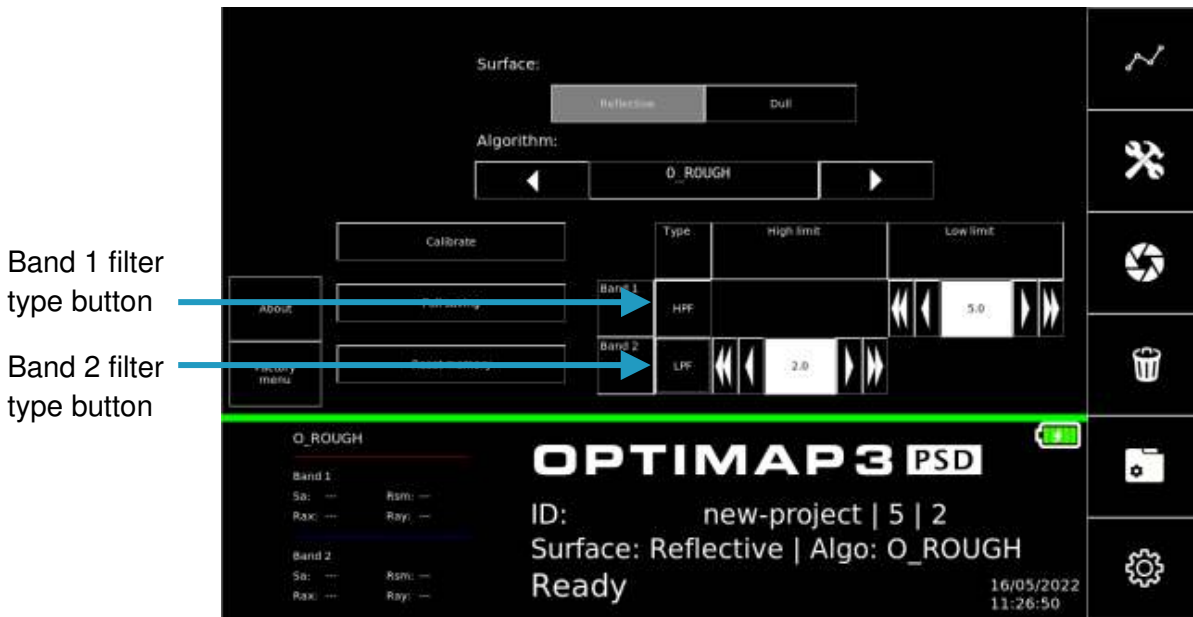
Low limit

This is where user can set the cut off value of the first band in case of HPF or LPF selected. In case of BPF, this value is the low cut-off limit of the first band. This value is given in millimeters with a resolution of 0.1mm.



High limit

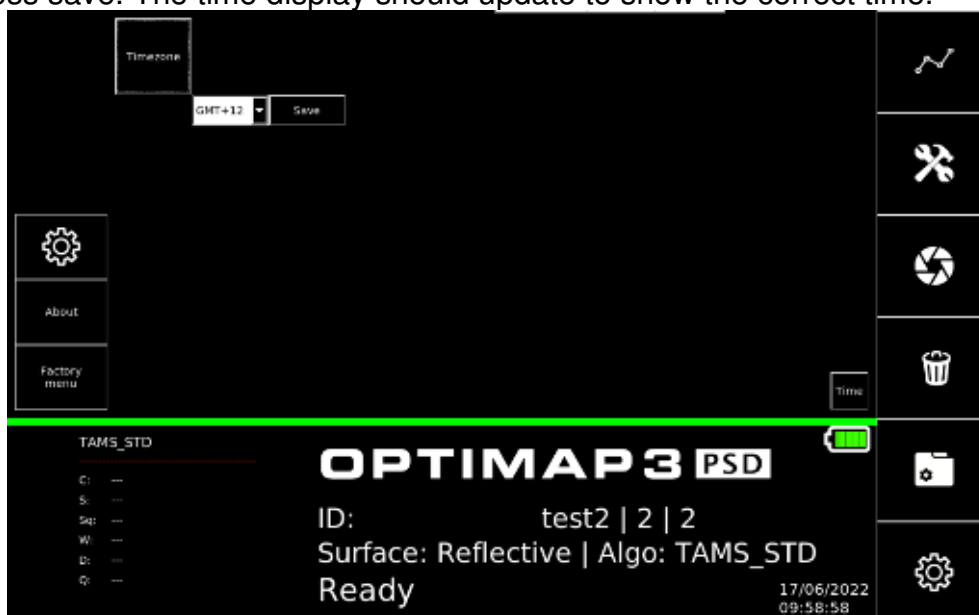
User can set the high cut-off limit of the first band in case of BPF. This value is not used in case of HPF and LPF. This value is given in millimeters with a resolution of 0.1mm.


The limits can be adjusted by 1 by pressing the double arrow and by 0.1 by pressing the single arrow.



More information about the different algorithms can be found further in this manual.

To change the time displayed on the instrument, and used to timestamp measurements, press the further settings button.  Then press the  button to open the time zone settings. Use the drop down to select the appropriate time zone and press save. The time display should update to show the correct time.



This is the first way to change the time however if the time drifts over time the exact time can be set by pressing the  button.

Timezone

GMT+12 Save

| | | | | | | | | | | |
|----|---|----|---|------|---|----|---|----|---|------|
| DD | ▲ | MM | ▲ | YY | ▲ | h | ▲ | mm | ▲ | Save |
| 17 | ▼ | 06 | ▼ | 2022 | ▼ | 10 | ▼ | 09 | ▼ | |

about

Factory Menu

Time

TAMS_STD

OPTIMAP3 PSD

ID: test2 | 2 | 2
Surface: Reflective | Algo: TAMS_STD
Ready

17/06/2022
10:05:14

8.6.1 Calibration

Before measuring with Optimap3, you must calibrate the instrument. The calibration procedure will adjust camera focus position and get results of the reference surface (a top coated glass silver mirror).

To calibrate the Optimap3, you need the calibration plate provided with the instrument in the box. This plate has two sides:

- Surface reference plate: used for focus surface settings
- Silver reference plate: use for focus screen settings and reference measurement

To start the calibration, press the calibrate button on the settings screen. The Optimap3 will guide the user through the calibration steps.

Calibration step 1:

The Optimap3 will first ask to place the instrument onto the surface ref tile. Make sure that the instrument is sitting properly on the surface and press start (at that time, the process is now running). The system is performing surface auto-focus setting.

Calibration step 2:

If the first step is successful, then the Optimap3 will ask to place the instrument onto the silver ref. plate(mirror), on the reverse of the surface reference. Make sure that the instrument is sitting properly on the surface and press start. The system is performing screen auto-focus setting and measurement calibration.

9 Measurement Principle

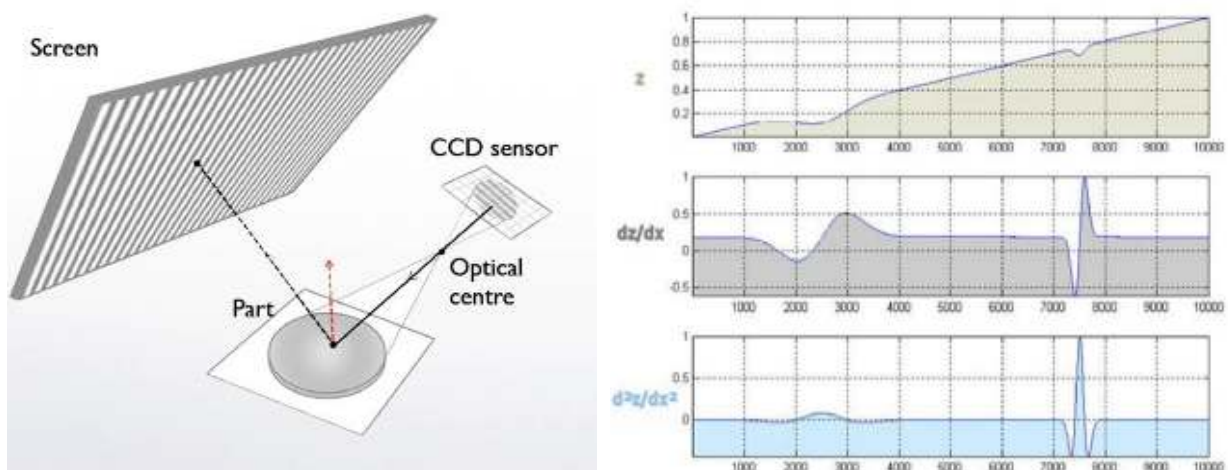
Phase Stepped Deflectometry (PSD), a white light optical technique, uses a periodic pattern with a sinusoidal waveform to measure the profile or curvature (K) of a surface.

The waveform is presented to the surface using a high-resolution display and the reflected pattern captured by a high-resolution camera. This waveform acts as a ruler over the surface allowing the ordinates of the light source to be determined as they are proportional to the spatial phase of the sinusoidal pattern profile.

By “shifting” or stepping the waveform phase across the surface it allows an accurate measurement of each point from the corresponding point per pixel on the camera.

Using the known geometric relationship between the display, the object surface and camera, light rays reflected from the surface are spatially modelled to calculate the direction of the normal at each point across the surface thereby allowing the profile at that point to be obtained.

Displaying the sinusoidal waveform in horizontal and vertical directions across the surface allows slope information to be determined in both orthogonal directions.



By differentiating the slope information curvature data can be produced allowing accurate characterisation of the surface profile.

As curvature is the first derivative of slope and second derivative of amplitude it combines both parameters to produce a more adapted quantity capable of being expressed in traceable SI units as m^{-1} .

Integration of this information allows the original 3D surface topology to be reconstructed.

10 Measurement Algorithms

All measurement algorithms use the same process to compute the altitude maps which are displayed on the main screen at the end of a measurement. The choice of algorithm depends on which numerical parameters best characterise your application and what filtering is applied to the altitude map.

10.1 O-Rough algorithm

This algorithm has been specifically designed to apply band filtering, before computing any roughness characteristics. Based onto ISO-16610 norm, user has got the possibility to apply High pass (keep only high frequency – short waves-), Low pass (keep only low frequency – large waves-) and band pass (keep only a range of wavelength). Two bands can be defined independently, adjusting low limit, high limit, or both in case of band filtering.

After the algorithm has applied filters, 4 characteristics are calculated following ISO-25178 norm. They are Sa, RaX, RaY, RsM. User should refer to this norm to know more about calculation formulae. Optimap3 is performing calculation using the whole field of view from the Altitude topographic map. This map is given without filtering and is also given for the two selected bands.

10.2 Altitude

The Optimap3 is also capable of filtering the raw altitude map with a series of band pass filters to highlight specific features.

The altitude map is filtered using 7 bands, to produce 7 surfaces.

| Band name | Low limit (mm) | High limit (mm) |
|-----------|----------------|-----------------|
| A | 0.1 | 0.3 |
| B | 0.3 | 1.0 |
| C | 1.0 | 3.0 |
| D | 3.0 | 10.0 |
| E | 10.0 | 30.0 |
| LW | 1.2 | 12.0 |
| SW | 0.3 | 1.2 |

The altitude map is filtered using a 2D Gaussian filter like that described in ISO-16610.

For each filtered surface, a Sa parameter is calculated following ISO-25178 norm

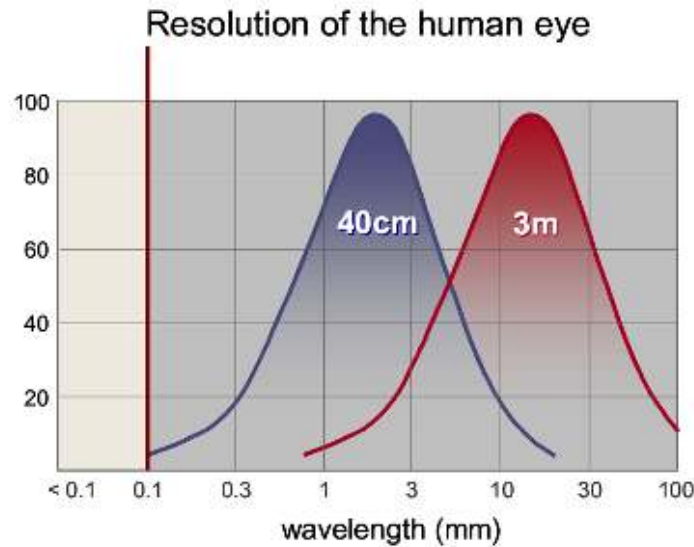
- **Arithmetical Mean Height (Sa)** is calculated using the filtered altitude map of the measured area. It is reported in μm . It is defined as follows:

$$Sa = \frac{1}{A} \iint_A |Z(x,y)| dx dy$$

10.3 Curvature

By filtering the curvature data, in accordance with standardised wavelength ranges as shown in the table below, curvature bands Ka...Ke, Ksw - Klw are then used to represent the SD (sigma) of surface curvatures for each wavelength range.

As an overall rating, Total curvature (K), is used to represent the SD (sigma) of curvatures falling within the range 0.1 – 30.0mm. As a totally flat surface would have no variation in curvature, higher curvature values indicate that there are more structures present on the surface at that particular wavelength range.



10.4 Texture

To correlate to the industry accepted Waviness scale regular equations are then applied to the filtered curvature data to produce a texture (T) scaling.

For this scale total texture (T), is used to represent the SD (sigma) of surface textures with the seven additional texture bands Ta...Te, TS - TL used to represent the SD (sigma) of correlated surface textures Wa – We, WS – WL.

This correlation provides a best fit translation from the dimensionless, single or multiple scan waviness scale to a dimensioned, full field, texture scale

10.5 TAMS_STD

The Rhopoint Total Appearance Measurement System (TAMS) is an extremely portable surface measurement device designed to give inspectors at the production line an audit tool which predicts how a customer will judge an automotive body finish in a showroom – will it yield a good or bad impression? Two new metrics are used to define the overall visual surface appearance, Quality and Harmony, replacing traditional multi-dimensional scaling's that have caused confusion amongst automotive manufacturers in the interpretation of results for many years. Those two metrics have been designed in collaboration with Volkswagen to satisfy their requirement. This algorithm is now available in the Optimap3.

The new metrics predict the visual appearance of a reflective surface:

Quality (Q) & Harmony (H)

- **Quality** represents the overall appearance of a surface finish. It is calculated using a specific algorithm combining three sub-characteristics: Contrast, Sharpness and Waviness. The Quality value goes from 0% (Poor quality) to 100% (Mirror finish quality).
- **Harmony** quantifies the surface texture difference between two painted surfaces when placed side by side. Do they have similar orange peel aspect or not? This value is calculated using two sub-characteristics: Waviness and Dimension. A result below 1 indicates that more than 50% of people would visually accept the surface structure difference in appearance between two surfaces. A value above 1 indicates that less than 50% would accept it.

To calculate Quality and Harmony, four sub-characteristics are firstly calculated by the instrument:

Contrast (C), Sharpness (S), Sharpness-Q (Sq), Waviness (W), Dimension (D)

- **Contrast** represents the difference between the reflection intensity of highlights (bright light sources) and lowlights (dark areas) of a reflected image on a surface. A value close to 100% (black reflective surfaces and mirrors) indicates that the reflected image is showing both very high and very dark light, in other words, the range from dark light to high light is large. On the contrary, low contrast values (<30%) indicate that the range is small, so dark, and high light are in a short intensity range.
- **Sharpness** represents the level of detail in the reflected image for a close look (<30cm) and the haze effect for a larger viewing distance (>1.5m). The value goes from 0% (low sharpness) to 100% (high sharpness).
- **Sharpness-Q** This is a rescaled version of the classic Sharpness parameter. Weighting has been improved especially for Quality calculation, and Contrast value is considered. Scale is still from 0 to 100%. This metric is not displayed into the screen but is accessible after data export.
- **Waviness** represents the overall wavy or non-flat aspect of the surface, also seen as a deformation level of the reflected image. The value goes from 0 (surface

perfectly flat, reflection without local distortion) up to 30 (very wavy surface, high distortion level).

- **Dimension** represents the main structure size perceived at 1.5m. The value is given in millimetres ranging from 0.5 to 8mm.

Remark: *Optimap3 has capability for others analysis methods. Rhopoint can supply **custom computation algorithm for special application**. User should contact distributor for more information.*

11 How to read *.res file format on PC

The Optimap3 can create altitude, slope, and curvature map. See above to know how to activate such saving option.

To get files exported on SD card, user must perform a full export to the SD card. Then, user will find altitude (alt.res), slopeX (slox.res), slopeY (sloy.res), curvatureX (curx.res), curvatureY (cury.res). The best way to view these maps is using Rhopoint Optimap Reader software.

The *.res file format contains first a header made of 256 bytes (from byte index 0 to byte index 255). To know more about header format user can contact his distributor. Then starting at byte index 256 are the data written "in line". Data are recorder in double precision 64bits.

Using any kind of 3D mapping software such as Mountains, MATLAB, Voxler, Surfer or others, user can easily create 3D rendering of the surface topography. If the user experiences some difficulties to read the *.res file, we recommend contacting the distributor.

12 Instrument Specifications

Display

- 10-inch Colour VGA TFT Touch Screen

Camera

- 3.2 Megapixels, image resolution 2048 x 1536

Measurement Area

- 65 x 54 mm

Lateral Resolution

- 37 μm

Data storage

- 20GB SSD
- 200 readings

Data Transfer

- SD card

Power

- Rechargeable Lithium Ion Battery 13400mAH
- 3 hours usage / charge

Weight

- 4.3 Kg

Dimensions

- H – 230mm, W – 310mm, D – 220mm

13 Environmental information

Directive 2012/19/EU on WEEE (Waste Electrical & Electronic Equipment)

The Waste Electrical and Electronic Equipment Directive is intended to reduce the amount of harmful substances that are added to the environment by the inappropriate disposal of these products through municipal waste.

Some of the materials contained in electrical and electronic products can damage the environment and are potentially hazardous to human health; for this reason the products are marked with the crossed out wheelee bin symbol which indicates that they must not be disposed of via unsorted municipal waste.

Rhpoint Instruments Ltd have arranged a means for our customers to have products that have reached the end of their useful life safely recycled. We encourage all end users to us at the end of the product's life to return their purchase to us for recycling as per Article 9 of the WEEE Directive.

Please contact us on +44 (0) 1424-739622 and we will advise on the process for returning these waste products so we can all contribute to the safe recycling of these materials.