OptiSense

EN Version 23.08

PaintChecker Mobile

User Manual

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1. Overview, Measuring Method and Models

1.1 How to use this manual

Thank you very much for purchasing the Paint-Checker Mobile. The device is based on the outstanding technology and high standards of OptiSense and offers maximum precision mobile coating thickness measurement.

This manual has been specially designed to guide you step by step through the features and options of your PaintChecker Mobile.

Please read the following section first!

- Before using your PaintChecker Mobile, read the entire manual and all safety instructions to ensure safe and proper operation
- The instructions in this manual refer to your device at default settings
- The pictures and images used in this manual may differ from the actual product
- The content of this user manual is subject to change without notice. The latest version of this manual can be found on the OptiSense website at www.OptiSense.com
- The available functions may differ depending on the particular device and software
- Keep this manual for future reference.

1.2 Challenges for today's coating companies

The challenges on coating companies are growing: More individual products, smaller batch sizes and more frequent colour changes. Added to this are the growing documentation requirements and more and more orders where the coating thickness is functionally relevant.

The PaintChecker mobile helps you to meet all these requirements by checking coating thickness at an early stage in the process – even before baking – without contacting the part.

The mobile handheld device is particularly suitable for random sample measurement as well as for coating inspection of large components or small batches.

1.3 The PaintChecker Mobile - Quick Reference

The OptiSense PaintChecker Mobile models support accurate measurement of wet, powdery and solid coatings on various substrates without contacting the surface. The compact, lightweight, handheld devices are designed for continuous, fatigue-free use in the laboratory and on the production line.

The PaintChecker systems use the photothermal measuring process to determine the thickness of coatings on a wide variety of substrates.

As with other non-destructive coating thickness measurement methods, e.g. ultrasonic, eddy current or induction, photothermal coating thickness is not measured directly, but calculated from measurement signals. It is therefore important to consider the individual thermal properties of coating material and substrate.

The measurement is carried out without contact from a distance of several centimetres. This means that wet and sticky coatings can be measured just as easily as soft and sensitive surfaces. A contamination of the part or the carry-over of coating material is thereby excluded in principle.

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1.5 The photothermal coating thickness measurement

1.5.1 Key technology for coating thickness checking

The photothermal coating thickness measurement is a contactless measurement method for paints, powder coatings and glazes on metallic and non-metallic substrates. The different thermal properties of coating and substrate are used to determine the coating thickness.

The surface of the coating is warmed up by a few degrees with a short, intense light pulse and then cools down again by dissipating the heat into deeper areas. The thinner the coating, the faster the temperature drops. The temperature curve over time is recorded with a highly sensitive infrared sensor and converted into coating thickness.
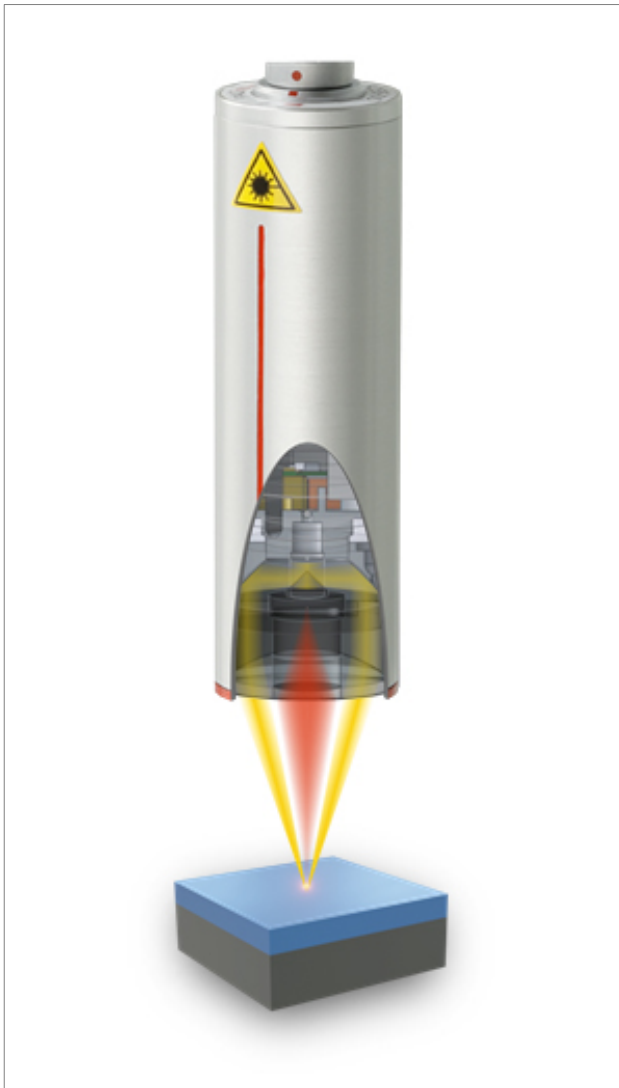
Fig. 1: The photothermal measuring method 1

1.5.2 Reproducible measurement results even with most demanding coatings

Thick, heavy coatings need more energy to heat up and cool down more slowly than thin, light coatings. During the measuring process, it is therefore important, as in photography, that the strength of the light source and the measuring time are optimally adjusted to the respective situation, in order to obtain accurate and reproducible measurement results.

In the case of powder coatings and paintwork, there is also the fact that the user often does not want to know the thickness of the powder or wet film that has just been applied, but the later, final thickness after baking or drying. For this purpose, the PaintChecker Mobile takes the expected shrinkage of the coating material during curing into account.

Thanks to the precise measuring spot, the method is also suitable for the smallest components. The coating thickness can even be determined on bending edges, corners and curved surfaces, where conventional measurement technology reaches its limits. Disturbances caused by rough surfaces or material grains are compensated for by optical averaging, so that even pastes and powders can be checked before baking.
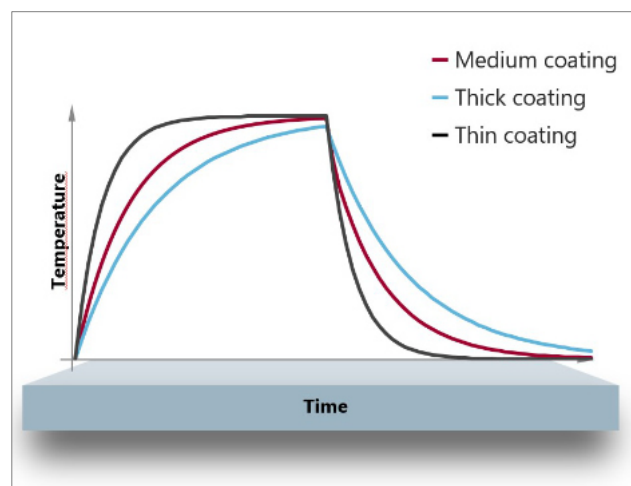
Fig. 2: The photothermal measuring method 2

1.6 The model range

OptiSense is the world's leading provider of photo-thermal measuring systems for coating thicknesses on a wide variety of substrates.

A common feature of all mobile handheld devices is their ability to measure a still soft powder layer on substrates such as metal, wood, glass or plastic, regardless of colour and type. With a simple measurement the very cost-intensive rework of under- or overcoating can be avoided.

The sensor head is detached from the control unit and connected with a flexible cable. The lightweight, ergonomically designed sensor can be carried comfortably in a holster and guided precisely and effortlessly to the component without touching or damaging the sensitive coating.

LED sensors feature a larger measuring spot making them ideal for freehand measurements on rough surfaces.

1.6.1 PaintChecker Mobile Gun-B

Fig. 3: PaintChecker Mobile Gun-B

The mobile OptiSense Gun-B is designed for contactless testing of freshly applied powder coatings prior to burn-in.

1.6.2 PaintChecker Mobile Gun-R

The Gun-R model is particularly suitable for components made of plastic or rubber.

Fig. 4: PaintChecker Mobile Gun-R

1.6.3 PaintChecker Mobile Laser Pen

Fig. 5: PaintChecker Mobile Laser Pen

The OptiSense mobile laser models are mainly used for smooth coatings on metallic substrates. With their tiny measuring spot the slim laser sensors are particularly suitable for coating thickness testing on delicate small parts, corners and edges. A special version with an extra short working distance allows you to measure in very confined spaces or on coatings containing high amounts of metal.

All OptiSense mobile models are eye-safe thanks to the patented LARES® technology.

1.7 PaintChecker Mobile Delivery Contents

Your new PaintChecker Mobile is delivered in a sturdy carrying case. Included in the scope of delivery are:

① Sensor with connection cable

② Gray glass reference

③ Controller

④ Charger

⑤ USB power supply

⑥ Two sets of 4 rechargeable batteries

⑦ Shoulder strap

⑧ USB data cable

⑨ USB drive with user manual, OS Manager software, etc.

1.8 Accessories

The following accessories are available for all models:

• Spacer caps

• Tripod

• Cable 2.3 m

• Calibration certificate

Use only accessories approved by OptiSense. Using non-approved accessories may cause malfunction of the device.

Fig. 6: PaintChecker Mobile Delivery Contents

Please note:

• The items supplied with the device have been designed for this unit and may not be compatible with other products.

• Other accessories may not be compatible with your device.

2. Safety and Responsibility

2.1 Warning symbols and other guidelines

This section provides you with all relevant information for proper personal protection and for safe as well as efficient operation. Read these instructions carefully before operating the device. Please observe any additional company- or country-specific directives and regulations that may apply.

For your safety, it is important that you read and fully understand the following list of warning symbols and their definitions! Safety instructions are indicated by symbols and signal words. The symbol provides information about the type of hazard while the signal word indicate it's extend.

DANGER!

Warning of an imminent threat that would cause death or serious injury

DANGER!

Warning of a serious threat from laser radiation

DANGER!

Warning of a serious threat due to fire hazard

DANGER!

Warning of a serious electrical voltage hazard.

ATTENTION!

Attention to a less serious hazard category. The symbol shows an exclamation mark.

TIPS

This symbol highlights hints and recommendations as well as information for efficient and trouble free operation

2.2 Correct use

The PaintChecker industrial photothermal measuring system is used to determine the thickness of wet and dry organic coatings for quality assurance and production-related testing. Proper use includes observing all information contained in this manual. Any use outside or beyond proper use is considered improper use.

Danger in case of incorrect use

DANGER!

Incorrect use of the PaintChecker Mobile can lead to dangerous situations

- The light beam of the sensor must never be directed at easily flammable materials
- The sensor must never be used in explosive areas
- The sensor must never be used to illuminate, heat or dry other object
- The sensor must never be used for medical purposes
- The sensor must never be immersed in liquids
- The light beam of the sensor must never be directed at people
- Incorrect measurement parameters may result in damage to the object being measured

2.3 Safety markings

2.3.1 Safety labelling in the working area

The following symbols and signs are located in the work area. They refer to the immediate environment in which they are placed.

- All safety, warning and operating instructions must be kept in a legible condition at all times
- Damaged signs or stickers must be replaced immediately

ATTENTION!

Danger with illegible signage! Over time, stickers and signs can become dirty or otherwise unrecognisable, so that hazards cannot be recognised and necessary operating instructions cannot be followed. This creates a risk of injury

2.3.2 Safety marking on the measuring system

Position Warning Label 1-4: Near the light source (Sensor lens)

Warning Label 1 | General warning sign

Warning Label 2 | Laser Radiation & ESD

Warning Label 3 | IR radiation

Warning Label 4 | UV radiation

Position Warning Label 5-7: Back of the controller on the battery compartment

Warning Label 5 | Class 1 Laser

Warning Label 6 | Risk Group 3 UV

Warning Label 7 | Risk Group 3 IR

2.4 Intended use

The PaintChecker Mobile from OptiSense is a portable hand-held device intended solely for measuring the thickness of coatings.

The device is to be operated only by persons who have read and understood this manual. Intended use also means that the user reads and understands this manual, in particular the safety section.

Guidelines to avoid damage to the device:

- Do not expose the PaintChecker Mobile to extreme temperatures. Keep it away from high humidity or moisture
- Do not place the device in locations where it is exposed to corrosive gases or salty air.
- Keep the PaintChecker in a locked cabinet and give it only to people who have read and understood the manual
- Do not use harsh cleaners, abrasives or solvents to clean the device. Use only a clean, dry cloth
- Observe the technical specifications. To operate the PaintChecker Mobile as intended, use only accessories tested by OptiSense

By proper disposal of electrical equipment, you will help to conserve valuable resources and avoid potential negative impacts on health and the environment, which could otherwise be caused by inappropriate waste disposal (see also Directive 2012/19/EU on remanufacturing and recycling). Accessories and packaging should also be recycled in an environmentally friendly manner.

2.5 Unintended use

Any operation that does not comply with the technical specifications is considered unintended use. The operator is solely liable for any damage caused by unintended use. The following is prohibited

- Operating the device in environments where liquids can enter the device
- Unauthorised alterations, additions or modifications to the device
- Opening the device, except for changing the batteries
- Removing safety marks, stickers, or labels. Keep all safety marks, stickers and labels in a legible condition
- OptiSense does not accept any liability for damages resulting from unintended use. In this case, warranty claims are void.

2.6 Danger from optical radiation

WARNING!

The PaintChecker Mobile uses short, intense light pulses (partly in the non-visible range) for measurement. Please observe the following safety instructions:

75 mm

Ø 45,8 mm
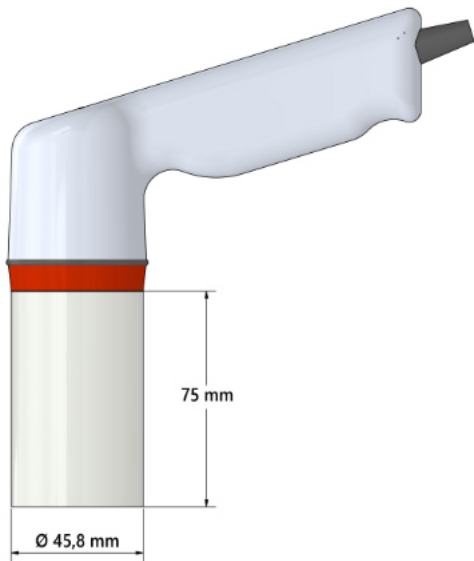
- Do not point the sensor at easily flammable material
- In order to completely exclude irradiation, a distance cap can be used and contacting measurements can be taken
- Do not put a damaged sensor into operation
- The device is not approved for operation in potentially explosive atmospheres (ATEX)

2.7 Dangers due to invisible light radiation from the sensor

ATTENTION!

The accident prevention regulations of DGUV regulation 11 as well as the regulations of the occupational health and safety ordinance on artificial optical radiation (OStrV) must be observed

The PaintChecker Gun-B emits UV radiation!

The description of the dangers of the radiation used here depends on the equipment. The risk class applicable to the PaintChecker is indicated on the warning label of the controller. The limits for radiation duration given here have been determined in part by an expert in laser technology and are not generally applicable to devices of this safety class.

Coherent radiation of laser class 1

Radiation in the IR-B spectrum. Radiation of this class can be dangerous if an optical instrument (magnifying glass, microscope, etc.) is in front of the eye. Glasses do not constitute an optical instrument in this case.

Irradiation of the skin near the exit aperture on the measuring head can cause burns in the focus. The laser radiation itself is not visible

Source:	Laser diode (Pen-1.6, Pen-3.5)
Mode of operation:	pulsed
λ:	1480 nm
Emax:	750 mJ (laser 16 mm)
Emax:	750 mJ (laser 35 mm)

Incoherent IR radiation of risk group 3 (RG3)

Radiation in the IR-A range: There is a low risk here. Damage to the retina can be largely ruled out. Even when looking into the light source for a longer period of time, no damage occurs. Irradiation of the skin in the vicinity of the exit aperture on the measuring head can cause damage to the skin in the focus. The laser radiation itself is not visible.

Source:	LED (Gun-R)
Mode of operation:	pulsed
λ:	950 nm +- 19 nm
Emax:	750 mJ

Radiation in the UV-B range poses a risk with short exposure within the safety distance. Protective measures are essential here. When an individual threshold dose (minimum erythema dose) is exceeded, the so-called sunburn (UV erythema) occurs. The maximum permissible irradiation of the skin is 64 seconds per day.

If the cornea is irradiated for more than 120 seconds within 1,000 seconds with the PaintChecker Gun-B, an impairment according to the criteria of the EN 62471:2008 standard is to be expected.

Source:	LED (Gun-B)
Mode of operation:	pulsed
λ:	365 nm +- 9 nm
Emax:	750 mJ

LARES

A health hazard due to invisible light radiation of class 1 is excluded when used correctly (see 3.2.4 LARES®). The radiation is accessible in this system, but so weak that any damage can be excluded. This is important because the light radiation is in the non-visible wavelength range

2.8 Risks caused by electricity

- Work on the electronics of the measuring system may only be carried out by OptiSense or by personnel trained by OptiSense

- If the insulation is damaged, the power supply must be switched off immediately and a repair arranged

- Fuses must never be bypassed or deactivated. When replacing a fuse, attention must be paid to the correct rating

- Voltage-carrying parts must be protected from moisture. Otherwise a short circuit may occur

- Protective covers must never be opened by the user except for installation. In the event of faults, the system must be returned immediately to OptiSense GmbH & Co. KG immediately.

2.9 Fire hazards

DANGER! The light beam can set fire to easily combustible materials, liquids or gases, causing serious or even fatal injuries

The sensor must not be used in a potentially explosive atmosphere

The light beam of the sensor must not be held onto easily flammable materials

Suitable extinguishing equipment (fire blanket, fire extinguisher) must be kept ready

In the event of a fire, work with the system must be stopped immediately. The danger area must be left until the all-clear is given and the fire brigade must be alerted

2.10 Hazards when handling Li-ion batteries

WARNING! The following instructions have to be observed when handling lithium-ion batteries:

- Protect Li-ion batteries from mechanical stress (shocks, drops, vibrations)
- Protect battery terminals from short circuit
- Do not expose Li-Ion batteries to high temperatures
- Regularly check Li-ion batteries for damage
- Storing and recharging only in fire-proof or separated areas.

- Do not store Li-Ion batteries near flammable materials (safety distance min. 2.5 m).
- Immediately dispose of defective Li-ion batteries in the proper manner.

2.11 Residual hazards

WARNING! The following instructions have to be observed when handling lithium-ion batteries:

- Suffocation hazard! Do not leave the packaging material in a careless way. It could become a dangerous toy for children
- The device is not a toy and does not belong in children's hands
- Keep a safe distance to heat sources

You will find warnings in this manual whenever the actions described can lead to hazards

2.12 Responsibility of the operator

The operator is the person who operates the measuring system for commercial or business purposes or who allows a third party to use the system and who takes legal responsibility for the product and the protection of users, personnel or third parties.

The system is used for commercial purposes. The operator of the system is therefore subject to the legal requirements for occupational health and safety.

In addition to the safety instructions in this manual, the regulations for occupational health and safety and environmental protection that apply to the system's area of use must be observed. In particular, the following applies:

- The operator must inform himself about the applicable occupational safety regulations and carry out a hazard analysis in order to determine additional risks resulting from the special working conditions at the place of use of the measuring system. These must be implemented in the form of work instructions for the users of the measurement system
- Throughout the period of use of the measuring system, the operator shall verify that his work instructions are up to date with the current harmonised regulations and shall adapt them if necessary
- The operator must clearly regulate and specify who is responsible for commissioning, operation and cleaning

- The operator must ensure that all employees who handle the measuring system have read and understood this manual
- The operator remains responsible for ensuring that the measuring system is free of technical faults at all times. The operator must have all safety devices checked regularly for functionality and completeness
- The safety of a system into which the device is integrated is the responsibility of the installer of the system
- If the device is used in a manner not specified by the manufacturer, the protection supported by the device may be compromised

The operator remains responsible for ensuring that the measurement system is free from technical faults at all times. The operator must have all safety devices checked regularly for functionality and completeness.

2.13 Requirements for personnel

DANGER! If unqualified personnel carry out work with the measuring system or are in the danger zone of the measuring system, risks arise which can lead to serious injuries and considerable damage to property

- There is a risk of injury if insufficiently sufficiently qualified personnel
- All tasks must be carried out by qualified qualified personnel
- Keep unqualified personnel out of the away from the danger zone

3. Setup and first steps

3.1 Charging the batteries

You need to charge the batteries before using the PaintChecker Mobile for the first time or when it has not been used for a long time. The device is operated with lithium-ion batteries.

Take the included batteries out of the transport box and insert them into the charger. Observe polarity and always charge all four batteries.

Connect the charger to the USB power supply and plug the power supply into a mains socket.

Charging starts automatically. Once the charger display shows that charging is complete, you can remove the batteries.

ATTENTION! Do not insert AA batteries, NiCd or NiMH rechargeable batteries of the same size into the PaintChecker Mobile controller or charger.

3.2 Insert batteries

Now the batteries are inserted into the controller. Pull the controller out of the rubber sleeve.

Unscrew the battery cover on the back and insert the batteries. Again, observe the correct polarity. Reattach the battery cover, screw it down and put the rubber sleeve back on.

ATTENTION! Use only chargers and cables approved by OptiSense. Using non-approved chargers or cables can cause the batteries to explode or damage the device.

TIP When the batteries are low, the device shows a warning signal and displays a warning message. Charge the batteries for continued use of the device.

If the batteries are completely discharged, the device cannot be switched on.

Charge the empty batteries for some time before trying to turn on the device again.

Fig. 7: Inserting batteries

3.3 Connecting sensor and controller

The PaintChecker mobile consists of the controller and the hand sensor. The sensor is connected to the controller via a cable.

Take the controller and sensor out of the transport case. Connect the sensor cable to the controller. The red dots on the plug and socket must match.

3.4 Switching the device on and off

Press the on-off button for one second to switch on the PaintChecker mobile. The start screen appears and you are directly in the measuring menu. If you press the measuring button once, the PaintChecker mobile is immediately ready to measure

The PaintChecker mobile finishes its work by pressing the on-off button again. Press and hold the button until the display turns off.

Fig. 8: Switching the device on and off

4. Operation

The PaintChecker Mobile controller is operated via a membrane keypad and an illuminated LCD graphic display.

Fig. 9: PaintChecker Mobile operation

4.1 Display

After switching on, the Paint Checker Mobile display first shows the start page while the device initializes and loads the last used measurement batch and application. The display then changes to the measurement view

In the headline (A) the measuring program (application) and the battery status are displayed. The application is selected according to the material properties, e.g. measurements on cured paint or on a freshly applied powder coating before baking. More information on applications can be found in section 6.
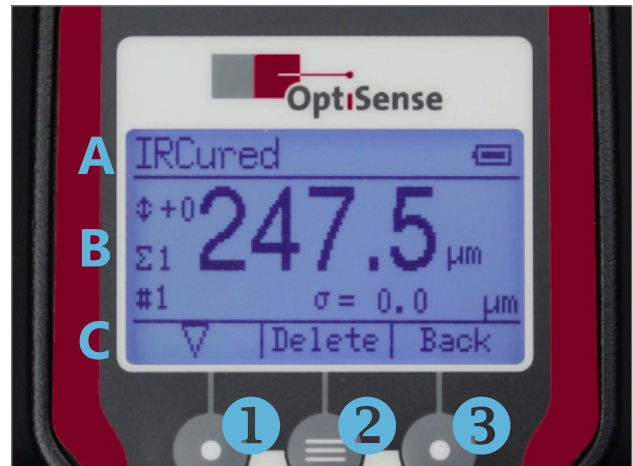

Fig. 10: Display and keys

The battery symbol indicates the level of the rechargeable batteries in four stages. A flashing symbol indicates that the batteries are almost empty and the device will turn off soon

The center area of the display (B) contains the result of the last coating thickness measurement. Left to it, the current measurement offset as well as the number and length of the current batch of measurements are displayed. Below the measurement result, the statistical parameters of the batch can be called up with the Select button (1). More information on batches can be found in Chapter 5.

The footer (C) shows the current assignment of the function keys below.

4.2 Keys

The three function keys below the display (1-3) are used to navigate in the menus. The key assignment is shown in the display above the respective button.

The large button in the center triggers a measurement. With the PaintChecker Mobile Gun models, the measurement can alternatively be started by a button on the sensor.

The button in the lower area of the controller is used to switch the PaintChecker Mobile on and off. To avoid unintended operation, the button must be held down for about one second.

If no button is pressed for an extended period of time, the device automatically turns off.

4.3 Menu navigation

All functions and settings of the PaintChecker Mobile are organized in a hierarchical menu system. The main menu is called up in the measuring view with the *Back* button (3). The *Back* button (3) switches between the measurement view and the main menu.

Fig. 11: Menu navigation

The menu system is controlled with the three function keys.

1. Select a menu item (▽)
2. Confirm the selection *(OK)*
3. Return to the parent menu *(Back)*

The key assignment is also shown in the display above the respective button. To enter a menu, first select it with the *Select* button (1) and then confirm with the *OK* button (2).

4.4 Instrument Settings

The *Instrument settings* menu contains the general settings of the PaintChecker Mobile.
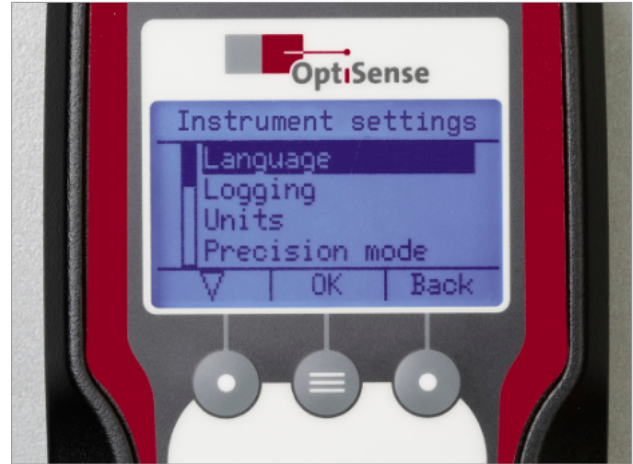
Fig. 12: Instrument Settings

4.4.1 Language | User interface langusge

In the *Language* menu, the language of the user interface can be changed. Select the desired language with the *Select* button (1) and confirm with *OK* (2).

4.4.2 Logging

See also Measurement/Batches in section 5.4

The PaintChecker Mobile saves measured values in batches that can be statistically evaluated and transferred to a PC. The *Logging* menu is used to define how measurement data is stored in batches.

4.4.3 Units | Switching metric/inch

In the *Units* menu, the unit of the length dimension is set. You can choose between *microns* (micrometer, µm) and *mils* (1/1000 inch). The setting applies system-wide to all linear dimensions (coating thicknesses, tolerances, mean values, etc.).

4.4.4 Precision mode | Number of decimal places

The *Precision mode* menu sets the number of decimal places displayed for the length dimension:

Precision mode	metric	inch
On	1	2
Off	0	1

This setting only affects the display readout. It has no impact on the measurement accuracy.

4.4.5 Sound | Confirmation by signal tone

By default, the PaintChecker Mobile confirms the start and end of a coating thickness measurement with a beep. This tone can be switched off in the *Sound* menu.

4.4.6 Power saving | Automatic shutdown

The PaintChecker Mobile features a power saving function that automatically turns off the device if no button is pressed for an extended period of time. The time to automatic shutdown is set in the *Power saving* menu.

All measured values are retained during automatic shutdown and are still available after switching on again.

4.4.7 Time | Display system date and time

The PaintChecker Mobile saves date and time of measurement for each measured value. The system date and time can be called up and displayed via the *Time* menu. It is not possible to change them on the device in order to prevent tampering with the batch recording.

4.4.8 Check instrument | Automatic self-test with gray glass reference

In the *Check instrument* menu, you can perform a self-test of the photothermal measuring system. To do this, first activate the sensor of the PaintChecker Mobile by pressing the measuring button so that the three-dot sight lights up permanently.

Then place the sensor flush on the included gray glass reference and hold it in position.

Fig. 13: Automatic self-test with gray glass reference

Pressing the measuring button again starts the self-test. After about one second, the test result is shown in the display. If the power and function test are both confirmed with OK, the self-test of the sensor and controller has been successfully passed.

ATTENTION! Please make sure that the sensor is resting light-tight on the gray glass reference during self-test and that no ambient light can enter

4.4.9 Firmware | Display the firmware versions of sensor and controller

The *Firmware* menu displays the version of the installed sensor and controller firmware. The version identifier consists of two six-digit groups of numbers/letters followed by a three-part version number in the format

$$aaaaaa - bbbbbb - x.x.x$$

In case of support requests, please provide OptiSense with both firmware versions of your device.

4.4.10 Factory reset | Restore factory defaults

A factory reset deletes all parameters of the PaintChecker Mobile and resets them to the factory default. All user created settings, applications and measurement batches are lost.

After calling up the *Factory reset* menu, the reset process is started with the *OK* button. If the menu was called up by mistake, the process can be aborted with the *Back* button without loss of data.

4.4.11 Smart alerts | Coating Thicknesses Out of Range

As factory default, the message *Coating thickness too thin* or *Coating thickness too thick* is displayed when exceeding the measurement range. These messages can be deactivated in the *Smart alerts* menu.

Smart alerts are only shown if an application is active.

4.5 PC connection and OS Manager

The PaintChecker Mobile can be connected to a PC for data exchange and remote control. To do this, the micro USB socket on the front of the controller has to be connected to a PC USB port using the included USB cable.

Fig. 14: Micro USB socket

ATTENTION!

Please note that the PaintChecker Mobile continues to run from the batteries even when connected to a USB port. Continuous operation using USB as a power source is not possible

4.5.1 OS Manager

The included OS Manager software is used for communication with a PC, allowing PaintChecker coating thickness measurement devices to be controlled and operated via a graphical user interface.

OS Manager can be used to perform and visualise measurements and transfer stored measurement batches to the PC. This greatly simplifies data acquisition, evaluation and archiving tasks, reduces the probability of reading errors and allows measurement data to be collected, structured and displayed in Microsoft Office or other third-party software.

OS Manager is also used to determine and optimise the measurement settings for special combinations of coating material and substrate and to store, load, transfer and organise them in applications.

For more information, please refer to the OS Manager User manual, which is available as a PDF file on the included USB drive.
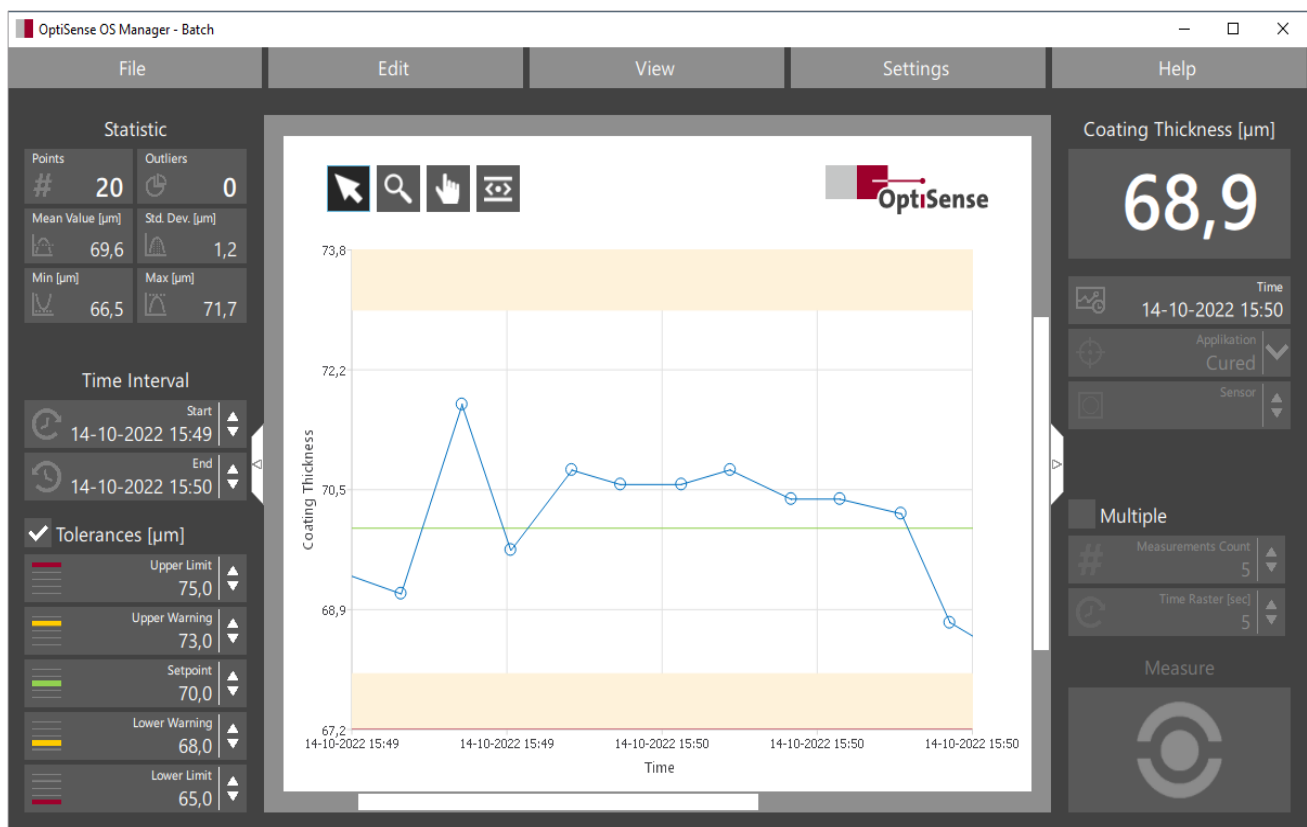

Fig. 15: OS Manager user interface

5. Measuring with the PaintChecker Mobile

OptiSense mobile PaintChecker models can measure wet, powdery and solid coatings on metallic and non-metallic substrates accurately and without contact to the surface.

The measurement is taken from a few centimetres distance. This means that wet and sticky coatings can be tested just as easy as soft and sensitive surfaces.

One of the most common applications of the Paint-Checker Mobile is the routine coating thickness check immediately after application of the coating, e.g. directly after the powder coating booth even before the curing oven. Here, the coater uses the displayed coating thickness for immediate post-control of the coating process.

Fig. 16: Coating thickness check immediately after application

Another typical application are post production measurements in quality assurance. Due to the compact sensor and the precise measuring spot, the PaintChecker Mobile is suitable for the smallest components and narrowest spaces. Even at bending edges, corners and curved surfaces, the thickness of the coating can be clearly determined.

The coating thickness is often not just measured, but stored in measurement batches and later archived in an audit-proof manner.

5.1 Performing a measurement

After switching on the PaintChecker Mobile, the sensor is in a power-saving standby mode. The LEDs of the three-dot sight flash at short intervals.

First press the measuring button once to activate the sensor. The three-dot sight lights up.

Fig. 17: Align the three light dots to a single point

Aim the sensor at the point of the part to be inspected. Adjust the distance between the sensor and the part so that the three light dots of the sight converge to a single point. When you have aligned the light dots of the sight at the desired measuring point, the sensor is correctly positioned.

The measurement is started by pressing the measuring button on the controller. With the PaintChecker Mobile Gun models, the measurement can alternatively be started by the button on the sensor. The PaintChecker Mobile confirms the start of the measurement with a short beep.

The measurement process takes about 0.5 to 1 second, depending on the coating thickness and material combination. Hold the sensor steady and at an even distance during this time. The three-dot sight is briefly switched off during the measurement.

After the measurement is completed, another signal tone sounds, the three-dot sight switches on again and the measured coating thickness is shown on the display. The PaintChecker Mobile is then immediately ready for the next measurement.

5.2 Measurement with spacer cap and tripod

As an alternative to the three-dot sight, a spacer cap can optionally be attached to the sensor for measurements on cured coatings.

Place the sensor with the spacer cap attached on the part and press the measuring button without paying any further attention to the three-dot sight. The bars of the spacer cap automatically ensure the correct alignment of the sensor.

Fig. 18: Spacer caps

For serial measurements on small parts, a tripod is available holding the sensor of the PaintChecker Mobile. The measuring distance between the sensor and the part is set once using the three-dot sight and the adjusting screw of the tripod. To measure, place one part at a time under the tripod and trigger a measurement at the controller.

Fig. 19: Tripod

5.3 Measuring with OS Manager

Especially for serial measurements in the lab, the OS Manager PC software offers many advantages. To use it, connect the PaintChecker Mobile to a PC via the USB cable and start the OS Manager software.

As soon as the connection to the PaintChecker Mobile is established, the Remote controlled message appears in the display and the buttons of the controller are locked. The PaintChecker Mobile is now operated via the OS Manager.

OS Manager provides various tools for efficient serial measurements .The measured coating thicknesses are immediately visualised in a diagram and statistically evaluated.

You can define tolerance windows and perform automatic multi-measurements. The recorded measurement batches can be conveniently organised with OS Manager, archived on the PC and further processed in e.g. Microsoft Excel.

For more information, please refer to the OS Manager User Manual, which is included as a PDF file.

5.4 Measurement batches

In many applications, it is sufficient to simply measure and display the coating thickness with the PaintChecker Mobile. Especially in quality assurance, however, it is often desired to store the measured values and evaluate them later in order to optimise the coating process. For this purpose, the PaintChecker Mobile can save the measured coating thicknesses on the controller in batches and analyse them later on the device itself or on a PC using OS Manager.

To save measured values in a batch, you first need to activate data logging. To do this, call up the *Main* menu in measurement view using the *Back* button, open *Instrument settings* and select the *Logging* menu. Enable logging by selecting the *On* option.

5.5 Create a new batch

First create a new measurement batch. In measurement view, call up the *Main* menu with the *Back* button, select *New Batch* and confirm with OK. The display changes back to the measurement view and all measured values are now saved in the newly created batch. Along with the measured coating thickness value, the time of measurement and the application used (see Chapter 5.4) are also stored in the batch.
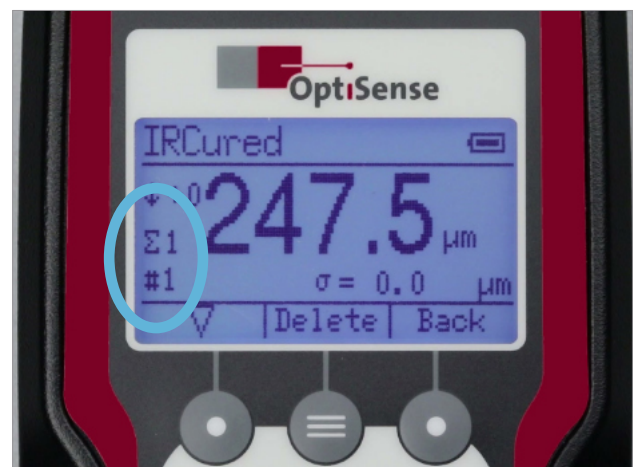

Fig. 20: Batch number and size

The PaintChecker Mobile can store 20 batches with up to 1000 measurement values each. New batches are automatically assigned a consecutive number when they are created. The number of the batch currently used for storing the measured values appears behind the Σ symbol in the measurement view.

5.6 Recording a batch

After activating data logging and creating a new batch, all subsequently measured coating thickness values are stored in this batch. The number of values already stored in the batch is displayed in the measurement view behind the # symbol.

By default, all measured values are saved in the current batch. The *Delete* function key can be used to remove the last value in the batch. Several values can also be deleted by pressing the *Delete* key multiple times. OS Manager offers many more comfortable features for editing batches.
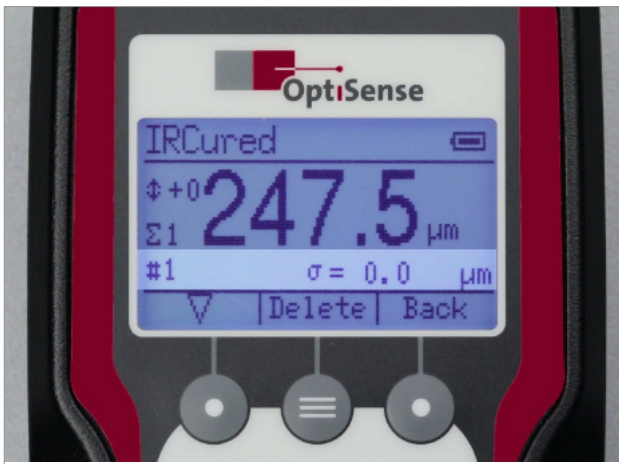

Fig. 21: Statistical key figures

The statistical key figures of the batch are already calculated during recording. They are displayed in the measuring view below the current measured coating thickness value. The ▽ *Select* button can be used to toggle between the following key figures:

$\bar{x}$: Mean value

σ: Standard deviation of the measured values

$\bar{\top}$: Maximum value

$\bot$: Minimum value

5.7 Evaluating a batch

Batches are organised in the *Measurement data* menu. To get access to the batches, call up the *Main* menu in measurement view using the *Back* button, select *Measure settings* and then *Measurement data* and confirm with *OK*. A list appears containing all batches saved on the device.

To evaluate a particular batch, select it from the list and confirm with *OK*. The following information of the batch is displayed:

- Batch number
- Number of measurement values contained (#)
- Date and time the batch was created
- Application used by the batch (see section 6)
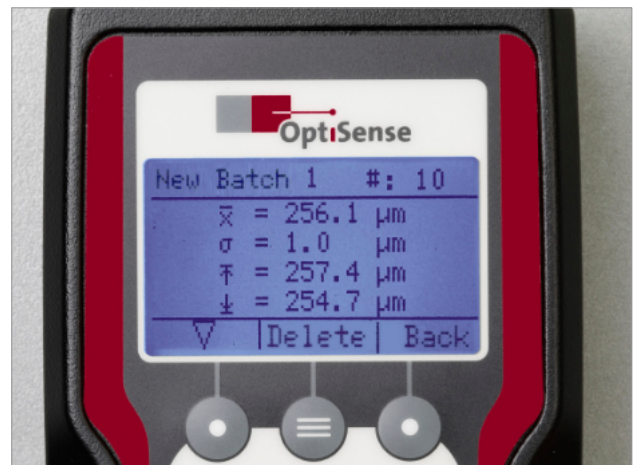
Fig. 22: Batch statistics

The statistical key figures of the batch can now be displayed using the ▽ *Select* button:

$\bar{x}$: Mean value

σ: Standard deviation of the measured values

$\bar{\top}$: Maximum value

$\bot$: Minimum value

5.8 Appending to a batch

To append measurements to a particular batch, call up the *Main* menu in measurement view with the *Back* button, select *Measure settings*, then M*easurement data* and confirm with *OK*. A list appears containing all batches saved on the device.

Select the batch you want to append to from the list, confirm with *OK* and then press the *Load* function key. The display changes back to measurement view and the number of the selected batch becomes the current batch (Σ). All further coating thickness measurements are now appended to this batch.

5.9 Deleting a batch

To delete a batch, call up the *Main* menu in measurement view with the *Back* button, select *Measure settings* and then *Measurement data* and confirm with *OK*. A list appears with all the batches available on the device. Select the batch you want to delete, confirm with OK and then press the ▽ *Select* button. The batch can now be deleted with the *Delete* function key.

To delete all batches at once, select *Delete all* in the *Measurement data* menu and confirm with *OK*. If you also confirm the following confirmation prompt with *OK*, all batches stored in the device will be deleted. The deletion process takes a few seconds, during which no further messages appear on the display.

If *Logging* is enabled, a single batch remains in the *Measurement data* menu even after deleting all batches. This is an empty batch containing no data. It is successively filled with coating thickness measurements again while *Logging* is enabled.

5.10 Setting limits

In almost any coating process, the thickness of the applied coating must stay within a specified tolerance range defined by an upper and lower limit. Parts whose coating thickness is outside this tolerance range are usually rejected or have to be reworked.

The PaintChecker Mobile can automatically monitor compliance with a tolerance range. If a predefined limit is exceeded or not reached during coating thickness measurement, a corresponding arrow symbol appears as a warning next to the measured value.

Fig. 23: Measurement exceeds limit

The tolerance range is set in the *Limits* menu. To do this, call up the *Main* menu in the *Measurement view*

with the *Back* button, select *Measure settings* and then *Limits* and confirm with *OK*.

First switch on the limit monitoring by selecting the *On* option and confirming with *OK*.

Then set the minimum coating thickness (lower tolerance limit) by selecting the first digit of *Min.:* with the *Select* button ▽. Now select the first digit of the minimum coating thickness by advancing with the *Select* button from 0 - 9. As soon as the desired number is displayed, confirm with *OK*. The number is accepted and the next digit of the limit value becomes selected.

Set all digits of the minimum *Min.:* and maximum *Max.:* coating thickness in this way one after the other. You can then exit the *Limits* menu with the *Back* button to continue the measurement with active limit monitoring.

Once limits have been set, they remain in effect even if the PaintChecker Mobile is switched off and on again. To terminate limit monitoring, select *Off* in the *Limits* menu and confirm with *OK*.

5.11 Changing the application

The PaintChecker test systems use the different thermal properties of coating and substrate for non-contact determination of the coating thickness. The material-specific relationship between thermal behaviour and coating thickness is summarised in applications.

If the coating thickness of a material with different thermal properties is to be measured, e.g. a baked powder instead of a freshly applied powder coating, the application intended for this purpose must be loaded beforehand. Various applications are included in the scope of delivery of the PaintChecker measuring instruments, covering a large range of typical coating configurations.

To switch the application, call up the *Main* menu in *Measurement view* with the *Back* button, select *Measure settings*, then *Application* and then *Load*. Confirm with *OK* in each case. A list of all applications available on the device appears.

Select the desired application with the *Select* button ▽ and confirm with *OK*. The display changes back to measurement view and the new application is shown in the headline.

ATTENTION! Please note that all values of a batch must be measured with the same application. Therefore, when changing the application, all stored values of the currently active batch will be deleted

5.12 LARES® – Safety redefined

LARES® stands for a safe LAser Radiation Eye Safety technology and is the intelligent answer to the continuously increasing requirements in the field of personal and eye protection.

These safety requirements always have the highest priority, especially in direct handling of lasers. By using the new LARES®-technology in the manufacturing and process industry, people, machines and the environment are reliably protected.

The handling and use of the devices can be carried out without the need for documentation and user instruction. Thanks to the LARES® technology, the devices can be used directly and without any restrictions in almost all areas of application.

Thanks to the LARES®-logo on the corresponding OptiSense-products, the safe laser technology can be easily recognised. All devices carrying the LARES®-logo are absolutely safe for the eye - even during prolonged irradiation.

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6. Applications

The OptiSense PaintChecker measuring instruments use the photothermal method for coating thickness measurement (see chapter 1.5).

The optimum excitation strength, measurement time and number of averages as well as the relationship between thermal behaviour and thickness of the coating material are summarised in applications.

6.1 Creating a new application

If there is no suitable application for a particular coating material in the scope of delivery, it is necessary to create a new one. With the PaintChecker Mobile, a new application is always created using an existing one as a template. The basic settings of the photothermal measuring system (excitation intensity, measuring time and number of averages) are taken from the template. The thermal behaviour as well as the shrinkage during curing are subsequently determined and added to the application using coating samples.

Suitable coating samples are essential for creating a new application. These samples must match the coating material and substrate of the part to be measured later. Ideally, at least three coating samples are available, which differ only in their coating thickness, and whose coating thicknesses cover the entire expected measuring range.

Please note that the quality of the coating samples is crucial for the quality and accuracy of the newly created application.

If measurements are to be made on uncured coatings later, uncured coating samples are required as well.

6.1.1 Selecting a suitable template

To create a new application, a suitable template has to be selected first. To do this, load one of the existing applications (see Chapter 5.11 Changing the application) and perform some trial measurements on the coating samples. The important thing here is not the actual measured value, but that consistent, clearly distinguishable values can be obtained for coating samples of different thickness, even with repeated measurements.

Example:

Coating sample	Reading Template A	Reading Template B
100 µm	90	75
150 µm	92	115
200 µm	125	160

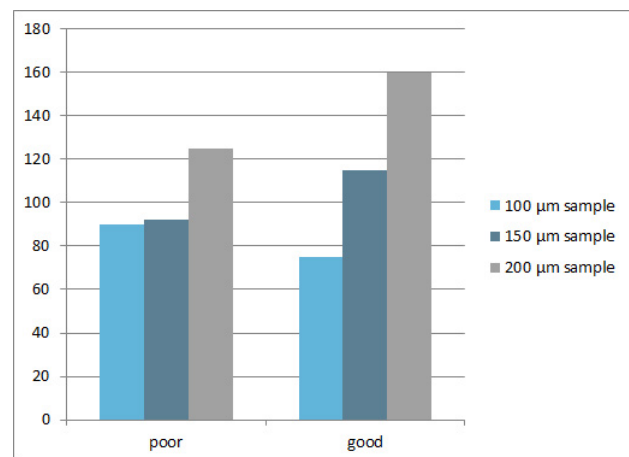Displaying the values in a diagram yields the following figure:

Fig. 24: Application templates

Template A is not suitable because the readings of the 100 µm and 150 µm coating sample hardly differ. The difference is much smaller than between the 150 µm and 200 µm sample (no linear relationship).

Template B shows a distinctive gradation of the readings and a clearly visible relationship to the thickness of the coating samples. It is well suited as a template for the new application.

6.1.2 Single point application

If the coating thickness measured with the template application differs only by a constant amount from the thickness of the respective coating sample, a single-point application is sufficient. To create this, call up the *Main* menu in Measurement view with the *Back* button, select *Measure settings*, then *Application* and then *New application*. Confirm with *OK* in each case.

Now select the template from the list of existing applications and confirm with *OK*. Then select the *1 Pt.-Application* option and confirm with *OK*.

The automatically generated name of the new application is displayed in the headline. It is composed of the letter U followed by a sequential number and the name of the template, e.g. U-01-IRCured.

Now carry out some measurements on the coating sample. The respective measured value is displayed behind the x symbol, the mean value of all measurements behind the $\bar{x}$ symbol.

Then enter the actual coating thickness of the coating sample by setting the first digit of the coating thickness with the Select button by advancing from 0-9.

TIP Make sure that the sign remains positive (+). Otherwise, continue switching until the sign becomes positive

As soon as the proper number is displayed, confirm with *OK*. The number is accepted and the next digit of the actual coating thickness becomes selected.

Set all digits of the actual coating thickness one after the other in this way. After entering the last digit, you can complete the single-point application with the *Done* function key. The display changes back to Measurement view, the newly created application is displayed in the headline and can be used right away.

6.1.3 6.1.3 Two-point application

Two-point applications are more complex and require two coating samples, but provide more accurate readings over a wider coating thickness range.

TIP If sufficient coating samples are available, give preference to a two-point application

Use coating samples with widely different coating thicknesses if possible. Ideally, these should be close to the upper and lower limits of the intended measuring range. The order in which you process the two coating samples is arbitrary.

Except for the use of two coating samples, the procedure corresponds to a single-point application (see above). In Measurement view, call up the *Main* menu with the *Back* button, select *Measure settings*, then *Application* and then *New application*. Confirm each with *OK*.

Now select the template from the list of existing applications and confirm with *OK*.

Then select the *2 Pt.-Application* option and confirm with *OK*. The automatically generated name of the new application is displayed in the headline.

Now carry out some measurements on the first coating sample. The respective measured value is displayed behind the x symbol, the mean value of all measurements behind the $\bar{x}$ symbol.

Then enter the actual coating thickness of the first coating sample by setting the first digit of the coating thickness with the *Select* button by advancing from 0-9. As soon as the proper number is displayed, confirm with *OK*. The number is accepted and the next digit becomes selected.

Fig. 25: Enter the actual coating thickness

Set all digits of the actual coating thickness of the first coating sample one after the other in this way. After entering the last digit, press *Next* to process the second coating sample in the same way.

Carry out some measurements on the second coating sample and enter the actual coating thickness in the same way as described above. After entering the last digit, you can complete the two-point application with the *Done* function key. The display changes back to Measurement view, the newly created application is displayed in the headline and can be used right away.

6.2 Applications for measuring uncured coatings

When measuring uncured coatings, the Paint-Checker Mobile is usually not expected to display the thickness of the fresh coating, but to predict the coating thickness after curing.

Therefore, when creating an application for uncured coatings, the measurement is performed on uncured samples, but the actual coating thickness entered is that of the cured samples. The PaintChecker Mobile takes into account the degree of shrinkage of the coating during curing when calculating the coating thickness value.

Proceed as follows when creating applications for uncured coatings:

1. Coat the samples
2. Measure the uncured samples in the *Application* menu
3. Cure samples
4. Measure the coating thickness of the cured samples using a reference method (e.g. eddy current)
5. Enter the measured values as actual coating thicknesses in the *Application* menu

6.3 Editing an application

With the *Edit* option in the *Application* menu, you can fine-tune your self-created applications. To do this, call up the *Main* menu in Measurement view using the *Back* button, select *Measure settings*, then *Application* and then *Edit*.

Select the application you want to edit from the list and confirm with *OK*. In the *Edit* menu, you can now enter an offset value for each coating sample used in the creation of the application (i.e. one offset for single-point applications, two offsets for two-point applications).

The entry is performed digit by digit by advancing with the *Select* button from 0-9 and confirming with *OK*. When entering the first digit, the sign can also be set. Modify the offset values so that the actual coating thickness is displayed as accurate as possible when subsequently measuring the coating samples.

As soon as all offset values have been entered, you can finish the editing with *Done*.

6.4 Deleting an application

To delete an application from the device, call up the *Main* menu in measurement view with the *Back* button, select *Measure settings*, then *Application* and then *Delete*. Confirm with *OK* in each case.

Select the application you want to delete from the list and confirm with *OK*. If you also confirm the following security prompt with *OK*, the selected application is deleted.
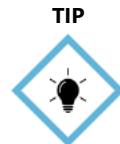
TIP Please note that only the applications you have created by yourself can be deleted. The factory installed applications cannot be deleted

6.5 Editing applications with OS Manager

Applications can be edited much more comfortably with OS Manager than directly on the device. Instead of using an existing template, completely new applications can also be created there. Multipoint applications with more than two coating samples are also possible.
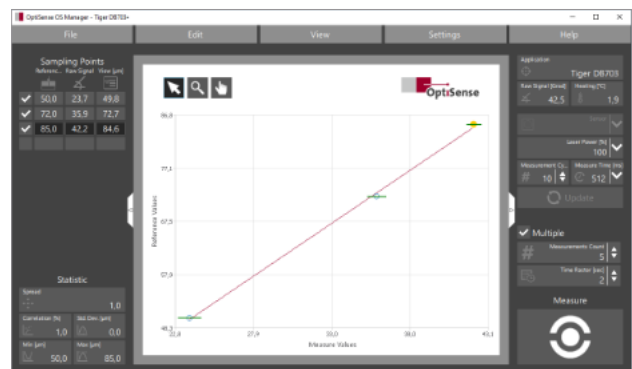

Fig. 26: Editing applications with OS Manager

For more information, please refer to the OS Manager User manual, which is available as a PDF file on the included USB drive.

7. Maintenance, error messages and best practice

7.1 Transport and storage

TIP The PaintChecker Mobile may be damaged if improperly stored or transported

7.1.1 Transport

Use the case delivered with the device for transportation and to protect it from external impacts.

7.1.2 Storage

If you do not use the PaintChecker Mobile for an extended period of time, observe the following storage conditions: Store the device…

- dry and protected from freezing and heat
- in a place protected from dust and direct sunlight
- with batteries removed from the device

7.2 Cleaning and Care

Do not use any solvents for cleaning to avoid damaging the surface of the enclosure

Please use eyeglass cleaning cloths for lens cleaning. In case of heavy soiling, wipe controller and sensor with a damp, soft cloth.

7.3 Periodic Check

It is recommended to have the device inspected and serviced annually by OptiSense or by persons instructed by OptiSense.

In particular, never open the controller or unscrew the front ring of the sensor.

7.4 Services

OptiSense accompanies your projects with a variety of services from consulting to the final support module. Below we have compiled an excerpt from our ServicesSuite for you:

7.4.1 Feasibility Study

First, we create a measurement application for your samples. Thus, we can quickly and reliably check whether your metrological requirements, such as the coating thickness range or accuracy, can be met under the desired operating conditions.

Furthermore, it is possible to use traceable samples for the measurement application. Through precise analyses and inclusion of your process parameters, all critical values are determined in advance to ensure compliance with all quality requirements.

7.4.2 Application service

As with many other non-destructive coating thickness measurement methods, the photothermal method does not measure the coating thickness directly, but calculates it from measurement signals.

Therefore, the individual thermal properties of coating material and substrate have to be taken into account. With this service, OptiSense provides you with an application based on your coating samples, which is specifically tailored to your coating and substrate.

7.4.3 Trainings

Our experts know all the little tips and tricks that can simplify your daily work and are happy to pass them on.

Through hands-on learning and in-depth knowledge exchange with our experts, your staff will be perfectly qualified to properly operate, maintain and service the measuring equipment. The training sessions can be tailored and scheduled to meet your individual requirements.

7.4.4 Calibration service

Our highly accurate, cost-effective calibration services ensure consistent high quality as well as full compliance of your measurement equipment. You can even request us to come to your company and perform the calibration on site. The reference standards used for calibration meet the requirements of the respective standard for photothermal measurement (DIN EN 15042-2). The measuring system receives a calibration sticker with a validity of one year.

7.4.5 Maintenance service

We will take care of the annual maintenance and functional testing of the OptiSense measuring systems according to DIN 31051. We also perform a Type 1 factory calibration and the important insulation test. On completion of maintenance, all services are documented by a detailed report and an inspection sticker is attached to the measuring system.

For additional services, please refer to our ServicesSuite at *https://OptiSense.com/en/services.html*

7.5 Error messages

In case of a measurement error, the following error messages are displayed:

Error description	Recommended action
Warning of increased sensor temperature	• If possible, reduce the measuring rate • Mount the sensor in a heat dissipating fixture
Signal too weak	Use a measurement setting with increased laser power
Signal too strong	Use a measurement setting with reduced laser power
Coating thickness exceeds application limit	Use an application with larger maximum coating thickness
Coating thickness below application limit	Use an application with smaller minimum coating thickness
Amplitude signal or time signal of the reference measurement exceeding specifications	• Make sure the reference surface is clean and free of scratches • Check the correct alignment of reference sample and sensor • If the error persists, please contact OptiSense Service
Sensor overheated	Further measurements are only possible if the sensor temperature is <40°C.
Part temperature too low (< 0° C)	Heat the part to room temperature

7.6 Disposal

By proper disposal of electrical equipment, you will help to conserve valuable resources and avoid potential negative impacts on health and the environment, which could otherwise be caused by inappropriate waste disposal (see also Directive 2012/19/EU on re-manufacturing and recycling). Accessories and packaging should also be recycled in an environmentally friendly manner.

7.7 Customer service and service hotline

OptiSense customer service supports you on technical questions:

7.7.1 Technical customer service

OptiSense GmbH & Co. KG
Annabergstraße 120
45721 Haltern am See
GERMANY
Tel. +49 2364 50882-0
info@OptiSense.com
www.OptiSense.com

7.7.2 Service-Hotline

+49 2364 50882-22 | Mo. – Fr. at 8:00 – 15:00
service@OptiSense.com

7.8 FAQ – Frequently asked questions

| Keyword	Error description	Reason and countermeasure
Does not start	Battery(s) are almost empty or defective	• The batteries are almost empty. Charge the batteries • Charge all batteries and check for error messages in the charger display • Replace the entire battery set
Sudden shutdown	The PaintChecker Mobile shuts down immediately after being switched on	If this happens rarely, restart the device. If it happens frequently, take the PaintChecker Mobile to your service partner
Controller responds slowly	Sensor is not properly connected	Check connection of sensor cable to controller. The red dots on the plug and socket must match
Indicator lights flash after the batteries have been charged	One or more batteries defective	• Charge all batteries and check for error messages in the charger display • Replace the entire battery set
Measurement data „disappears"	Logging is off	In menu Instruments Settings select Logging. Selecting Option On enables the logging of measurement data
Measurement incorrect	Sensor is not properly connected	In menu Instruments Settings select Check Instrument. Check the sensor excitation light using the included gray glass reference. Power and Function test should be displayed as OK
Unstable measurement result	Unstable measurements or fluctuating thickness values when measuring with the PaintChecker Mobile	• Ambient temperature too high: Move to a cooler measuring environment • Never expose the PaintChecker Mobile to direct sunlight for an extended period of time • The parts to be measured are too far away: Observe the instructions on measurement distance in section 5.1
Measurement not possible	Sensor is not properly connected	Check connection of sensor cable to controller. The red dots on the plug and socket must match
Display not in English	Wrong language setting	To select English, turn on the controller and press the function keys in the following sequence: 1 x Right | 4 x Left | 3 x Middle

7.9 Material Matrix - Best Practice

The material matrix gives you an overview of the most common coating-substrate combinations of the respective PaintChecker Mobile:

Substrate	Coating	Coating Condition	Pen-1.6	Pen-3.5	Gun-R	Gun-B
Application Matrix | PaintChecker Mobile						
Metal	CDC	dry	▪			
	Pigmented paint	wet / dry	▪	▪	▪	
	Clear coat	wet / powdered	▪	▪	▪	
	UV paint	wet / cured	▪	▪	▪	
	Zinc dust	dry	▪	▪		
	Bonding agent	wet / cured			▪	
	Powder coating	powdered			▪	
	Adhesive	wet / dry		▪	▪	
	Rubber coating	dry		▪	▪	▪
Rubber	Bonded coating	dry		▪	▪	
	Adhesive	wet / cured		▪	▪	
Ceramic	Pigmented paint	dry		▪	▪	
	Powder slurry	pre-dried			▪	
	Conductive paste	pre-dried		▪	▪	▪
Glass	Pigmented paint	wet / dry	▪	▪	▪	
	Bonding agent	pre-dried	▪	▪	▪	
	Conductive paste	pre-dried	▪	▪	▪	▪
Plastic	Bonding agent	wet / dry			▪	
	Laser paint	dry	▪	▪	▪	
	Clear coat	wet / dry		▪	▪	
	Powder coating	powdered			▪	
	Rubber coating	dry			▪	▪

8. Technical Data

Technical Data | PaintChecker Mobile Control Unit			
Model	Mobile-Laser	Mobile-R	Mobile-B
Order number	C22-02-03	C22-02-02	C22-02-01
Design	Mobile handset, Aluminium casing with protective holster		
Rechargeable battery	4 x Li-Ion		
Battery life	ca. 10 h		
Interface	PC: USB		
Dimensions (L x W x H)	182 x 79 x 43 mm		
Weight	700 g		
Maximum acceleration	5 g		
Standards	DIN EN 15042-2		

Drawing | PaintChecker Mobile Controller and Sensors
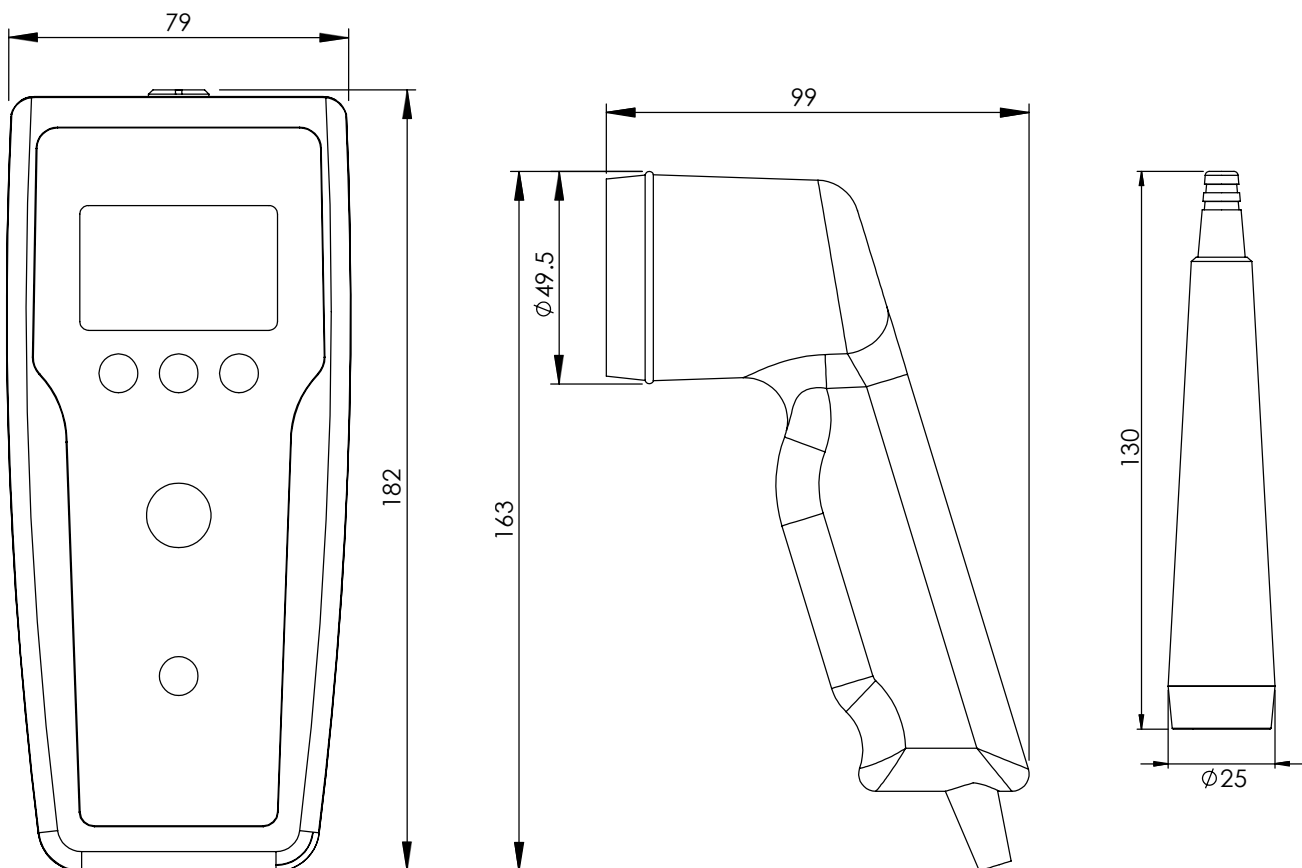
Controller   *Gun-R, Gun-B*   *Pen*

Technical Data | PaintChecker Mobile Sensors				
Model	**Pen-1.6**	**Pen-3.5**	**Gun-R**	**Gun-B**
Order number	S21-0700-001	S21-0700-002	S21-0600-003	S21-0600-001
Design	Laser, pen-shape		LED, pistol-shape	
Measurement range	1 - 1000 µm			
Measurement rate	max. 0.5 Hz			
Measurement time	250 - 1000 ms		250 - 2000 ms	
Diffusor	5°	1°	—	—
Duty Cycle	33 %			
Max. On-time	1s			
Operating mode	pulsed operation			
Maximum acceleration	5 g			
Resolution	1 % of reading (typical)			
Accuracy	3 % of reading (typical)			
Measuring distance from lens	16 mm	35 mm	33 mm	
Distance tolerance	± 1 mm	± 2.5 mm	± 3 mm	
Angular tolerance	± 15°			
Size of measuring field Ø	0.2 mm	0.3 mm	1 mm	
Energy	750 mJ		750 mJ	250 mJ
Wavelength	1470 nm		980 nm	365 nm
Classification	Laser class 1		Safety class Risk Group 3	Safety class Risk Group 3
Eye safety	yes			
Dimensions (L x W x H)	130 x Ø25 mm		163 x 99 x 49.5 mm	
Weight	50 g		225 g	
IP Code	IP 50 | USA only: Type 5 Enclosure			
Standards	DIN EN 15042-2			
Control unit	mobile-Laser		mobile-R	mobile-B

OptiSense.

At your service, worldwide.