



**coatmaster**

measure up. contactless.

**coatmaster Inline/Atline  
Operator Manual**



[coatmaster.com](http://coatmaster.com)

Version: 11-2020



**coatmaster AG**  
Flugplatzstrasse 5  
CH-8404 Winterthur  
SWITZERLAND



+41 (0) 52 212 02 77



info@coatmaster.com



www.coatmaster.com



+41 (0) 52 511 83 11

© 2020 coatmaster AG

Distribution and duplication of this document, and utilisation and communication of its contents other than for legitimate purposes, are not permitted without the express permission of coatmaster AG. Violations will result in legal action. All rights are reserved in the event of patent grant or utility model registration (ISO 16016).

Subject to technical changes and printing errors, the values given are approximate and are not to be understood as legally warranted characteristics. These values may vary according to component tolerance.

Last update: 11/2020

## Table of contents

<b>1</b>	<b>General</b> .....	<b>5</b>
1.1	Information.....	5
1.2	About this manual.....	5
1.3	Liability limitation.....	5
	Copyright.....	6
1.4	Warranty conditions.....	6
1.5	Scope of delivery.....	6
<b>2</b>	<b>Safety</b> .....	<b>7</b>
2.1	Responsibility of the operator.....	7
2.2	User qualification.....	7
2.3	Proper use.....	7
2.4	Improper use.....	7
2.5	Safety warnings and signals used in this manual.....	8
2.5.1	Description of the safety warnings.....	8
2.5.2	Used symbols.....	8
2.6	Product safety.....	9
2.6.1	General hazards.....	9
2.6.2	Integrated safety elements.....	10
<b>3</b>	<b>coatmaster Hardware Interfaces</b> .....	<b>11</b>
3.1	coatmaster.....	11
3.2	coatmaster Inline.....	13
<b>4</b>	<b>System Installation</b> .....	<b>16</b>
4.1	Hardware installation.....	16
4.2	Software requirements.....	17
4.3	Interface to connect with control computer.....	18
4.4	Network and administrator settings.....	18
4.4.1	Configuring coatmaster network with coatmaster Web Client.....	18
4.4.2	Installing coatmaster Desktop Software.....	20
4.4.3	Select language.....	21
4.4.4	Define administrator settings within the Operating System.....	21
<b>5</b>	<b>Measuring coating thickness with coatmaster</b> .....	<b>22</b>
5.1	Measuring principle.....	22
5.2	coatmaster application for rough surfaces.....	22
5.3	Measuring with coatmaster Operating System.....	23
5.3.1	Manual measurement.....	24
5.3.2	Automated measurement with external sensor.....	26
5.3.3	Measurement statistics.....	29
5.3.4	Warnings and Errors.....	30
5.3.5	System information.....	32

5.3.6	Optional windows for main view .....	33
<b>5.4</b>	<b>Measuring with the Web Client.....</b>	<b>34</b>
5.4.1	Monitor.....	36
5.4.2	Settings of coatmaster Web Client.....	38
<b>5.5</b>	<b>Making new coatmaster applications .....</b>	<b>38</b>
5.5.1	Setup application.....	39
5.5.2	Reference measurements .....	41
5.5.3	Display .....	42
5.5.4	Device .....	44
5.5.5	Evaluation.....	45
5.5.6	Bounds.....	46
5.5.7	Calibration report .....	47
5.5.8	Application offset .....	48
<b>5.6</b>	<b>coatmaster applications for coatings before curing.....</b>	<b>51</b>
5.6.1	Measuring powder coatings before curing .....	51
5.6.2	Measuring wet coatings before curing/drying.....	51
5.6.3	Procedure to make coatmaster applications for measuring coating thickness before curing	52
<b>5.7</b>	<b>Back-up and Transfer of coatmaster applications.....</b>	<b>52</b>
5.7.1	Export applications.....	53
5.7.2	Import applications .....	55
<b>5.8</b>	<b>Import a material file.....</b>	<b>57</b>
<b>5.9</b>	<b>Export measurement data .....</b>	<b>58</b>
<b>6</b>	<b>Remote control .....</b>	<b>60</b>
<b>6.1</b>	<b>TCP/IP.....</b>	<b>60</b>
6.1.1	General format of commands and results .....	61
6.1.2	MEASURE command.....	62
6.1.3	GETCONFIGURATIONS command.....	63
6.1.4	GETCONFIGIDS command .....	63
6.1.5	GETTHICKNESSBOUNDS command .....	64
6.1.6	STARTAUTOMATION command (automation mode).....	65
6.1.7	STOPAUTOMATION command (automation mode) .....	65
6.1.8	TRIGGERAUTOMATIONSENSOR command (automation mode).....	65
6.1.9	GETAUTOMATIONSTATE command (automation mode) .....	65
6.1.10	CREATESAMPLE command (automation mode).....	65
6.1.11	GETNUMBEROFMEASUREMENTS command .....	66
6.1.12	GETSERVICESTATUS command.....	66
6.1.13	GETAMBIENTSENSORDATA command (coatmaster Inline only).....	67
6.1.14	GETCOATMASTERSTATUS .....	68
6.1.15	GETOBJECTTEMPERATURE .....	69
6.1.16	GETLASTOBJECTTEMPERATURE .....	69
<b>6.2</b>	<b>HTTP .....</b>	<b>69</b>

<b>7</b>	<b>Maintenance / Service</b>	<b>70</b>
7.1	General	70
7.2	Software maintenance	70
7.2.1	coatmaster software diagnostics	71
7.2.2	coatmaster embedded software restore	72
7.3	Measurement window	72
7.4	Refill coolant	72
7.5	Filter pads	77
7.5.1	coatmaster	77
7.5.2	coatmaster Inline	77
7.6	Blank measurement	78
<b>8</b>	<b>Troubleshooting</b>	<b>79</b>
<b>9</b>	<b>Technical data</b>	<b>80</b>
9.1	Data sheet coatmaster	80
9.2	Data sheet coatmaster Inline	81
9.2.1	Dimension and assembly relevant information coatmaster	82
9.2.2	Dimension and assembly relevant information coatmaster Inline	83
<b>10</b>	<b>Transport, packaging, storage</b>	<b>84</b>
10.1	Transport inspection	84
10.2	Packaging	84
10.3	Storage	84

# 1 General

## 1.1 Information

This manual describes the coatmaster and provides all information required for its safe operation and to maintain it in good working order.

Read this manual carefully before installing and running your system and note the safety precautions in chapter 2 in particular. Store the manual in the immediate vicinity of the instrument, so that it can be consulted at any time.

Figures in this manual serve the general understanding and might deviate from the actual product design.

## 1.2 About this manual

The User Manual contains instructions on proper installation, use of the coatmaster, safety information, and user maintenance and trouble shooting. More detailed information on network and communication setup, calibration, applications and external remote control are available in the Operator Manual.

Paragraphs starting with NOTE transport helpful information for working with the device/software or its supplementaries. NOTE's are not related to any kind of hazard or damage (see following example).

NOTE

*Useful tips for the easy operation of the instrument/software.*

## 1.3 Liability limitation

The device is designed and built in accordance with current state-of-the-art technology. Nevertheless, risks to users, property, and the environment can arise when the device is used carelessly or improperly.

coatmaster AG has determined the following residual dangers emanating from the device:

- The Operator Manual is not considered.
- The device is not operated according to its proper use.
- The device is operated by insufficiently trained personnel.
- Unauthorized modification of the device.
- Use of unlisted spare parts

Appropriate warnings in this manual serve to make the user alert to these residual dangers.

Due to special designs, additional options are latest technical modifications, the actual scope of delivery might deviate from the descriptions and illustrations herein.

The obligations agreed upon in the delivery contract, the General Terms and Conditions as well as the delivery conditions of the manufacturer and the legal provisions in effect at the time of contract closure shall be applicable.

## Copyright

No technical modifications may be made to the device without the prior written agreement of coatmaster AG. Unauthorized modifications may affect the system safety or result in accidents.

This manual is copyright. Information from it may not be reproduced, distributed, or used for competitive purposes, nor made available to third parties. The manufacture of any component with the aid of this manual without prior written agreement is also prohibited.

### 1.4 Warranty conditions

The warranty conditions are part of the General Terms and Conditions of the manufacturer.

The software is installed on the embedded PC integrated in the coatmaster. Any system modification and modification of the embedded PC as e.g.

- Installation of further software
- Software updates

can affect or damage the coatmaster and are therefore prohibited.

coatmaster AG assumes no liability for data loss on the embedded PC. It is suggested to regularly backup the data on the embedded PC (application and measurement data).

### 1.5 Scope of delivery

Scope of delivery of the coatmaster:

- coatmaster
- 230V mains cable
- Operator's Manual, User's Manual, Service Book

Scope of delivery of the coatmaster Inline:

- coatmaster measurement head
- CM cooling unit (19" rack insert, 3 height units)
- CM control unit (19" rack insert, 3 height units)
- 230V mains cable
- Connecting cable between measurement head and CM Power Supply
- Connecting cable between CM Power Supply and CM Water Supply
- 2 coolant tubes between CM Water Supply and measurement head
- Operator Manual, Service Book

## 2 Safety

This section gives an overview of all relevant safety aspects for an optimal personal protection as well as for a safe and undisturbed operation.

### 2.1 Responsibility of the operator

The operator is responsible for training his/her personnel.

The operator shall inform the manufacturer without delay of any safety-related incidents which might occur during operation of the device or its accessories.

Issues can be reported to the e-mail address: [info@coatmaster.com](mailto:info@coatmaster.com)

Legal regulations, such as local, state and federal laws applying to the device or its accessories must be strictly followed.

### 2.2 User qualification

Before the use of the coatmaster the operation manual must be read and understood.

The device may only be used by persons who on account of training or professional experience have an overview of the dangers which may arise when operating the device.

### 2.3 Proper use

The coatmaster is exclusively designed for measuring thicknesses of coatings. It can be used for the following coatings:

- Powder coatings on metallic substrates
- adhesive coatings on metallic substrates
- polymer coatings on metallic substrates
- wet paint on metallic substrates
- wet paint (wet-state) on non-metallic substrates
- thermal spray coatings.

The device must only be operated and cleaned by trained personnel. The proper use also includes adherence to this manual. The service intervals have to be maintained.

### 2.4 Improper use

Use not mentioned above or use that does not comply with the technical specifications is considered improper use. The operator bears the sole risk for any damages caused by such improper use. The following uses are forbidden:

- Use of the coatmaster in environments, where liquids can enter the housing.
- Introduction of any objects into the coatmaster.
- Opening the coatmaster's housing. Exception: Cleaning or changing the filter pad (see chapter 7). This is also valid when the coatmaster is not connected to the mains. When the coatmaster is opened, the warranty is void and the manufacturer disclaims all liability.
- If liquid leaks from the coatmaster, unplug the device immediately and contact technical support.






Technical support for the coatmaster +41 (0) 52 212 02 77, [info@coatmaster.com](mailto:info@coatmaster.com)

## 2.5 Safety warnings and signals used in this manual



### 2.5.1 Description of the safety warnings

DANGER, WARNING, CAUTION and NOTICE are standardized signal words for identifying levels of hazard seriousness of risks related to personal injury and property damage. All signal words, which are related to personal injury are accompanied by the general safety sign.

For your safety it is important to read and fully understand the below table with the different signal words and their definitions!




Sign	Signal word	Definition	Risk level
	<b>DANGER</b>	Indicates a hazardous situation which, if not avoided, will result in death or serious injury.	□□□□
	<b>WARNING</b>	Indicates a hazardous situation which, if not avoided, could result in death or serious injury.	□□□
	<b>CAUTION</b>	Indicates a hazardous situation which, if not avoided, may result in minor or moderate injury.	□□
	<b>NOTICE</b>	Indicates possible property damage, but no practices related to personal injury.	

Supplementary safety information symbols may be placed in a rectangular panel on the left to the signal word and the supplementary text (see below example).

	 <b>DANGER</b>
<p><b>Supplementary text, describing the hazard/risk (e.g. explosion).</b> Result of the hazard if not avoided (e.g. death).</p> <p>1. List of measures to avoid the herein described hazard or hazardous situation.</p>	

### 2.5.2 Used symbols

The below reference list incorporates all safety information symbols used in this manual or on the device and their meaning.

Symbol	Meaning
	General hazard
	Device damage
	Electrical hazard

## 2.6 Product safety

The device is designed and built in accordance with current state-of-the-art. Nevertheless, risks to users, property, and the environment can arise when the device is used carelessly or improperly.

coatmaster AG has determined the following residual dangers emanating from the device:

- The device is operated by insufficiently trained personnel.
- The device is not operated according to its proper use.

Appropriate warnings in this manual serve to make the user alert to these residual dangers.

This device was built and tested in compliance with the safety requirements for electrical equipment for measurement, control and laboratory use IEC 61010-1 (2010) and the Low Voltage Directive 2014/35/EU.



The device satisfies the EMC requirements for electrical equipment for measurement, control and laboratory use of the international standard IEC 61326-1 (2012).

To ensure photobiological safety the device should be operated in accordance with the guidelines for the safe use of intense pulsed light source equipment on humans IEC 62471-3 (2015).

### 2.6.1 General hazards

The following safety messages show hazards of general kind which may occur when handling the device. The user shall observe all listed counter measures in order to achieve and maintain the lowest possible level of hazard.

Additional warning messages can be found whenever actions and situations described in this manual are related to situational hazards.

 A yellow triangular warning symbol with a black border and a black exclamation mark inside.	<p data-bbox="384 253 608 286"> <b>CAUTION</b></p> <p data-bbox="384 322 1206 356"><b>Integrated light source.</b> Direct visual contact can lead to visual impairment.</p> <p data-bbox="384 387 823 421">Never look directly into the light source.</p> <p data-bbox="384 452 1422 546">For using the coatmaster within a process environment we recommend to build an optical cover around the light source, to absorb the light impulse, so that it will not have an impact beyond the measurement area. For this purpose e.g. blackened metal sheets might be used.</p>
---	---

### 2.6.2 Integrated safety elements

A slow blow fuse of 12.5 A is integrated into the coatmaster as overvoltage protection.

### 3 coatmaster Hardware Interfaces

#### 3.1 coatmaster

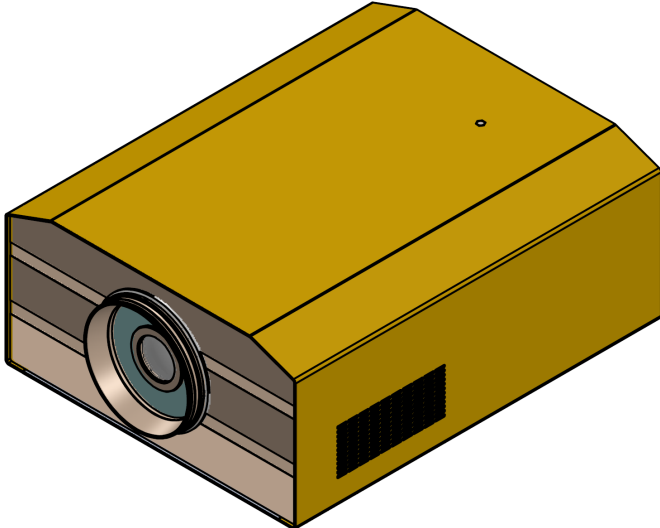


Figure 1. coatmaster 3D CAD illustration

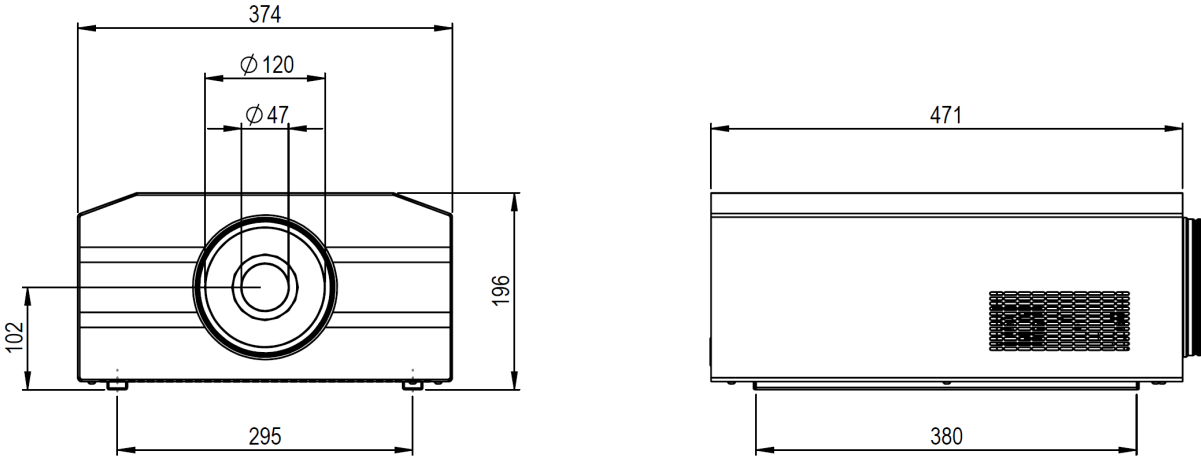


Figure 2 coatmaster frontal view (left) and side view (right)

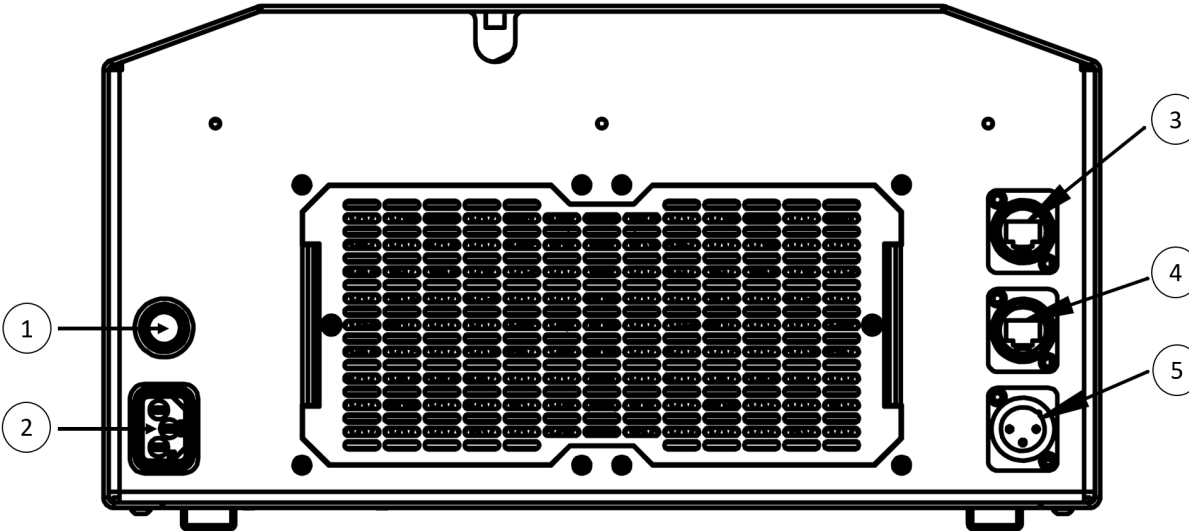


Figure 3 coatmaster connections - Rear view

1 ON/OFF push-button  
2 Power connection

3 USB Connection for WIFI  
4 Ethernet connection  
5 Sensor connection

### 3.2 coatmaster Inline

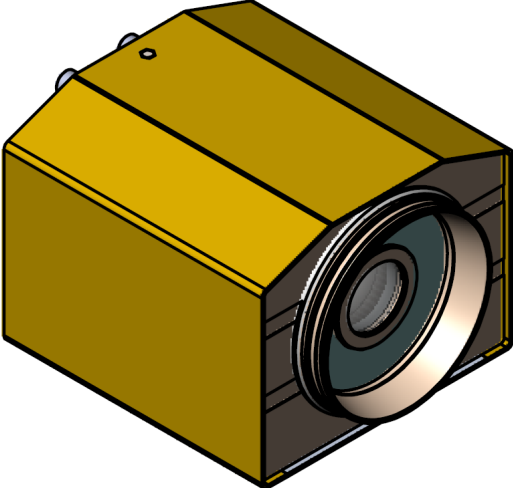


Figure 4. 3D CAD illustration of the coatmaster in-line measurement and sensor head

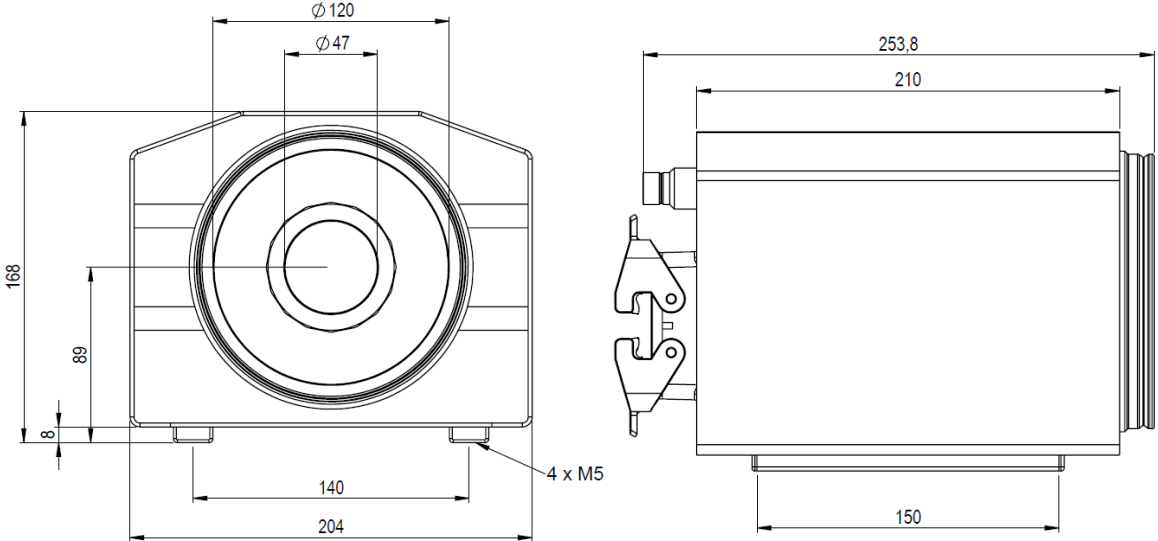


Figure 5. Frontal (left) and side view (right) of the coatmaster in-line measurement and sensor head

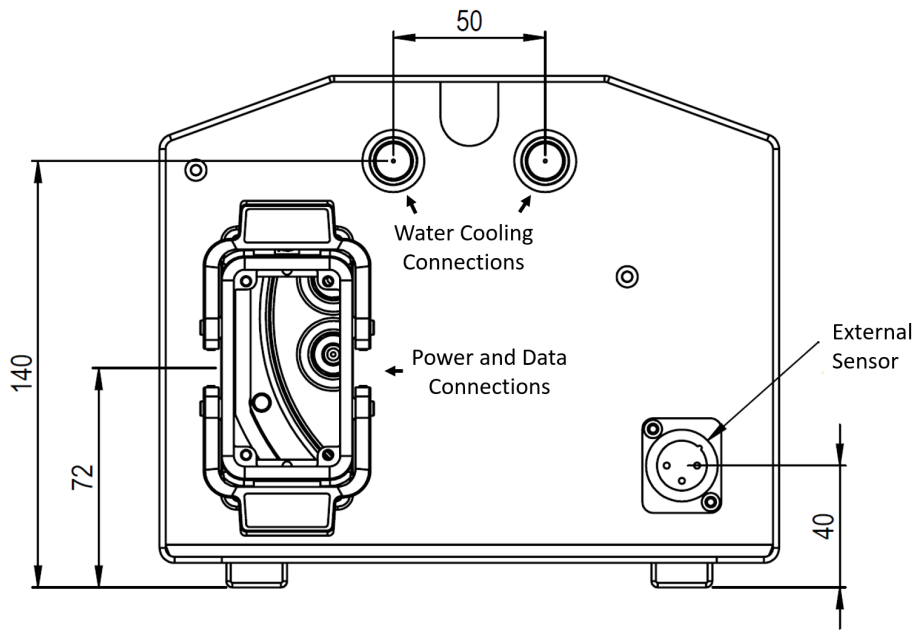


Figure 6. coatmaster Inline - measurement optics rear view

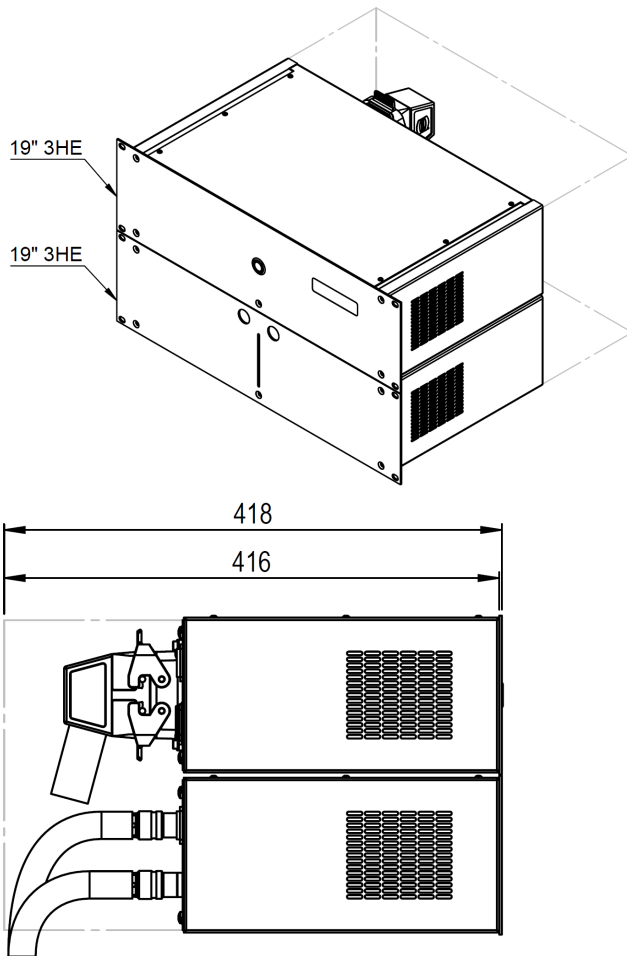


Figure 7. coatmaster Inline - Control (top) and Cooling (bottom) units

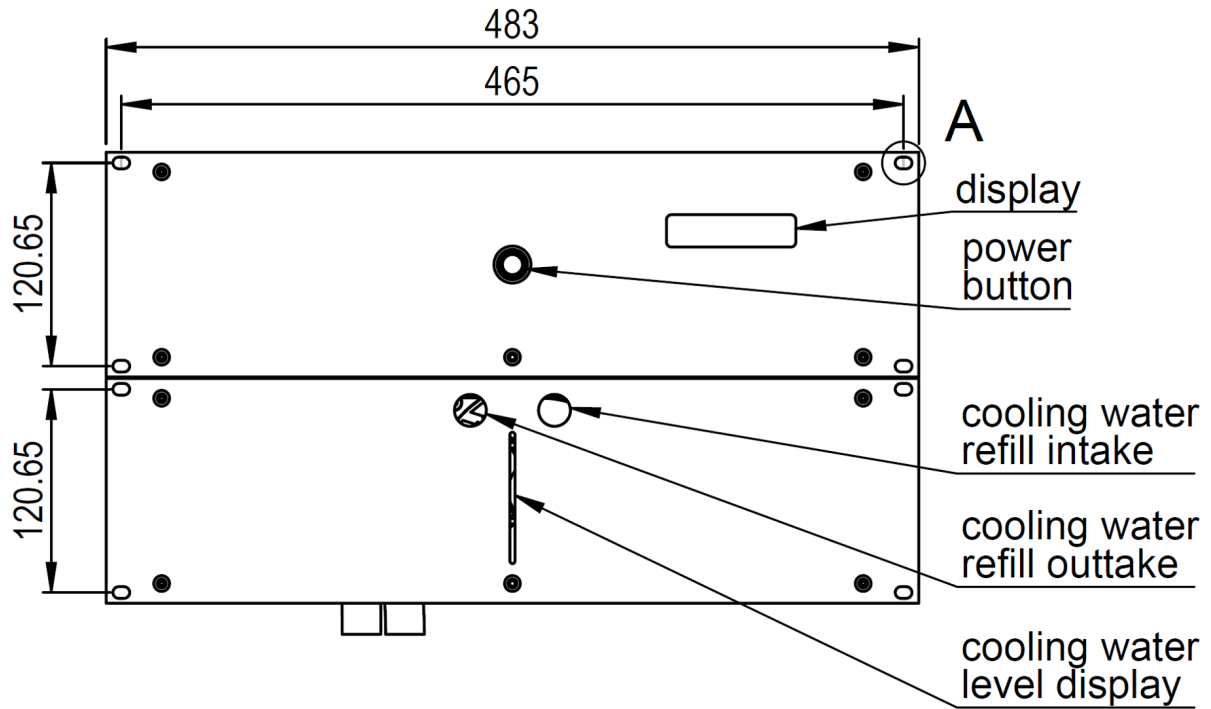


Figure 8. coatmaster Inline - Control (top) and Cooling (bottom) units - front view

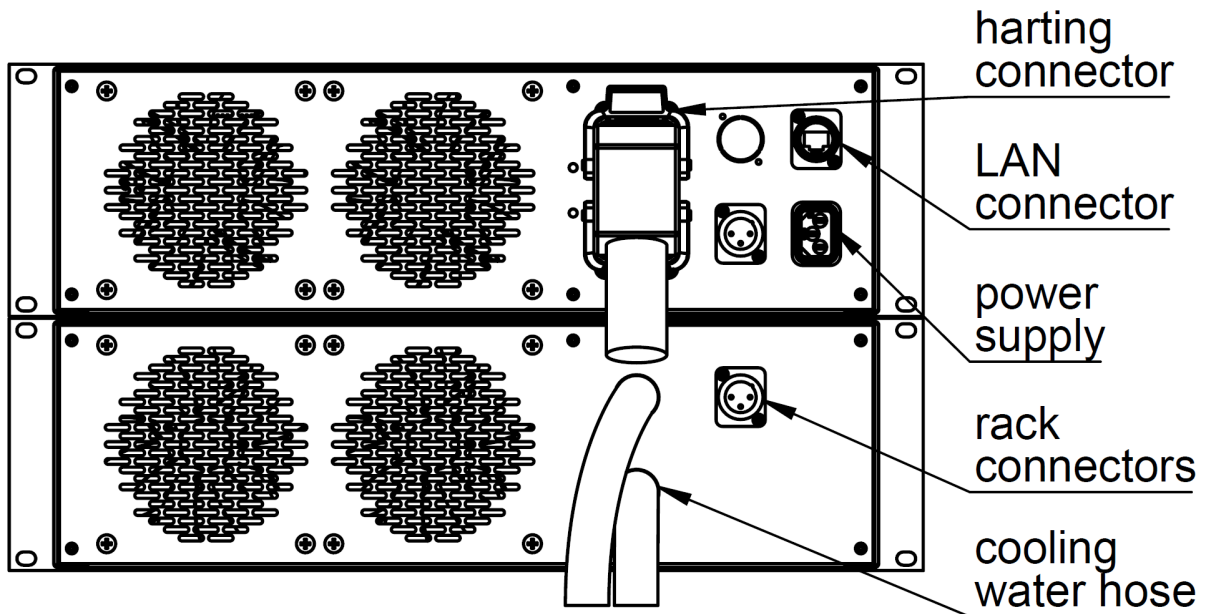


Figure 9. coatmaster Inline - Control (top) and Cooling (bottom) units - rear view



## 4 System Installation



### NOTE



*Inspect the device for damages during unpacking. Accept damaged packages only under reservation of possible damage. Write this reservation on the delivery note. Immediately inform the carrier and the sender and do not unpack the damaged package until notification of the sender.*

Keep the original packaging material for future transportation.

### 4.1 Hardware installation



- Put the device on a clean, stable, even and horizontal surface. Consider the maximum device dimensions, the weight and the operating conditions as described in chapter 3.1.
- Do not place any objects on or under the device.
- The device must have a distance of at least 20 cm to another object or the wall to guarantee a sufficient cooling.
- Connect the device with the mains by means of the mains cable contained in the scope of delivery.



	 <b>WARNING</b>
	<p><b>Risk of burns by electric current.</b> Serious injuries or death can result.</p> <p>Check for proper grounding before use. Replace defective cabling instantly.</p>



	 <b>CAUTION</b>
	<p><b>Integrated light source.</b> Direct visual contact can lead to visual impairment.</p> <p>Never look directly into the light source.</p> <p>For using the coatmaster within a process environment we recommend to build an optical shielding around the light source, to absorb the light impulse, so that it will not have an impact beyond the measurement area. For this purpose e.g. blackened metal sheets might be used.</p>

### NOTE

*To cut the power in case of an emergency by unplugging, the devices or any other items must not block the mains plug!*

	 <b>NOTICE</b>
	<p><b>Risk of false alarm of flame detectors.</b> Incompatible flame detectors might be triggered wrongly by means of the coatmaster's light impulse.</p> <p>For rooms where the coatmaster is operated, use compatible fire detectors with dual UV/IR sensors (e.g. from the company STS Brandschutzsysteme GmbH).</p>

	 NOTICE
	<p><b>Instrument damage by wrong installation.</b> Installing the device with a wrong tilt angle may lead to device overheating.</p> <p>When installing the device vertically tilted, an angle of 30° must not be exceeded. When installing the device horizontally tilted, an angle of 90° must not be exceeded.</p>

	 NOTICE
	<p><b>Risk of device error by fingerprints on the lense.</b> Contaminations on the lense might lead to measurement errors.</p> <p>Never touch the lense directly. Clean the lens and measurement window as described in chapter 7.2.</p>

## 4.2 Software requirements

The coatmaster can be operated via three different software environments:

**coatmaster Operating System:** Starting measurements, creating applications, exporting measurement data, display measurement values and statistics. The creation of applications and the export of measurement data can only be done with the coatmaster Desktop. The software must be installed on a Windows-PC.

System requirements:

- Operating system: Windows 10, 64bit
- Processor: 2.4 GHz
- Working memory: 4 GB
- Available harddisk memory: 300 MB
- Display resolution: 1024 x 768

**coatmaster Web Client:** Starting measurements, displaying measurement values, defining network- and administrator settings, installing software updates. The definition of network- and administrator settings, as well as the installation of software updates is only possible with the Web Client.

System requirements:

- Web-Browser

**Remote control:** Measure over the TCP/IP-interface. This interface is used to trigger measurements and to transfer measurement values. Examples: PLC systems like Siemens S7 or Beckhoff TwinCAT.

Before you can measure with coatmaster Web Client or through the remote control, a corresponding application must be created with the coatmaster Desktop Software. This is described in chapter 5.7.

### 4.3 Interface to connect with control computer

To be able to operate the coatmaster, the computer must be connected with an Ethernet cable to the coatmaster.

### 4.4 Network and administrator settings

Make sure that the coatmaster is correctly installed as described in chapter 4.1 Hardware installation and switch it on. Proceed as follows to configure network and install software:


1. Configure the coatmaster network access as described in chapter 4.4.1.
2. Install the coatmaster Operating System at least on one Windows-computer as described in chapter 4.4.2. The coatmaster Operating System is needed to create coatmaster applications.

#### 4.4.1 Configuring coatmaster network with coatmaster Web Client

Make sure the coatmaster and the operating computer are connected with an Ethernet cable. The IP address of the coatmaster is noted in the coatmaster Service Book, which is part of the scope of delivery. If you want to change the network configuration (IP address, net mask, gateway), proceed as follows:

1. Open a web browser, enter the IP address of the coatmaster (e.g. "192.168.1.140") in the URL field and confirm with Enter.

The web browser now connects to the coatmaster and opens the main window of the coat-

master Web Client. If necessary, change the language with the -button on the top right.

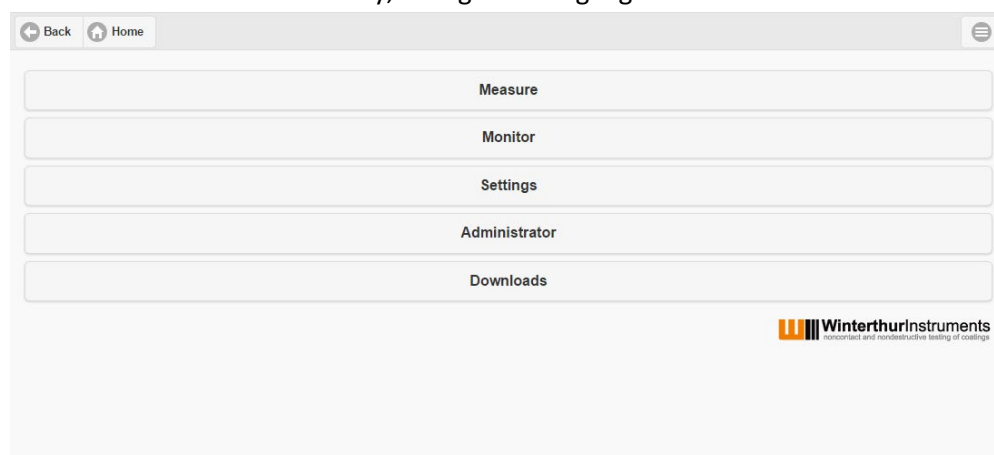


Figure 10. Web client start page

2. Click the *Administrator* line and log in with the user *admin* and the password *Welcome123*.

- In the network window the IP-address for the ethernet-connection, the WLAN-SSID (name) and the WLAN-password can be defined. The SSID can be hidden, if necessary. In this case, deactivate the checkbox *On*. Click on *Save*. Please note: subnet addresses 192.168.139.XXX and 109.198.7.XXX are not allowed.

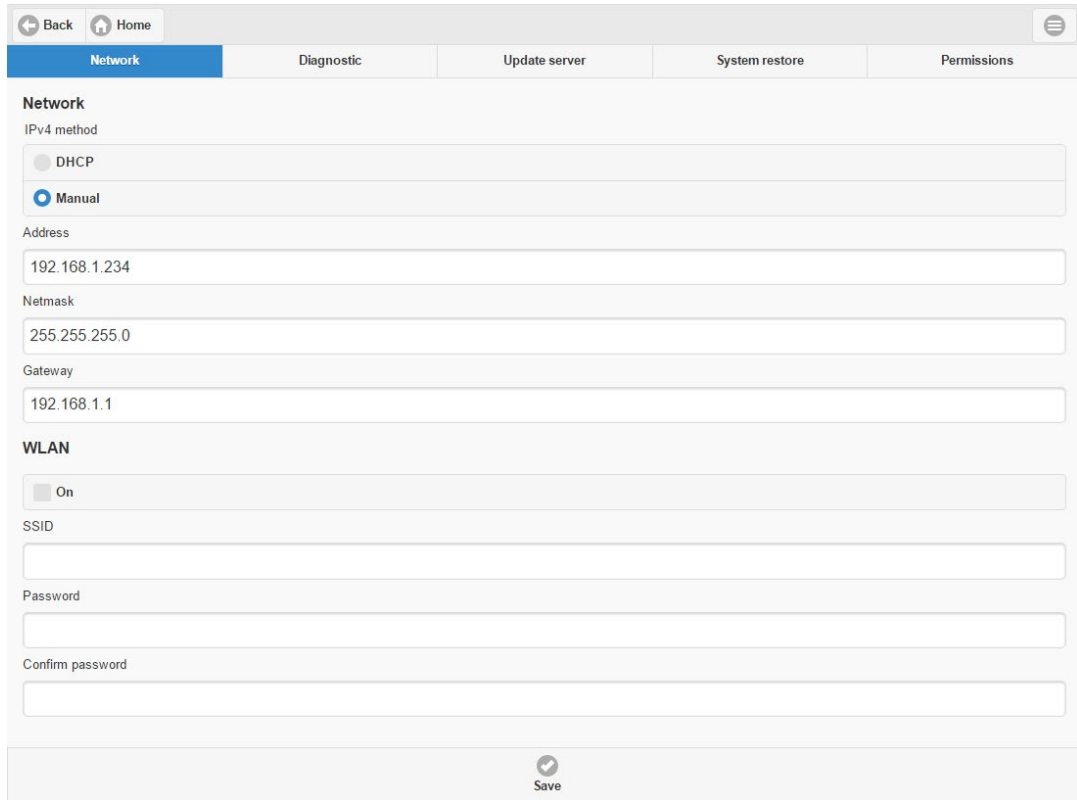


Figure 11. Administrator settings in the web client

Enter the data here to have them available for later use:

coatmaster serial no.:	
WLAN SSID:	
WLAN-password:	
Ethernet IP-address:	

If the login data is lost, please inform your administrator. After having changed the network settings, restart the coatmaster (switch off the main switch, wait for 10 seconds and switch on the device again).

#### 4.4.2 Installing coatmaster Desktop Software

Make sure the coatmaster and the operating computer are connected with an Ethernet cable. The IP address of the coatmaster is noted in the coatmaster Service Book, which is part of the scope of delivery.

1. Open a web browser, enter the IP address of the coatmaster (e.g. "192.168.1.116") in the URL field and confirm with Enter.

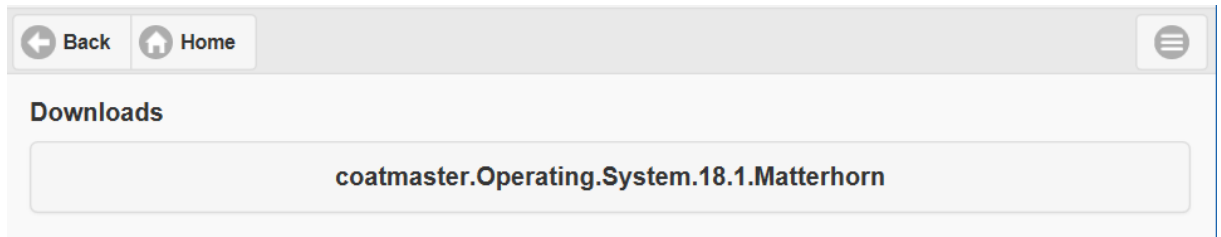


Figure 12. Download window in the web client

2. Click on *Download*. The *Downloads* submenu opens. Click on "coatmaster.Operating.System.18.1.Matterhorn" to download the coatmaster Operating System software. The message *Show all downloads* is displayed in the browser window (position and wording depends on the web browser type). On a click on the text an overview of the latest downloads opens (view depends on the web browser type).
3. Extract the content of the downloaded ZIP-file onto your computer (with right-click on the ZIP-file). The ZIP-file can be deleted afterwards.
4. The extracted archive contains the folder coatmaster.Operating.System. 18.1.Matterhon with the executive file "coatmaster Operating System 18.exe". Create a link from "coatmaster Operating System 18.exe" and move it to the desktop so that it is easily accessible.
5. Start the coatmaster Operating System 18 software by double-click on the icon. From the menu bar, select *Configuration* → *Preferences*. In the *Preferences* dialog box select *Server*.

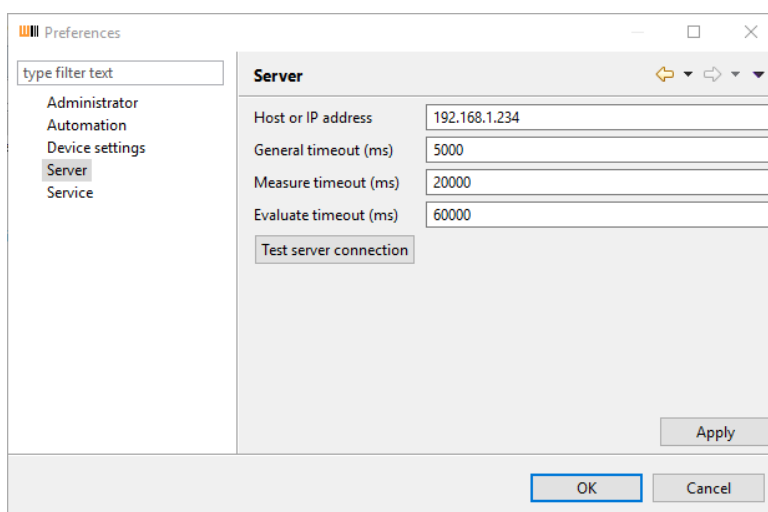


Figure 13. Server settings in coatmaster stand-alone program

6. In the field *Host or IP address* enter the coatmaster IP address (siehe chapter 4.4.1).
7. Connect the PC and the coatmaster via an ethernet cable. Click *Test server connection* to make sure that the connection can be established. If the server test fails please verify IP address and Ethernet connectivity.

To change the IP address, proceed as described in chapter 4.3.1.

#### 4.4.3 Select language

Start *coatmaster Operating System* by double-click on the icon. If the software is not displayed in your desired language, select Configuration > Language.

A submenu appears listing the available languages. Select the corresponding language by clicking on it. A dialog appears prompting to restart the software. Confirm with OK and restart the software. The program will now open in the selected language.

#### 4.4.4 Define administrator settings within the Operating System

Under the Administrator tab the software administrator can disable edit and deletion of applications for users.

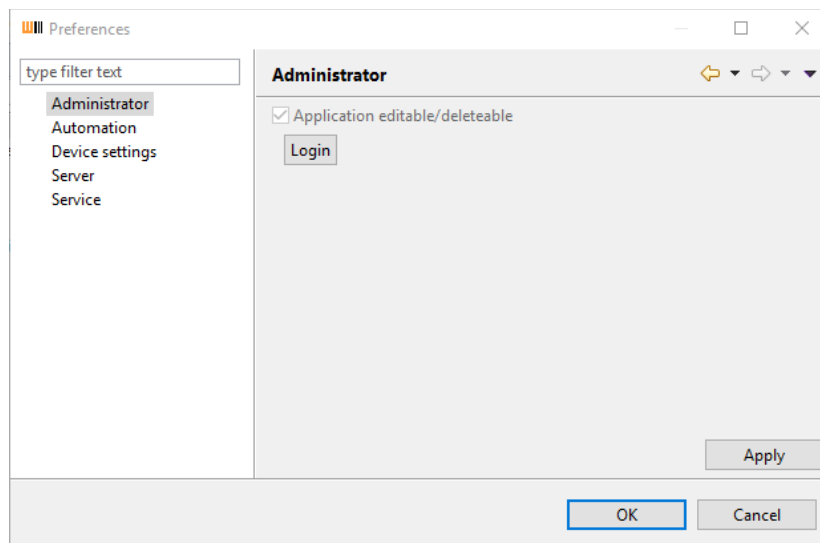


Figure 14. Administrator settings in coatmaster stand-alone software

To change the settings, click Login. A Login dialog opens. Administrator password: **admino041**. Click OK. The field *Application editable/deletable* becomes active. By activating or deactivating the check box you can now enable or disable the editing and deleting of applications. The function refers to the creation of a new application, to deleting, copying, renaming and editing an existing one and to deleting measurement values from the trend area.

## 5 Measuring coating thickness with coatmaster

### 5.1 Measuring principle

The coatmaster operates according to the principle of thermal testing of coatings. Thereby the coating surface is warmed by means of a light impulse. After the initial warm-up by a few degrees, the surface cools down as the heat diffuses in deeper areas of the coating and the substrate. The evolution on the surface depends on the physical properties of the coating. The thinner the coating is (given that it has a lower thermal conductivity than the substrate), the faster the surface temperature decreases.

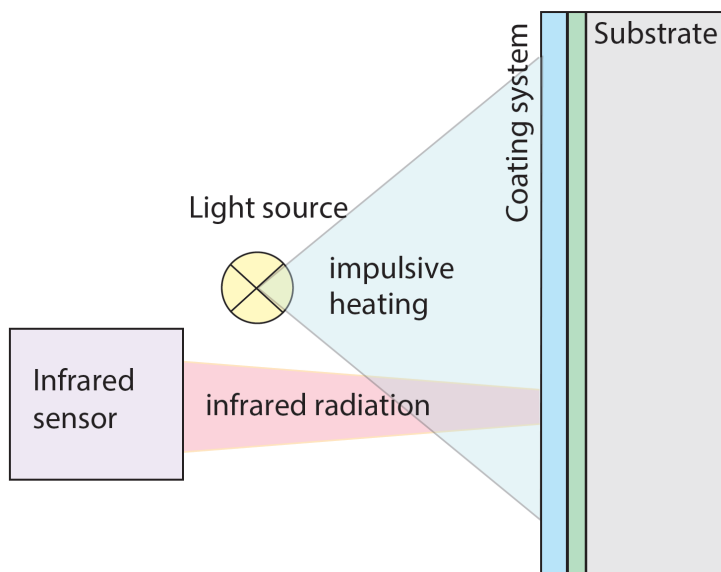


Figure 15 Schematic diagram of Thermal Testing of Coatings

### 5.2 coatmaster application for rough surfaces

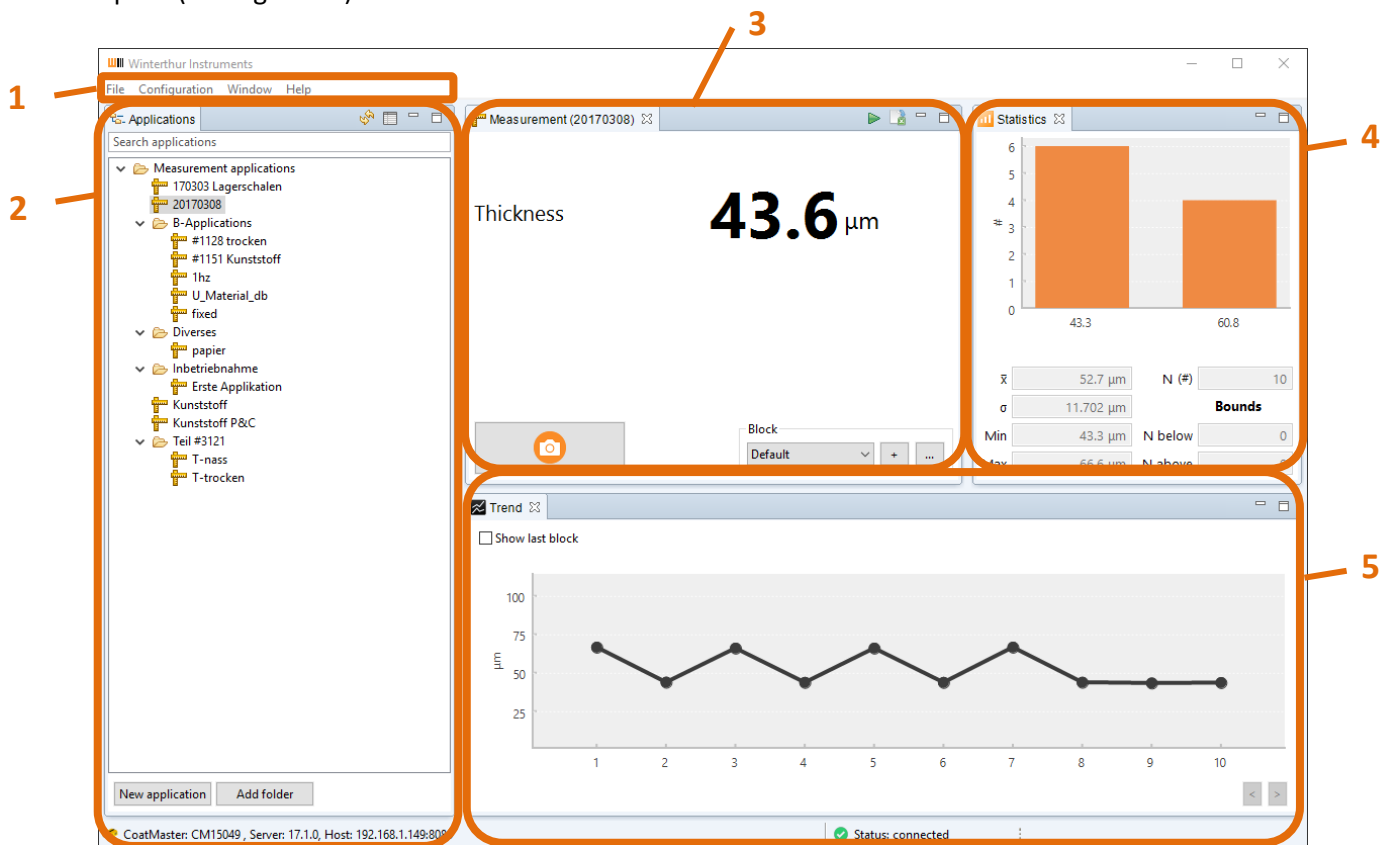
For rough surfaces we recommend to use a reference method such as weighing, or multiple microscopic cross-section measurements to even out the large variation in thickness results by cross-section analysis. With a contacting reference method (e.g. electro-magnetic or micrometer probes) the surface roughness drastically reduces the repeatability of thickness measurements. A large coatmaster measurement spot will reduce dependency of inaccurate part placement.

### 5.3 Measuring with coatmaster Operating System

coatmaster Operating System must be installed on a Windows computer for making applications and running manual and automated measurements. Turn the coatmaster on and after one minute connect the computer with the coatmaster by ethernet:

- **Ethernet:** Connect the computer and the coatmaster with Ethernet. This is possible either by direct connection with one cable or by integrating the coatmaster in your local network.
- **WIFI:** If an optional WIFI dongle has been installed according the guidelines provided by coatmaster AG, the coatmaster can be reached by inserting the provided SSID and password. Contact your administrator if you do not know the SSID (name) or password.

After connecting with the coatmaster, start the coatmaster Operating System. The main window opens (see Figure 16).



**Figure 16** The main window of the coatmaster Operating System is divided into five areas: 1. Menu, 2. Applications, 3. Measurement, 4. Statistics and 5. Trend (see chapter 5.5.3 on page 42 for setting the bounds for warning and error ranges).

#### Note:

To restore the main view as shown in Figure 16 select *Window > Reset window* from the Menu area (1).

To check if the coatmaster Operating System is connected to the coatmaster, refer to the status bar bottom right.



To carry out measurements first select the application from the Application area (2). If there is no appropriate application available, you can create it as described in chapter 5.7. If the application is greyed out it is not yet complete and requires additional input from the user.

### 5.3.1 Manual measurement

To start a manual measurement refer to the area Measurement (3) in Figure 16:

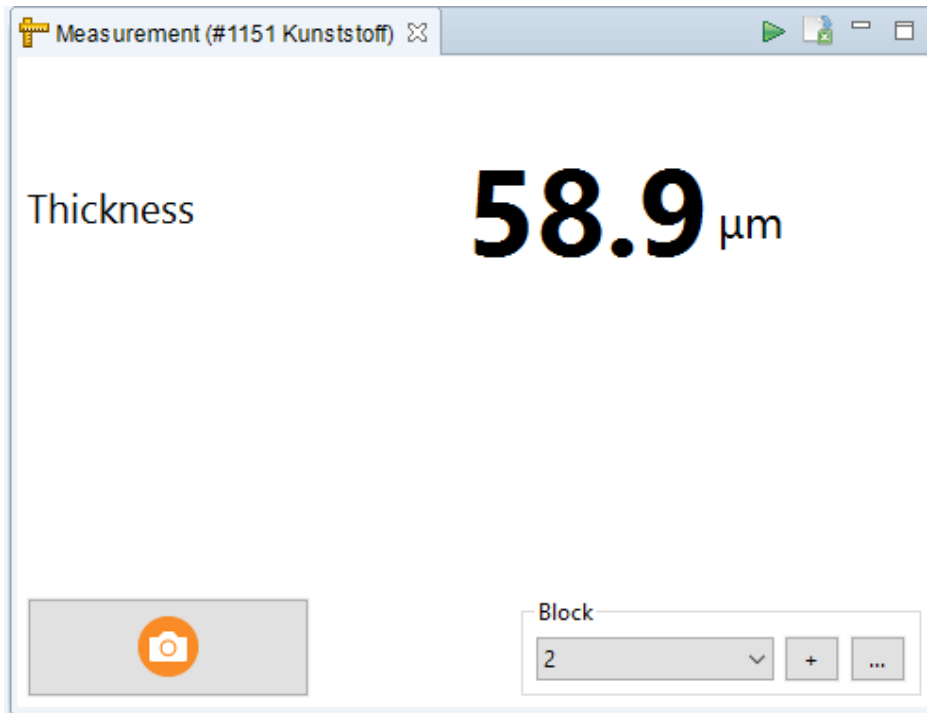









Figure 17. Measurement results window in the stand-alone software

A measurement is performed by clicking on the Measurement button . The result of the measurement is displayed in the defined units (e.g.  $\mu\text{m}$ ).


The Statistics area (4) contain statistical values like average, standard deviation, etc., which are calculated over all measurements in the currently selected block. Blocks are user-defined collections of measurements. If you carry out measurements at several positions, you can use for example a new block for each measurement position to view the mean value at each position. Each application is created with the *Default* block. To make a new block, press the -button. New measurements will be stored in the block currently selected.

In the Trend area (5) the last measurement values of a block are displayed, ordered according to the measurement time. Trends like systematic increase or decrease of the coating thickness are visible in this area. A zoom window can be drawn with the mouse to increase the resolution. By means of a right-click, single data points can be deleted.

Summary of functions in the Measurement area:

	Start measurement	Starts the measurement
	Add a block	Creates a new block where new measurements are saved
	Manage blocks	Opens the dialog to manage blocks
	Export measurements	Export the content of the current application, as done with File > Export
	Automation mode	Changes the view to the Automation mode (see chapter 5.3.2).

### 5.3.1.1 Manage blocks

A block is a collection of measurement values. Via the  - button in the block area you can name, delete and export blocks.

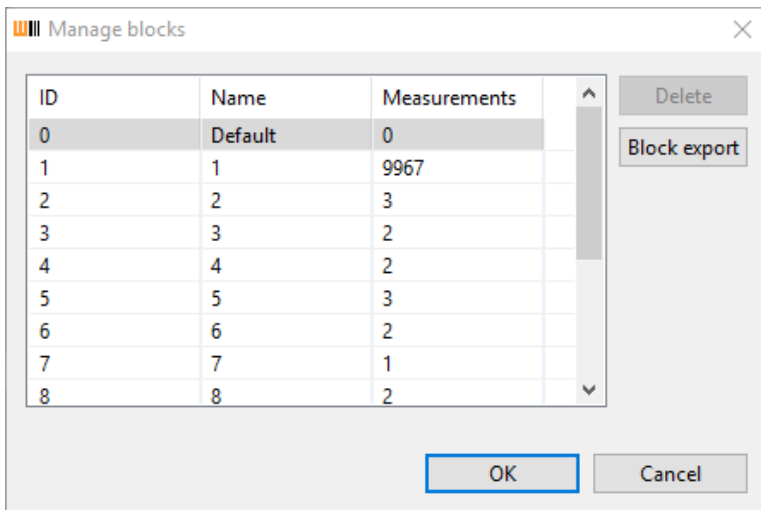


Figure 18. Block management in the stand-alone software

Highlight a block and click “Delete” to delete a block or “Block export” to export the block values from the coatmaster to your computer. Read chapter 5.9 for more information on exporting data. Click OK to save the settings and close the dialog. Click Cancel to close the dialog without saving.

### 5.3.2 Automated measurement with external sensor

In the automation mode of the coatmaster Desktop software, the measurement is triggered by an external sensor. The sensor has to be connected to the coatmaster, as described below. This function enables automated measurement e.g. in a production line. As soon as a part is detected by the sensor, a series of coatmaster measurements can be triggered.

The measurement values are stored on the coatmaster. There are three possibilities to view the measurement values that are generated in automation mode:

1. Export the measurement values to your computer by means of the Operating System software, where they can be treated further with another software (e.g. Excel) (see chapter 5.9).
2. Display the measurement values live with the coatmaster Desktop software (see chapter 5.3.2.2).
3. Display the measurement values live on a connected display (e.g. a tablet or a monitor) with the coatmaster Web software (see chapter 5.4.1).

#### 5.3.2.1 Connecting the external sensor

The external sensor is connected to the coatmaster over a standard 15 V interface provided with an XLR-connector (see Figure 19).

The sensor connection has the following pin assignment:

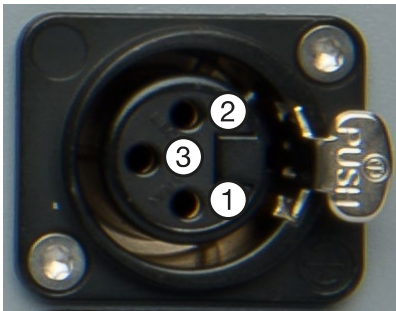


Figure 19 XLR-3f connector for external sensor: 1 GND, 2 +15V supply, 3 signal.

#### 5.3.2.2 Starting and stopping automated measurements with coatmaster Operating System

Start the automation mode by clicking the -icon in the top bar of the Measurement area (3) of the main window (see Figure 16). The screen view changes to the automation view, see Figure 20.

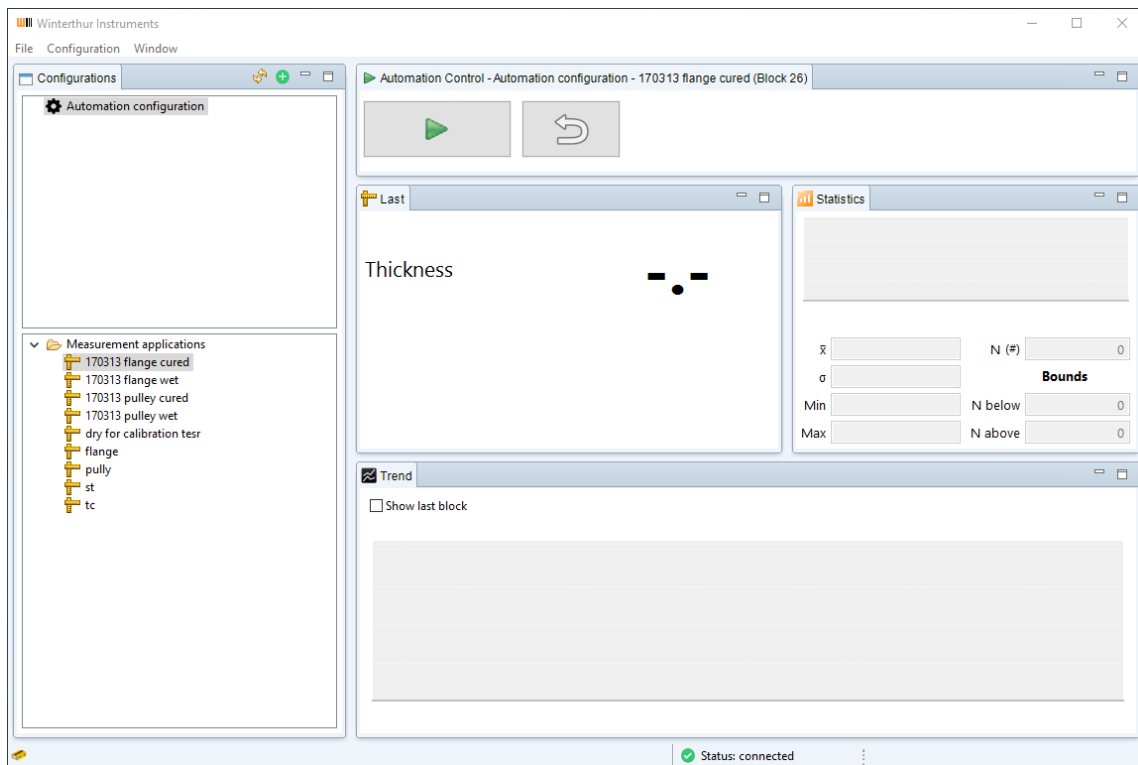




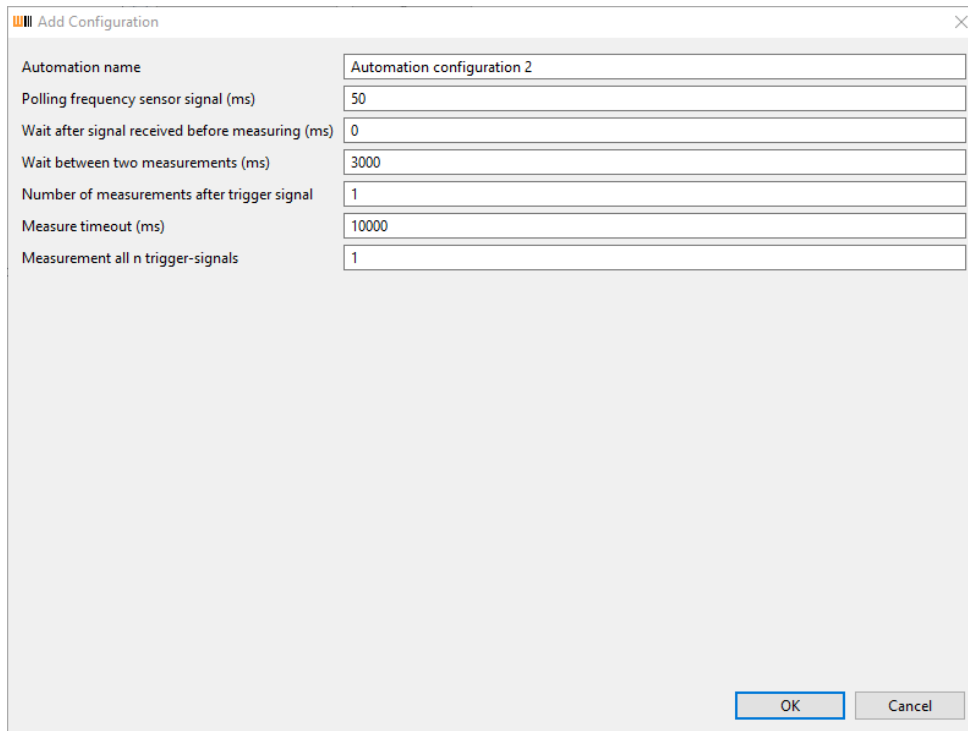


Figure 20 Automation view of coatmaster Operating System

To start the automation mode, select an automation configuration (top left) and a measurement application (bottom left), then press the -button. The view changes to the active automation view. Measurements will be shown in the Trend area (Figure 20). In the status line (bottom) the sensor status is displayed (polling or measurement). To change configuration or application, stop the automation mode by pressing the -button. To return to standard measurement view (Figure 16), press the -button.

### 5.3.2.3 Creating and editing automation configurations

Prepare an automation configuration by either editing an existing configuration (right click on the configuration name > “Edit configuration”) or by adding a new configuration with the -button in the Configuration window. Edit the automation properties to suit your application:



Automation name	Automation configuration 2
Polling frequency sensor signal (ms)	50
Wait after signal received before measuring (ms)	0
Wait between two measurements (ms)	3000
Number of measurements after trigger signal	1
Measure timeout (ms)	10000
Measurement all n trigger-signals	1

Figure 21. Setting for automation in the stand-alone software

**Automation name:** Name for this configuration that will be displayed in the automation view.

**Polling frequency sensor signal (ms):** Time interval for checking the sensor signal. Decrease this value to adapt to fast moving objects. For example, an object with speed of 40 m/min will move 3.3 cm in 50ms. If the measurement spot has to be placed with higher accuracy, decrease the polling interval accordingly.

**Delay between sensor trigger and first measurement(ms):** Adjust this time to set the delay between sensor trigger and the first measurement.

**Number of measurements after sensor trigger:** Set the number of consecutive measurements to be executed after the sensor trigger.

**Wait between two measurements (ms):** Time delay between consecutive measurements.






**Measure time-out (ms):** Time delay after measurement trigger until a time-out error is shown.

**Measurement all n sensor triggers:** Set this number greater to one if you want to skip objects that are detected by the sensor. For example, a value of 3 will trigger measurements for every third object only (skipping two objects).

**Ok:** keep changes.

**Cancel:** discard changes.

Summary of functions of automation view:

	Start automation	Start automation mode
	Stop automation	Stop automation mode
	Quit automation	Quit automation mode and get back to the main window
	Warning icon	Is displayed next to the measurement value, when it deviates significantly from the used application
	Error icon	Is displayed next to the measurement value, when it deviates to much from the used application

### 5.3.3 Measurement statistics

The Statistics area (4) of the main view of coatmaster Operating System (Figure 16) contains detailed statistical information on the measurement data in the currently selected block. Figure 22 shows an example of a statistical analysis from block data.

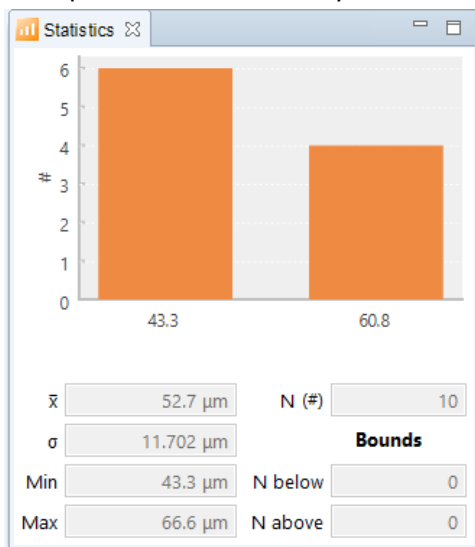


Figure 22 Statistical information of currently selected data block.

$\bar{x}$  : mean value

$\sigma$ : standard deviation

Min: minimum value in data block

Max: maximum value in data block

N(#): number of measurements in the data block







N below: number of measurements below the lower tolerance bound

N above: number of measurements above the upper tolerance bound








If the block is changed, the statistics window is updated with the values for the newly selected block.



### 5.3.4 Warnings and Errors

Warnings and errors are displayed in the Measurement area (3) of the main view (Figure 16). The following table lists warning and error icons for the coatmaster:

	Measurement Warning	Indicates a possible deviation of the current measurement to the application data.
	Measurement Error	Indicates a strong deviation of the current measurement to the application data.
	Notification Maintenance due soon	Maintenance of the device is due soon. Inform your administrator to organize maintenance cycle. Please have the data from the <i>Help &gt; About this coatmaster</i> display ready (see chapter 5.3.5).
	Notification Maintenance due.	Maintenance of the device is due. Operating the coatmaster without due maintenance reduces the life time, causes deterioration of accuracy and increases the risk of sudden failure. Inform your administrator to organize maintenance immediately. Please have the data from the <i>Help &gt; About this coatmaster</i> display ready (see chapter 5.3.5).
	Measurement warning range	Indicates that a user-specified number of consecutive measurement values lie in the warning range (see description of Display setting for new applications in chapter 5.5 Making new coatmaster applications ).
	Measurement error range	Indicates that a user-specified number of consecutive measurement values lie in the error range (see description of Display setting for new applications in chapter 5.5 Making new coatmaster applications ).

For the coatmaster Inline the following additional icons are available:

	Warning icon Coolant temperature	Coolant temperature is high. Wait with further measurements until the sign disappears.
	Error icon Coolant temperature	Coolant temperature is too high, damage to coatmaster system is possible. Shut down the coatmaster and contact your administrator.
	Warning icon Coolant flow	Coolant flow is too low. Make sure that the coolant liquid tubes are arranged to allow free liquid flow.
	Error icon Coolant flow	Coolant flow is critically low, damage to coatmaster system is possible. Shut down the coatmaster and contact your administrator.
	Warning icon Coolant level	Coolant level is too low. Refill coolant liquid (see chapter 7.4).
	Error icon Coolant level	Coolant level is critically low, damage to coatmaster system is possible. Immediately refill coolant liquid (see chapter 7.4).
	Error icon Server / client connection failed	Software incompatibility detected (server / client connection failed). Update the software from the coatmaster (see chapter 4.4.2).

	 <b>NOTICE</b>
	<p><b>Risk of overheating.</b> Too little or too hot coolant liquid within the instrument can lead to overheating.</p> <p>React to the appearance of the corresponding warning or error icon immediately.</p>



### 5.3.5 System information

To display information about the software version and the hardware status, press the *Help > About this coatmaster* in the Menu area (1) of the coatmaster Desktop main view (Figure 16).

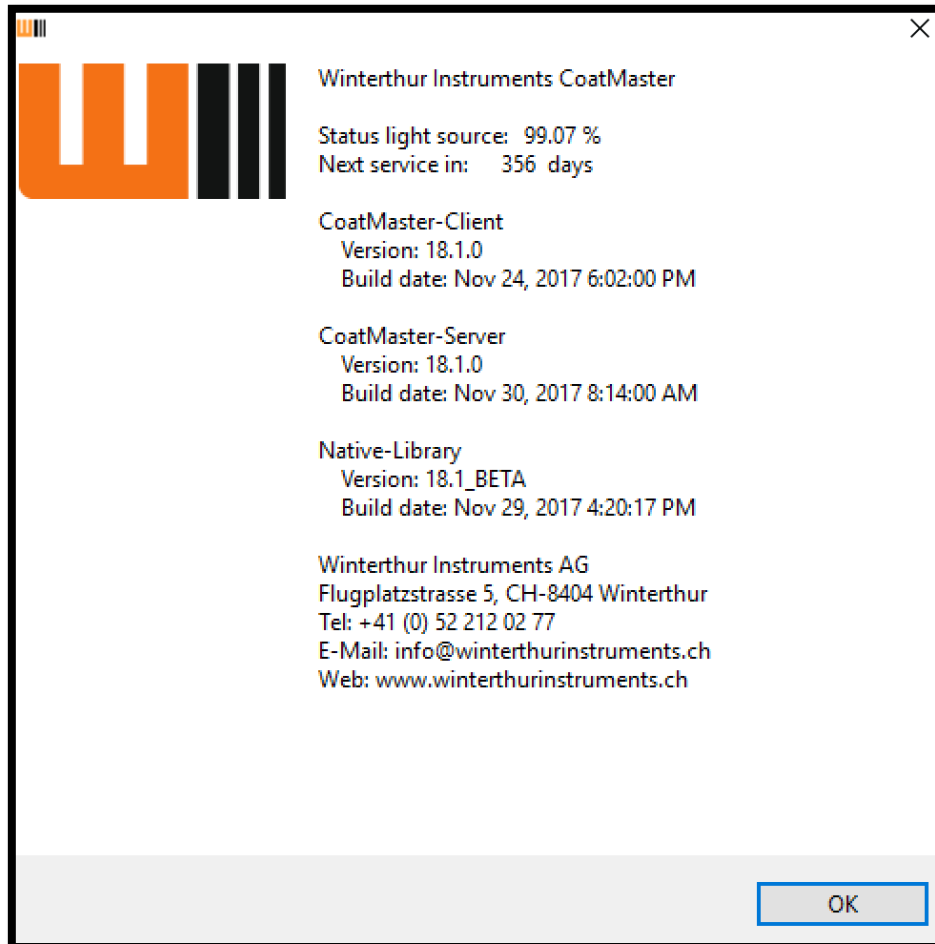


Figure 23. System information in the stand-alone software

**Status light source:** Indicates the amount of usage of the light source (100% - new light source, 0% - light source needs to be replaced). Contact your administrator for replacement of the light source.

**Next service in:** Shows the number of days until the next maintenance and service cycle is due.

The coatmaster must be serviced either after 364 days or when the light source reaches 0%. Operating the coatmaster after reaching either boundary reduces the life time, causes deterioration of accuracy and increases the risk of sudden failure. Inform your sales contact to organize maintenance cycle.

Press OK to close this window.

### 5.3.6 Optional windows for main view

Which areas are visible in the main window can be defined via the menu *Window > Show View*.

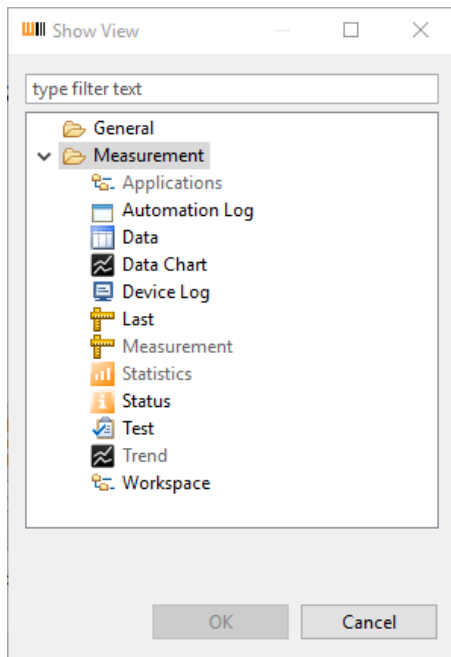


Figure 24. Selection of possible displayed windows and tabs

To display a new area in the main window, highlight the corresponding entry and click OK.

To reset the main window to its default setting, select *Window > Reset Window*.

Now the areas Applications, Measurement, Statistics and Trend of the selected Application are displayed.

#### NOTICE

*A submenu is available when right-clicking the charts in the areas Statistics, Trend and Data Chart, enabling to define the properties of the chart, to save and print it, zoom in and out, defining an auto range, exporting the chart and deleting it.*

These windows have the following names and functions:

**Last:** Shows the last measured value

**Automation Log:** Log of all Automation Control data

**Data Chart:** Display measurement signals as time curves

**Data:** Display measurement signals in numeric table form

**Device Log:** Used for service operation only.

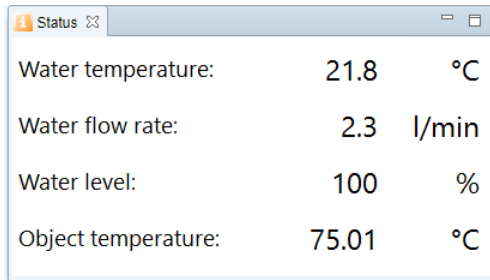
**Test:** To carry out a device test, e.g. a defined amount of successive measurements

**Workspace:** Used for service operation only.

### 5.3.6.1 Test

### 5.3.6.2 Status

For the coatmaster Inline, the status window shows the current temperature, the flow and the level of the coolant liquid.



Water temperature:	21.8	°C
Water flow rate:	2.3	l/min
Water level:	100	%
Object temperature:	75.01	°C

Figure 25. Status window showing sensor data in the stand-alone software

Threshold value for warnings:

Temperature: 40 °C  
Coolant flow: 2 l/min  
Coolant level: 20 %

Threshold value for errors (measurement is no longer possible):

Temperature: 60 °C  
Coolant flow: 1l/min  
Coolant level: 10 %

**Note:**

To restore the factory main view as shown in Figure 16 select *Window > Reset window* from the Menu area (1).

## 5.4 Measuring with the Web Client

Connect you computer with the coatmaster and start the Web Client software as described in chapter 4.4.1. The following screen appears:

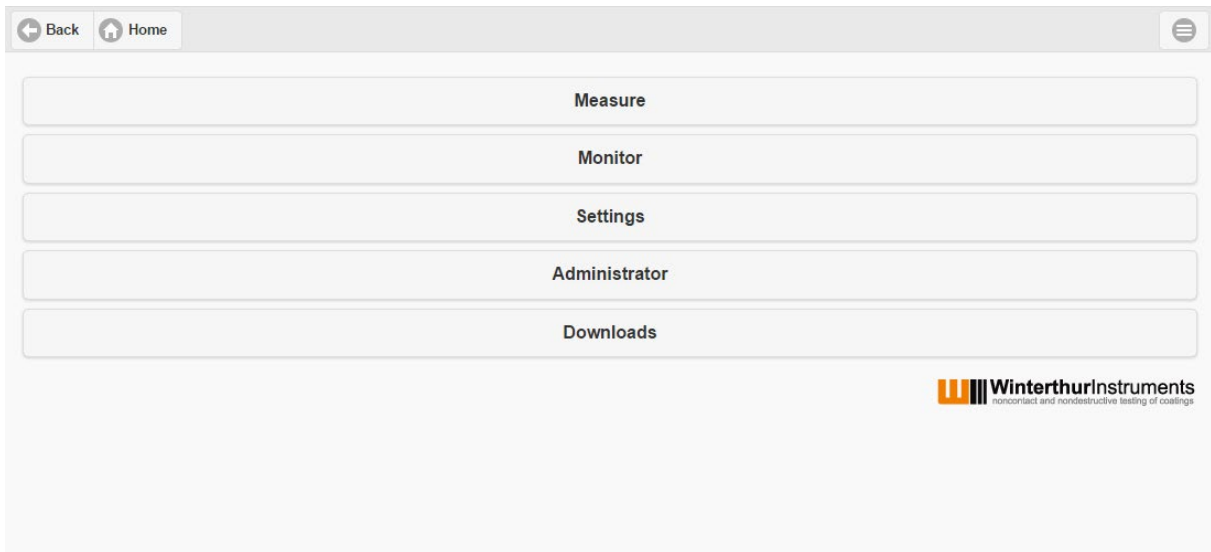


Figure 26. Web client homepage

Click Measure, a selection dialog with all applications saved on the coatmaster appears:



Figure 27. Choosing the application in the web client

Click on the row with the application to use for the measurement. If the corresponding application is not available, it has to be created first (see chapter 5.7).

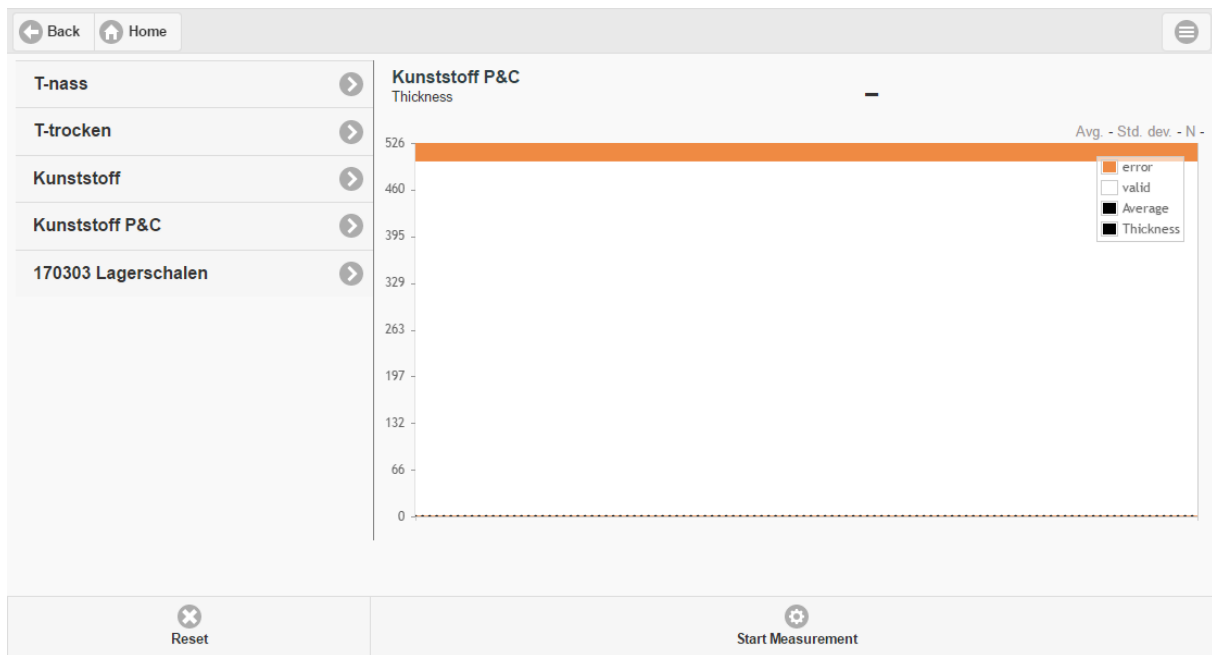


Figure 28. Measurement window in the web client

Start the measurement by pressing *Start measurement*. The measured value is plotted on the curve diagram and displayed above the diagram in the selected unit.

The grey area on the diagram marks the tolerance range. The red area on both sides marks the outside of the tolerance range. The tolerance range is defined in the application. The black dotted line in the center shows the mean value.

The mean value (*Avg.*), standard deviation (*Std. dev.*) and the number of performed measurements (*N*) are displayed on the right above the curve diagram. By pressing *Reset* the course of measurement is deleted.

#### 5.4.1 Monitor

The Monitor option allows to display values from measurements with external triggering (either sensor or remote control software). After clicking Monitor a selection dialog appears:

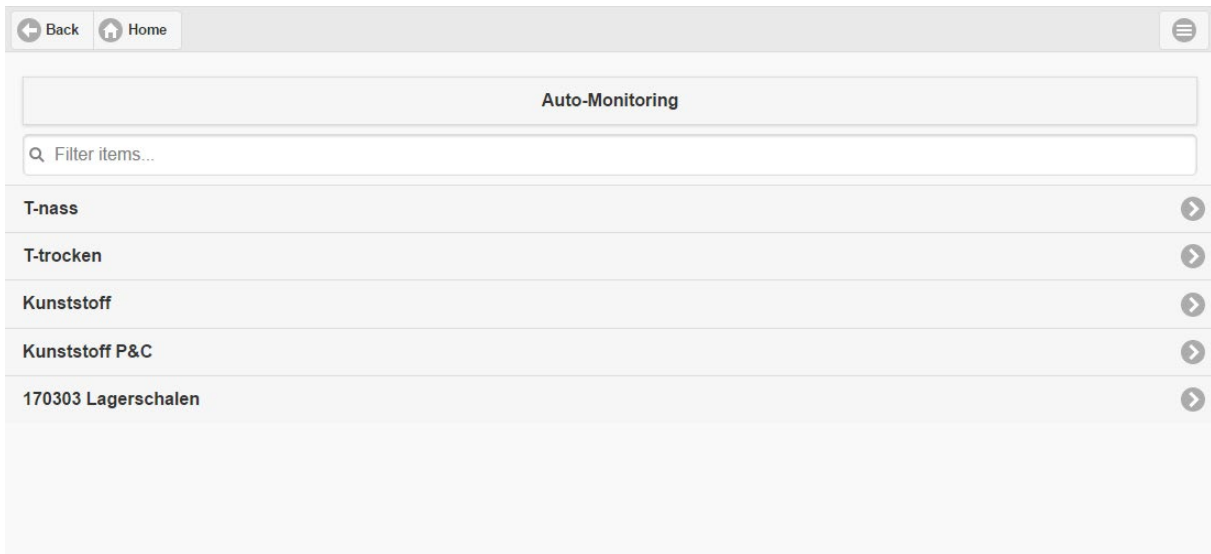


Figure 29. Choosing the application to monitor in the web client

Click on the row with the application to monitor. The following dialog opens:

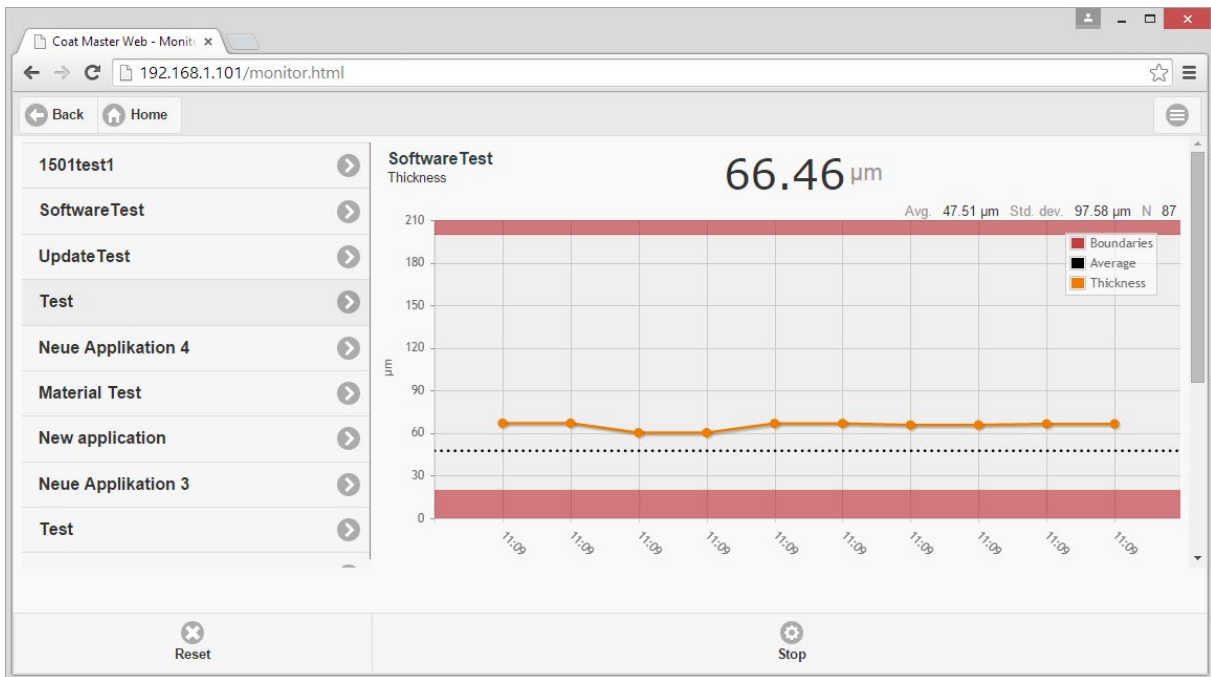


Figure 30. Monitoring measurements in the web client

Press *Start* to activate the monitoring function. When the coatmaster is running in automatic mode or measurements are triggered by remote control software, the course of measurement can be controlled continuously by means of this screen.

### 5.4.2 Settings of coatmaster Web Client

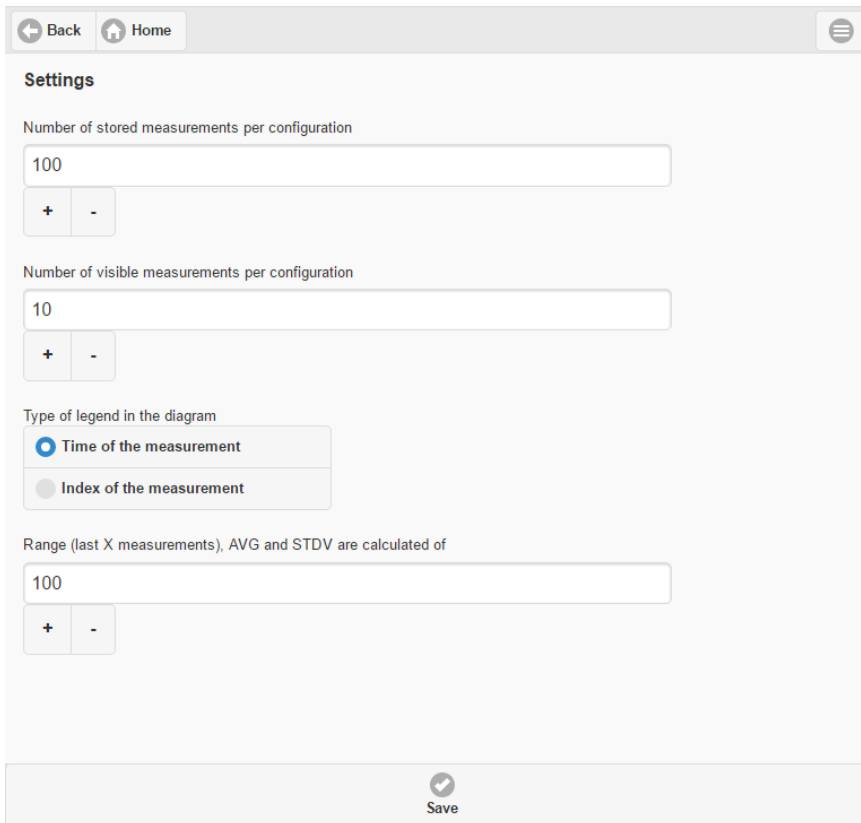


Figure 31. Settings in the web client

In this dialog the settings for displaying measurement trends with coatmaster Web client are defined.

**Number of saved measurements:** Number of recent measurements to be saved on the device.

**Number of displayed measurements:** Number of recent measurements displayed in the measurement curve.

**Caption x-axis:** Either the measurement time or the measurement index can be selected as caption for the x-axis.

**Calculate mean value and standard deviation for the last X values:** Number of last measured values for which the mean value and the standard deviation are to be calculated.

Click **Save** to save the settings.

## 5.5 Making new coatmaster applications

**This function is only available in the coatmaster Operating System.**

Coating processes are specified by an upper and lower limit value for the coating thickness (tolerance window). For calibration by reference measurements, we recommend to use at least one sample

with a coating at the lower boundary and one sample at the upper boundary of the tolerance window. On these reference samples, carry out 2-4 measurements each with the coatmaster and mark the measurement points, so that the coating thickness can be measured with a reference method at the same measurement points later on.

For best results we recommend to use the same materials and parts for calibration as used later for measurement. However, the coatmaster tolerates certain deviations between calibration and measurement as follows:

1. Calibration on metal substrate and measurement on substrate with slightly different alloy combinations (e.g. different steel types).
2. Calibration on thin plates, measurement on thick plates or vice versa (activate the checkbox *Enable variation of substrate properties* in the software).
3. Calibration on plane surfaces, measurement on round surfaces.
4. A certain amount of temperature variation is acceptable, depending on coating and substrate material.

The following factors influence the coatmaster measurement, so that there should be the same conditions during calibration and measurement:

1. Surface roughness: If the measurement is carried out on rough surfaces, the calibration should be done on rough surfaces as well.
2. Coating surface: If only a small area or a discontinuous area is coated, the calibration should be done on the reduced area as well.
3. Substrate material: In case the same coating is measured on different substrate materials (e.g. on metal or plastic or on aluminium or steel) for each substrate material a new coatmaster application should be created.

The reference samples should be kept, if possible, to check the long-term stability of the coatmaster.

To make a new application, produce the reference samples and keep them at hand for the calibration process. Switch on the coatmaster and start the coatmaster Desktop. In the Application area on the left-hand side click the button *New application* (see Area 2 in Figure 16 on page 23). If this button is greyed-out, the administrator has locked this feature for the user (factory setting). To unlock this feature, please enter the administrator password (refer to chapter 4.4.4).

Follow the application setup procedure as follows.

### **5.5.1 Setup application**

After clicking on the *New Application* button, the application setup dialog starts:



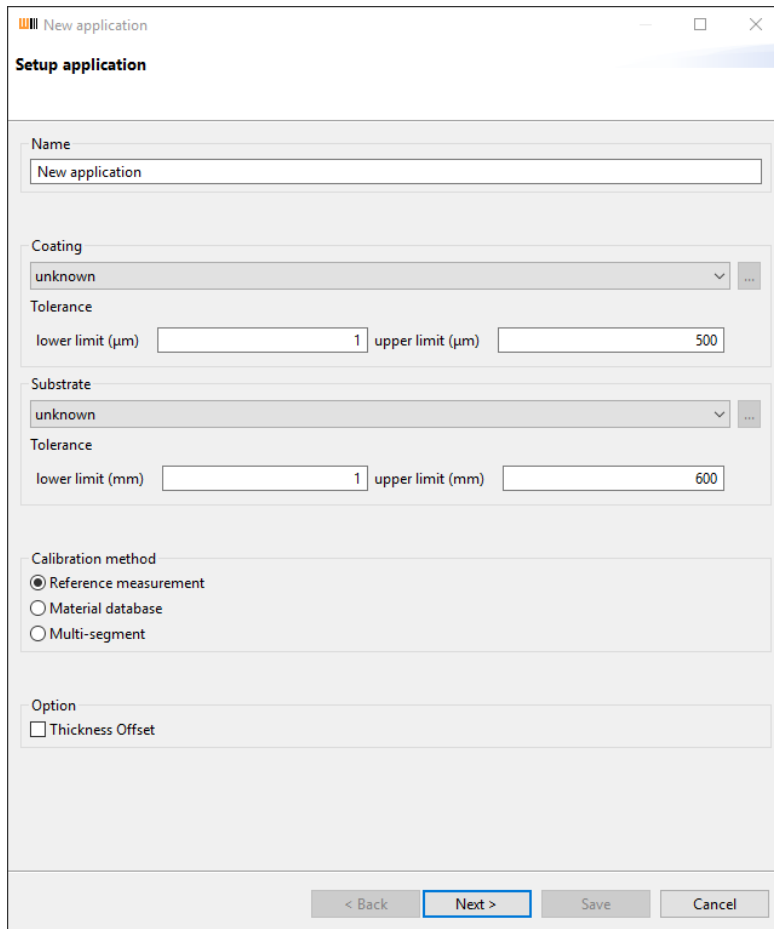


Figure 32. Setting up an application in the stand-alone software

In the field **Name** enter a name for the new application.

Under **Coating** select the best suiting coating material from the drop-down menu. If no suitable coating material is available, choose *Unknown*.

If necessary, change the **Tolerance** settings for the coating. Fill in the fields for the **upper** and **lower limit** to define the tolerance window.

Under **Substrate** select the best suiting substrate material from the drop-down menu.

If necessary, change the **Tolerance** settings for the substrate. Fill in the fields for the **upper** and **lower limit** to define the tolerance window.

Under **Calibration method** select the radio button **Measurement**, when the calibration is done via a measurement or **Material**, when the calibration is done according to the existing material database of the coatmaster.

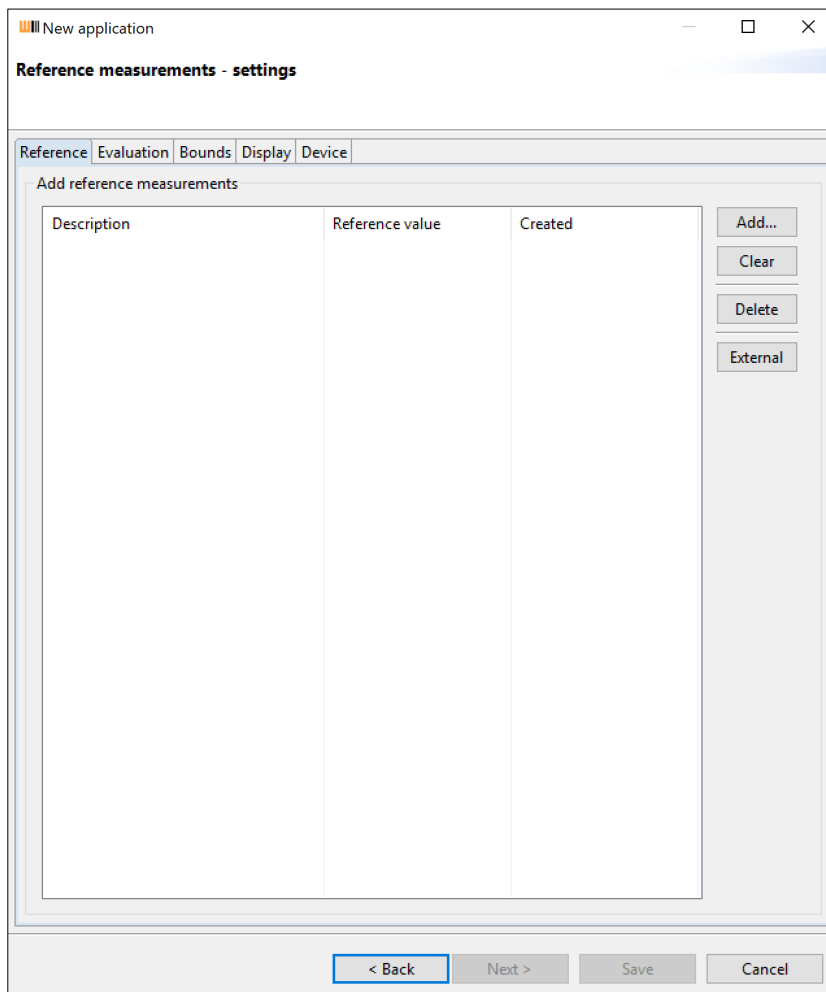
#### NOTICE

*When Material is selected, the new application becomes available without needing further steps and can be finished by clicking on **Save**. The calibration is done according to material properties stored in the material data base. Our data base is continuously expanded and updated. However, deviations of the coating material to the standard materials stored in the data base may lead to errors in the measurement values. For more accurate results, use the calibration by reference measurements.*

**Offset:** Leave the checkbox **Thickness Offset** inactive at this state. You need more information about the correlation between the coatmaster measurements and the reference measurements to decide about this option. This information is available after you have run the calibration procedure (see chapter ).

Click **Next >**. The following dialog appears:

### 5.5.2 Reference measurements



**Figure 33.** Adding calibration measurements in the stand-alone software

To carry out a new reference measurement, place the object to be measured in front of the coatmaster's measurement window and click **Add** to carry out the coatmaster measurement. Alternatively the measurement can be triggered by external sensor or by TCP command. This feature can be activated by selecting external trigger in the Reference -window.

Add at least one reference measurement for all calibration samples. For each coatmaster reference

measurement, add the reference thickness value by clicking in the reference value field. The reference thickness value is often determined by electromagnetic hand-held coating thickness gauges or microscopic cross-section analysis.

Please refer to chapter 5.6 on p. 51 for making applications on coatings before curing.

If not all reference thickness values have been specified for all coatmaster reference measurements, it is not yet possible to proceed with the calibration. However, the application can be saved using the Save button. A saved application can be edited and the reference thickness values can be entered at a later stage.

If all reference thickness values are available, the **Next>** button is activated. Pressing the **Next>** button runs the calibration algorithm. The results of the calibration are displayed in the calibration report (see chapter Calibration report 5.5.7).

For each application, further parameters can be configured. These parameters control the display of the measurement values (chapter 5.5.3), the light energy and measurement time (chapter 5.5.4) and measurement evaluation (chapters 5.5.5 and 5.5.6).

### 5.5.3 Display

This tab contains further settings on displaying the measurement values.

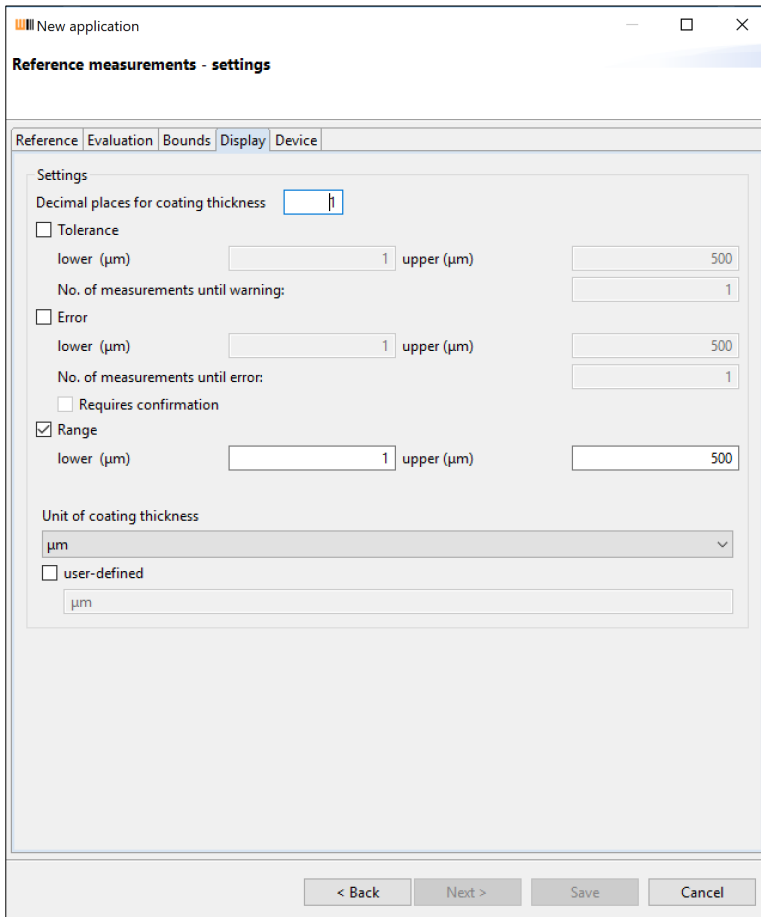




Figure 34. Choosing the limits for measurements in the stand-alone software

**Decimal places for coating thickness:** Set number of decimal places for display.

The trend window can be divided into three areas: tolerance (grey), warning (light orange) and error (dark orange). If a specified number of consecutive measurements lie in the warning range, the warn-

ing range symbol  is indicated in the Measurement window. If a specified number of consecu-

tive measurements lie in the error range, the error range symbol  is indicated in the Measurement window. In the error case, it is possible to configure an error message that must be confirmed by the user before measurements can proceed.

**Specification of tolerance, warning and error ranges**

**Tolerance:** Specify the lower and upper boundaries for the tolerance range for the coating thickness in the trend window (grey area). **No. of measurements until warning:** Specify the number of consecutive measurements in the warning range that trigger the warning range symbol.

**Error:** Specify the lower and upper boundaries between warning and error range for the coating thickness in the trend window. **No. of measurements until error:** Specify the number of consecutive measurements in the warning range that trigger the error range symbol.

**Range:** Specify the lower and upper display boundaries for the trend window.

See the below example showing tolerance, warning and error ranges in the trend window, corresponding to the settings in the Display tab of the application settings:

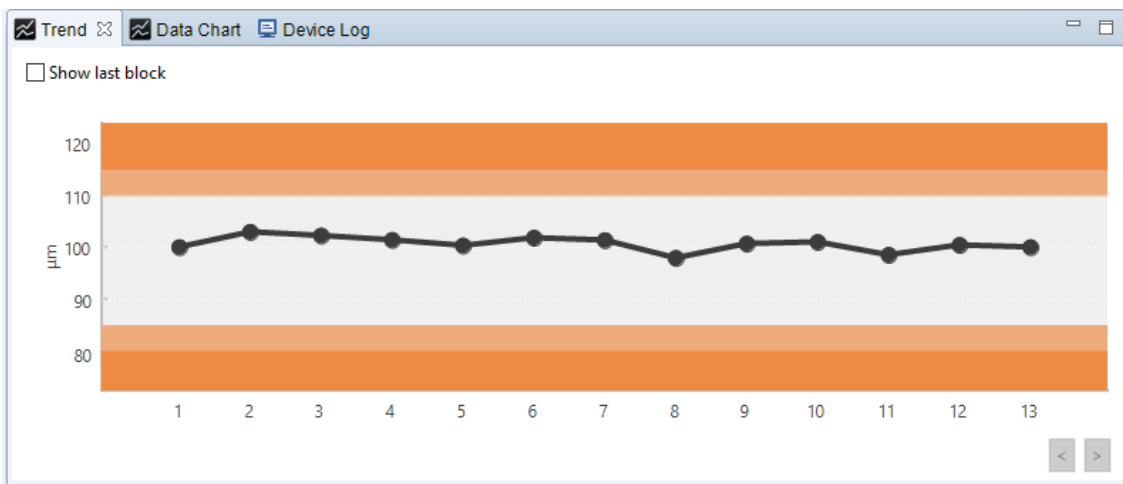


Figure 35. All measurements in a block are plotted in the Trend window

**NOTICE**

*Settings for tolerance range, units and decimal places affect only the the trend chart and the display of the measurement values and have no influence on calculation of measurement values.*

Click **Save** to save the new application, add it to the application list and close the dialog.  
Click **Cancel** to close the dialog without saving.

#### 5.5.4 Device

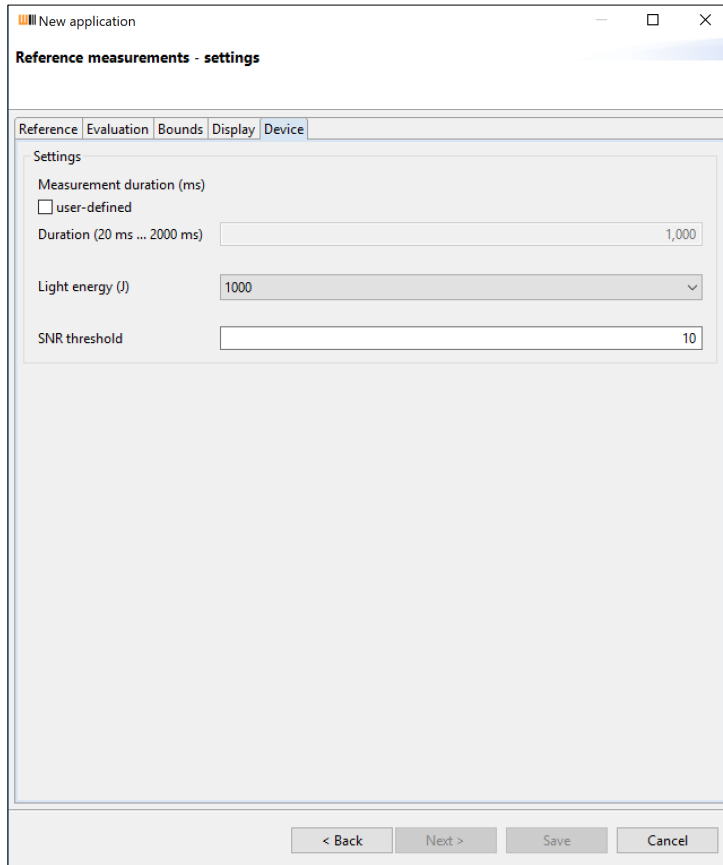


Figure 36. Setting the measurement duration, light energy and SNR threshold in the stand-alone software

**Measurement time (ms):** set the length of the dynamic surface temperature measurement. The field contains a default value determined by your choice of coating material and thickness range.

**Light energy (J):** Set the energy level of the light flash. **This option is only available if no reference measurements are stored in the application!** Increase this value to increase the SNR in order to gain better repeatability or to increase the distance between coating surface and coatmaster. Too little SNR can be a cause for unsuccessful calibration.

**SNR threshold:** Measurements with SNR value below this threshold will be discarded. Set the SNR threshold to some value lower than the SNR value shown in the calibration report. If the SNR threshold value is too high, valid measurements will be discarded. If the SNR threshold value is too low, invalid measurements might not be discarded.

### 5.5.5 Evaluation

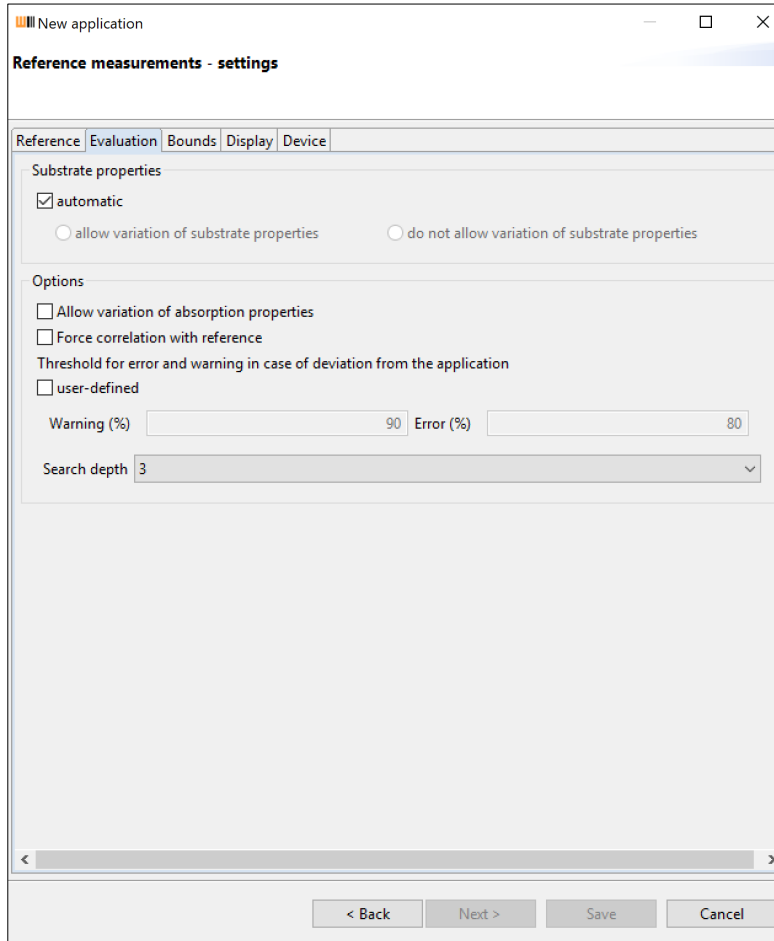


Figure 37. Settings for evaluation in the stand-alone software

**Allow variation of substrate properties:** This checkbox must be activated if the calibration and the measurement are carried out on substrates with different thickness (e.g. different metal sheets).

#### NOTICE

*For optimum results we recommend to carry out the calibration and the measurement under as similar conditions as possible.*

**Allow variation of surface properties:** Activate this checkbox when the surface roughness can vary, for semitransparent coatings or when the coating is so thin that the substrate is visible through the coating. This setting can increase the measurement quality in an unsuccessful calibration.

The fields **Warning** and **Error** list the corresponding threshold value marking the limit for a warning or an error message (rating a later measurement as unsuccessful), when the measurement value deviates too much from the used application. In case of a warning, the warning icon is shown in the main window next to the measurement value. In case of an error, the error icon is shown.

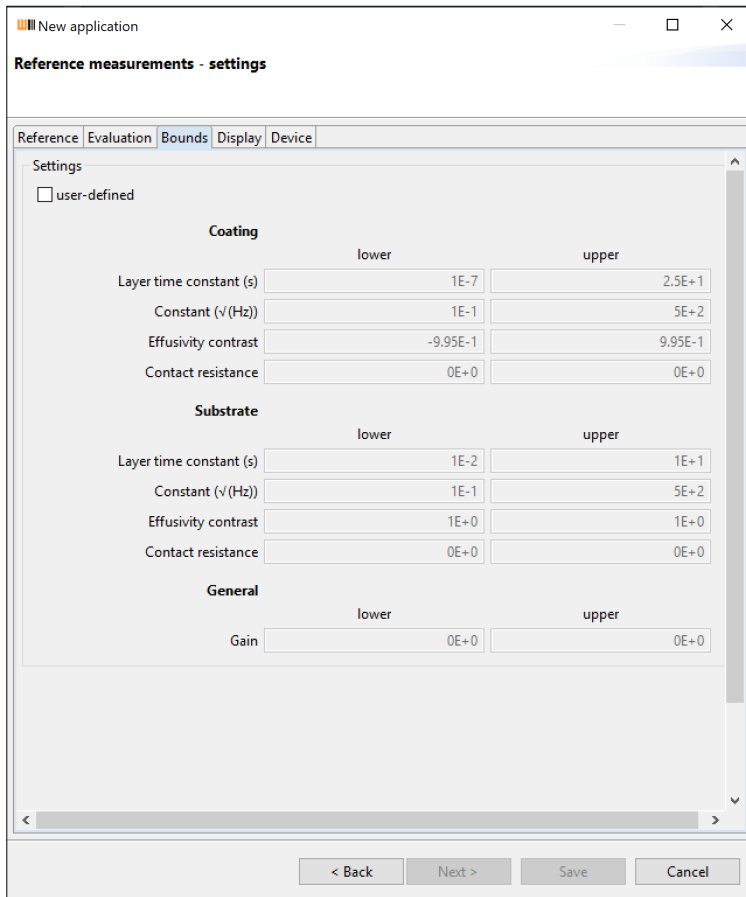
The predefined settings are a proposal according to the measurement data acquired with the application.

### 5.5.6 Bounds

The settings in this dialog are predefined according to the material settings for the application. To modify the settings in this dialog, the checkbox user-defined must be activated.

#### NOTICE

*These settings have a strong influence on the application quality and thus on the quality of the measurement results. They are reserved to experts with technical knowledge.*



Section	Parameter	lower	upper
Coating	Layer time constant (s)	1E-7	2.5E+1
	Constant (v(Hz))	1E-1	5E+2
	Effusivity contrast	-9.95E-1	9.95E-1
	Contact resistance	0E+0	0E+0
Substrate	Layer time constant (s)	1E-2	1E+1
	Constant (v(Hz))	1E-1	5E+2
	Effusivity contrast	1E+0	1E+0
	Contact resistance	0E+0	0E+0
General	Gain	0E+0	0E+0

**Figure 38.** Upper and lower parameter limits for the evaluation. Note: Should not be changed without expert knowledge!

**Layer time constant:** Time needed by the heat to penetrate the layer

**Optical constant:** Indicates, how deep the light or the heat, respectively, penetrates the coating, i.e. qualifies the absorptive properties of the coating

**Effusivity contrast:** Indicates the contrast in thermal properties of coating and substrate

**Contact resistance:** Indicates, whether the heat has to overcome a barrier when passing the transition between two coatings or between the coating and the substrate

**Gain:** Indicates, how far the coatmaster is away from the sample, i.e. how well the heat is absorbed and emitted again.

### 5.5.7 Calibration report

After the calibration process is finished, the result of the calibration is shown in the Calibration report.

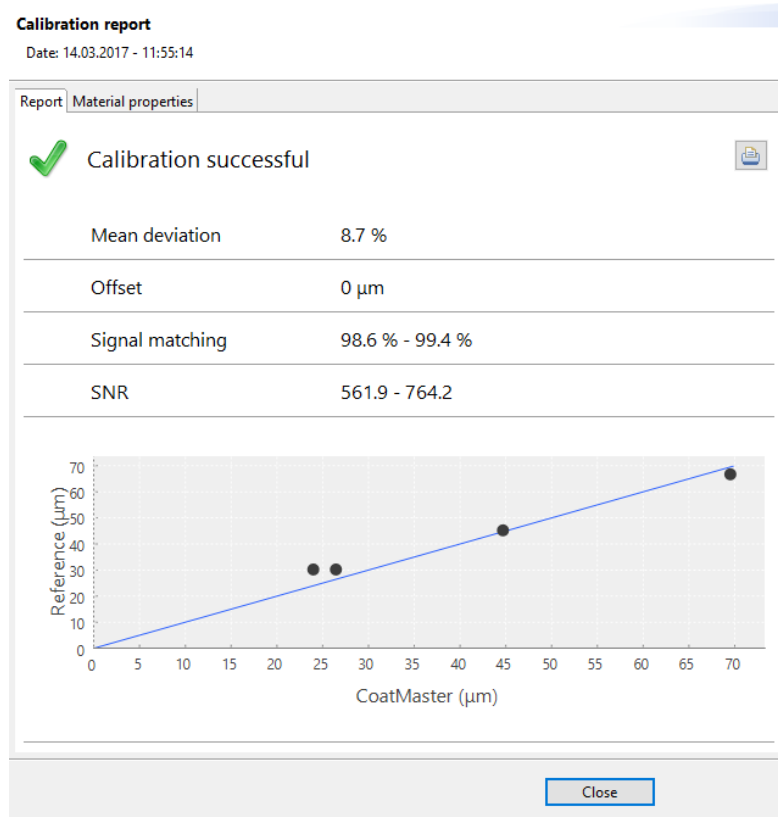


Figure 39. Calibration results in the stand-alone software.

The calibration algorithm determines if the correlation between the coatmaster and the reference measurements is good and if the coatmaster measurements are reliable. The algorithm uses the following measures:

**Mean deviation:**

> 25 %: The deviation between coatmaster and reference measurements is too large.

between 10 and 25 %: correspondence is not optimal.

< 10 %: correspondence is acceptable.



Means to reduce the mean deviation:

- Possibly an outlier or a bad reference measurement is present. This is the case if the points in the correlation graph generally lie on a straight line, except one point. In this case, remove the outlier point in the reference measurement list by pressing the <Back button.
- Possibly the coatmaster measurements were disturbed. Repeat all coatmaster reference measurements.
- If the points in the correlation graph lie on straight line but not on the calibration line, activating the Offset option improves the mean deviation.

#### **Quality index:**

> 94 %: This quality index is good.

Between 90 and 94%: This quality index is acceptable, but might be improved. A higher quality index could result in more accurate measurement.

< 90 %: This quality index is not good.

Means to improve the quality index:

- Possibly the materials selected for coating and substrate are a bad match for the real materials. In this case, choose the entry *unknown* for substrate and coating material.
- Repeat the blank measurements, as described in chapter 7.6.

#### **SNR:**

< 20: An SNR value less than 20 is very low and can lead to unreliable measurements.

Means to improve the SNR:

- Position the part closer to the measurement opening of the coatmaster. Do not put the surface of the part closer than 5cm to the measurement opening of the coatmaster. Please note that changing the distance between the part and the measurement opening also changes the measurement spot size.
- Increase the light energy in the application. You will have to delete all previous reference measurements to be able to change the light energy setting.
- If both measures do not help, use an optical reflex amplifier.

### **5.5.8 Application offset**

The data plot of coatmaster and reference measurement might sometimes show systematic deviation between reference and coatmaster values. This can be detected by the fact that for thin coatings all calibration points are located above the calibration line while for thick coatings all calibration points are below (or vice-versa). The following example illustrates this situation:

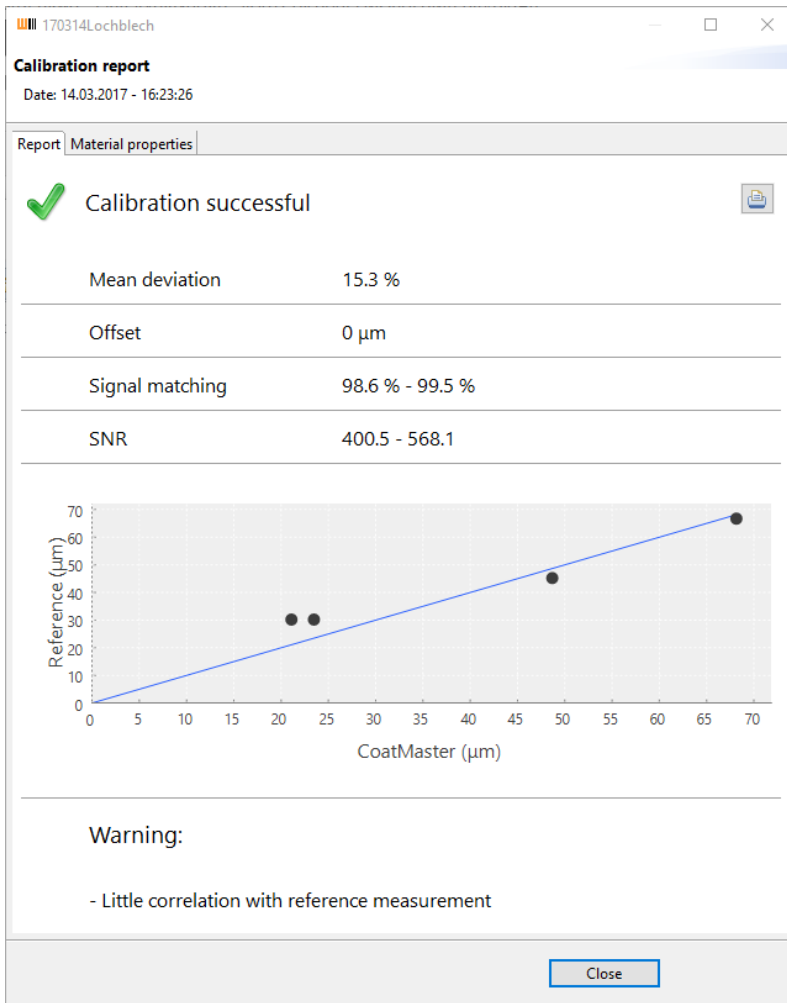


Figure 40. Calibration results in the stand-alone software

Although the mean deviation is below the 25% limit that causes an unsuccessful calibration, a systematic deviation of the coating thickness value of reference and coatmaster is evident. In this case it is appropriate to allow the offset for this application. For this purpose select *Back* twice to get back to the first page, activate the option *Thickness offset* and select *Next* twice.

After enabling the Offset, the data plot now shows smaller mean deviation:

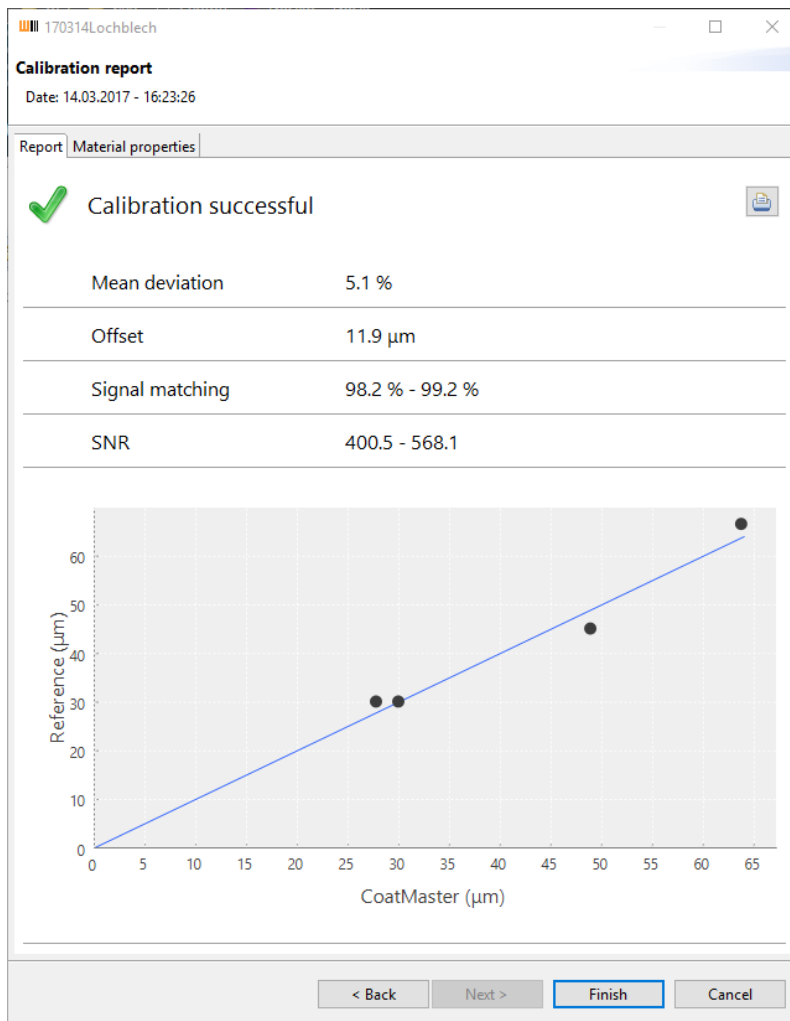


Figure 41. Calibration results in the stand-alone software

**Offset:** Shows the offset of the calibration (in this case 11  $\mu\text{m}$ ).

The offset enables to balance systematical deviations between reference and coatmaster. Such deviations can especially occur on rough or porous substrates / coatings. To correctly determine the offset at least four to eight reference measurements are necessary.

## 5.6 coatmaster applications for coatings before curing

The coatmaster can be used to measure coating thickness before curing without touching (and thus destroying) the coating. This allows to use the coatmaster for process control and to measure process statistics. For this purpose, the coatmaster can be configured to predict cured coating thickness from measurements before curing. The steps required to make an application are described in chapter 5.6.3.

Special considerations must be made for measuring before curing, depending on the type of coating (powder or wet), as described in chapters 5.6.1 and 5.6.2.

### 5.6.1 Measuring powder coatings before curing

Powder coatings are not even in thickness, rather the surface is wavy and the thickness changes within few millimeters' distance. This waviness is influenced by different parameters such as pre-treatment, type and waviness of the substrate, paint type (e.g. grain size distribution and chemical composition). The waviness is also still visible after curing, and depends on curing conditions (temperature distribution, curing times). Figure 42 shows a 2x2 mm extract of a powder coating surface with thickness differences of 15 $\mu\text{m}$ .

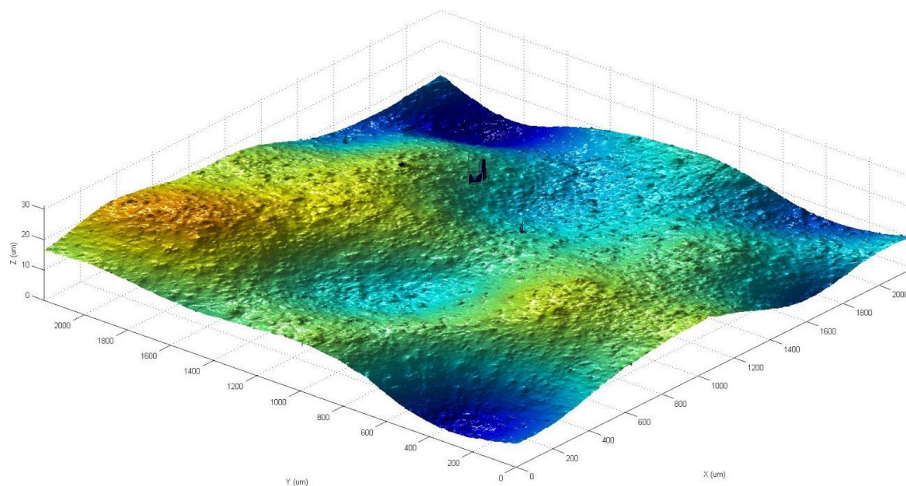


Figure 42: Waviness of powder coating after curing

The measurement principle of the coatmaster can compensate this waviness by an optical averaging. This allows reliable determination of the coating thickness.

### 5.6.2 Measuring wet coatings before curing/drying

The wet coating thickness is usually measured to determine the thickness of the coating after curing. This only produces repeatable results if the ratio of solvent to solids remains constant. However, in a wet coating the solvent evaporates, so that the ratio changes with time. Therefore, the coatmaster reference measurements should be made in the same state of the coating as when the coatmaster is

to be used to make measurements.

### 5.6.3 Procedure to make coatmaster applications for measuring coating thickness before curing

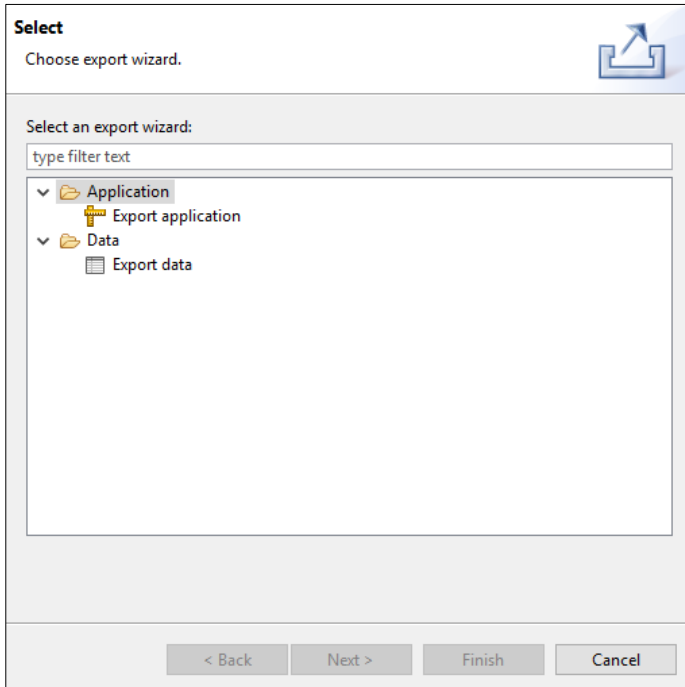
1. Produce reference parts to be used for the coatmaster application. These parts should cover the range to be measured by the coatmaster. This range can for example be the tolerance range of the coating process. We suggest to make two parts at minimum and two parts at maximum thickness of the measurement range.
2. Make a new application on the coatmaster as described in chapter 5.5 Making new coatmaster applications . Give a name to this application that indicates that this application is to be used for measurement in the process (e.g. “wet state”). On each reference part, if possible, take two reference measurements with the coatmaster at different positions. Press *Save* after taking the reference measurement without entering the reference values. Make sure the positions of the reference measurements can be found again, e.g. by marking without destroying the coating at the measurement positions. This gives a total of eight reference measurements for the coatmaster applications. Depending on the precision of the method to measure the reference value, the number of required measurements might change.
3. Finish curing the coating on the reference parts.
4. Measure the coating thickness on the reference parts in the marked positions with a reference method (e.g. microscopic cross-section analysis). Enter the coating thickness in the “wet” coatmaster applications.
5. If possible and required, make a second new application on the coatmaster, adding reference measurements on the cured reference parts at the same positions. If the parts have been cut for microscopic analysis, make the reference measurements close to the original position. Give a name to this application that indicates that this application is to be used on cured parts only (e.g. “cured state”). This application is only required for periodic verification of proper functioning of the coatmaster on the reference parts.
6. Repeat the measurements on the reference parts with the “cured” coatmaster application at the marked positions. Note down the coating thickness values from the coatmaster for each position. These values should be close to, but might not be the exactly same as the values from the reference method. The coatmaster should always produce these same values when repeating the measurements on the reference parts.

## 5.7 Back-up and Transfer of coatmaster applications

Application data is stored in the coatmaster’s embedded PC. If this PC crashes or is destroyed the work to create the applications is lost. It is therefore suggested to download applications by exporting this data from the coatmaster to an external storage. Furthermore, applications can also be transferred between different coatmaster systems.

### 5.7.1 Export applications

To export an application, select *File > Export*. The following dialog appears:



**Figure 43.** Export window in the stand-alone software

Double-click Application, select the submenu Export Application and click **Next >**. The following dialog appears:

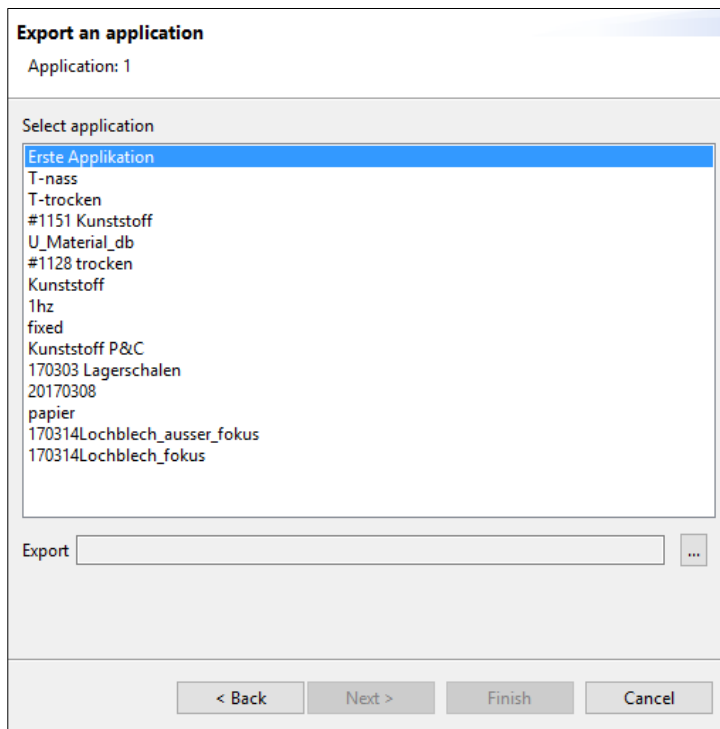


Figure 44. Window for exporting an application in the stand-alone software

From the list of applications, select those to be exported and click the button ..., to define the path and the name of the export file. Click **Save** and then **Finish** in the export dialog. The export file is now saved as \*.cmz-file under the defined name and path.

## 5.7.2 Import applications

To import previously exported applications, select File > Import. The following dialog appears:

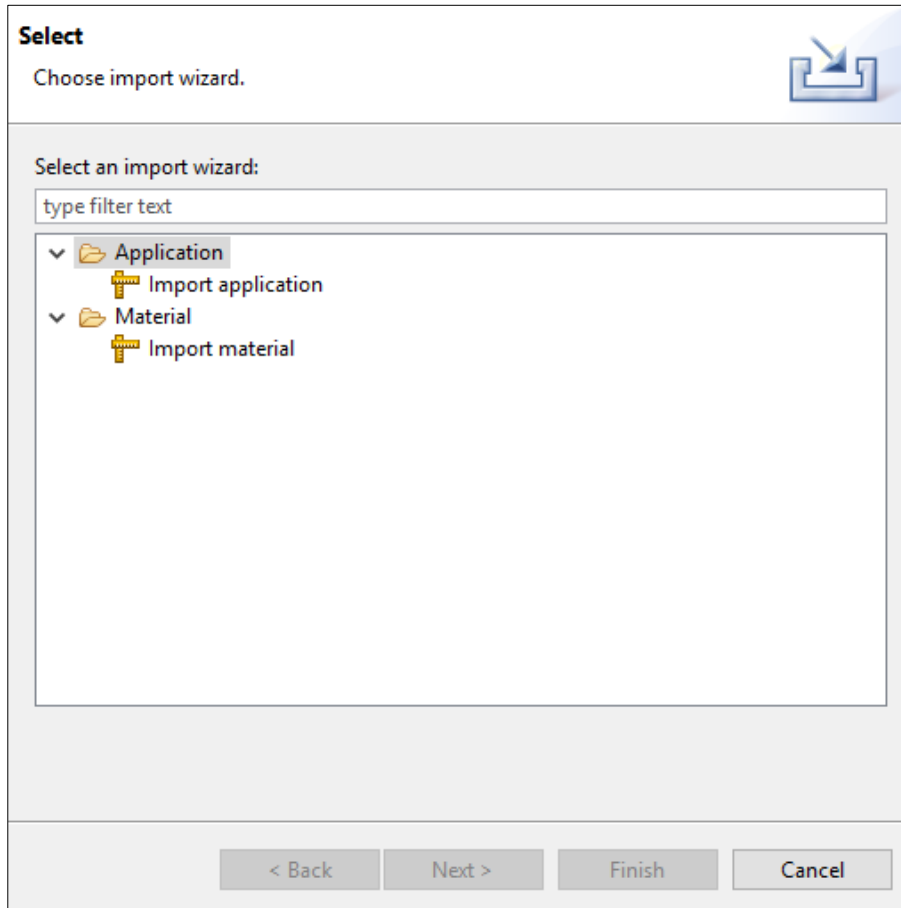


Figure 45. Window for importing an application in the stand-alone software

Double-click Application, select the appearing submenu Import Application and click **Next >**. The following dialog appears:



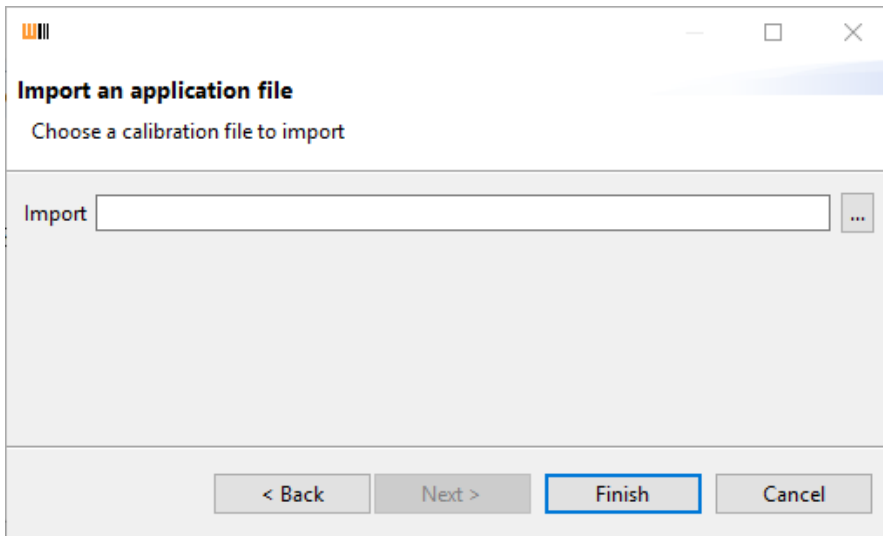


Figure 46. Selecting the application to import in the stand-alone software

Click the button .... In the appearing dialog select the \*.cmz-file to be imported and click **Open**. The corresponding path is shown in the import window. Then click **Finish**. The application file is now imported and added to the lists of applications.

## 5.8 Import a material file

To import the settings for a coating or substrate material, select File > Import. Such data is only available from coatmaster AG upon request for new coating or substrate materials. The following dialog appears:

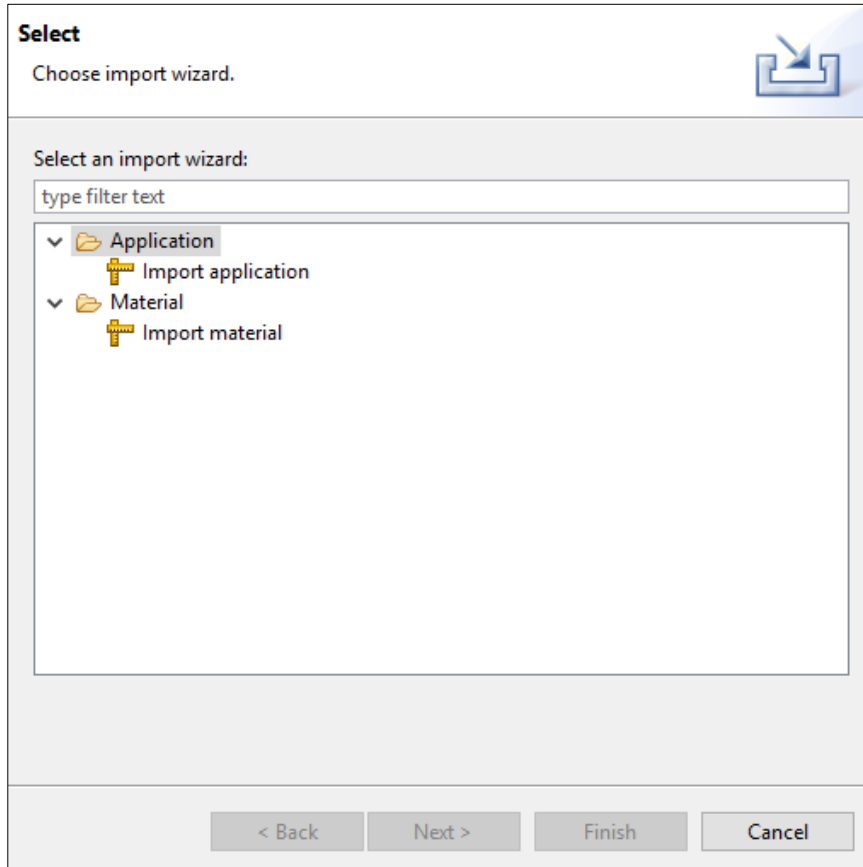


Figure 47. Importing material files in the stand-alone software

Double-click Material, select the appearing submenu Import Material and click **Next >**. The following dialog appears:

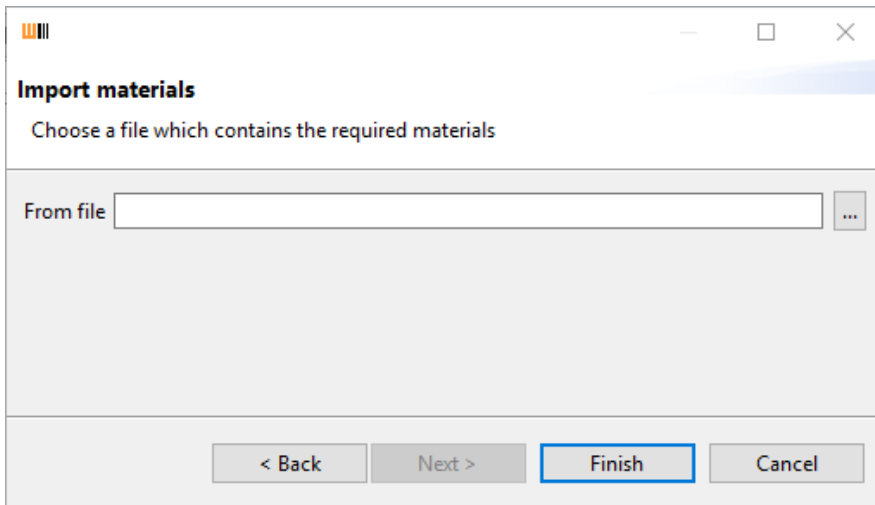



Figure 48. Selecting the file to import in the stand-alone software

Click the button .... In the appearing dialog select the \*.xml-file to be imported and click **Open**. Then click **Finish**. The settings for the selected material are imported and are now available for application development.

## 5.9 Export measurement data

To export the measurement data, select File > Export or click the -icon in the Application area of the main window. The following dialog appears:

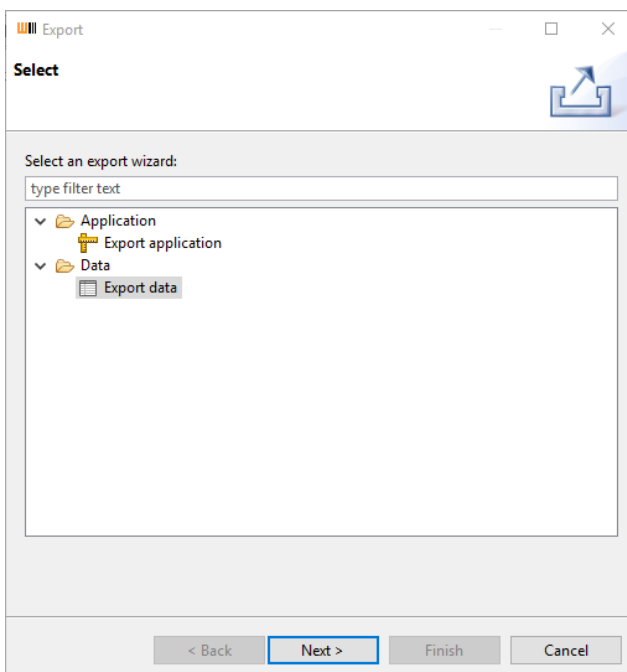
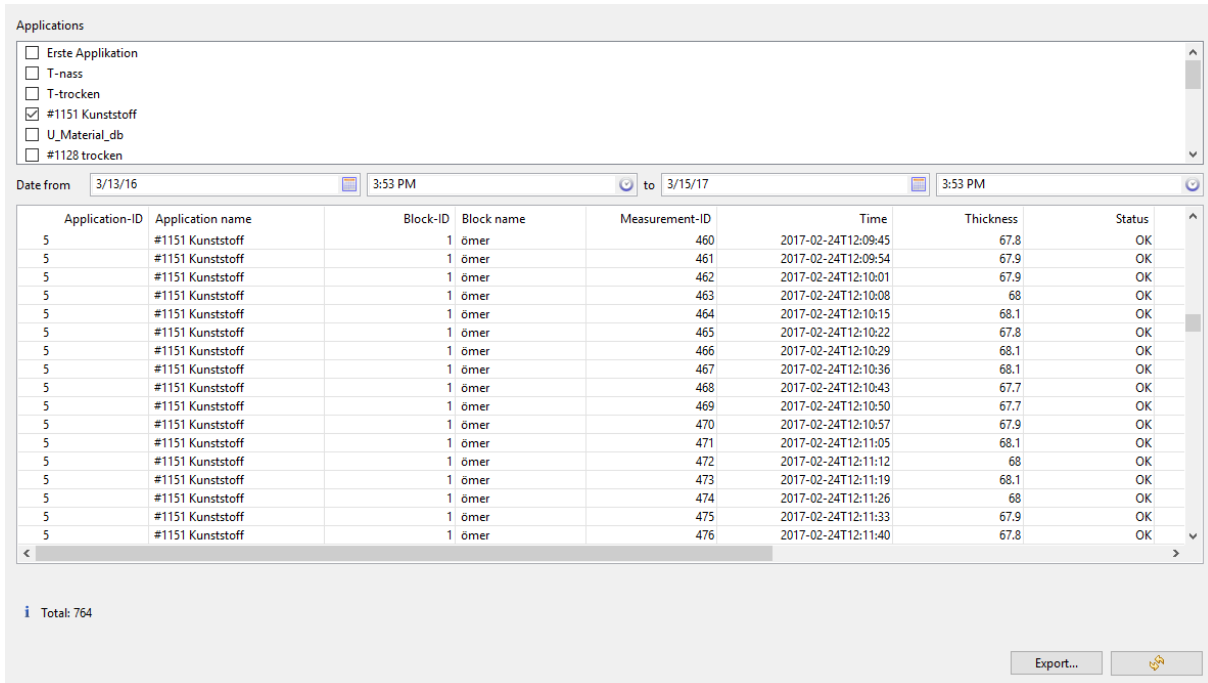


Figure 49. Exporting measurement data in the stand-alone software

Double-click Data, select the appearing submenu Export data and click **Next >**. The following dialog appears:



The screenshot shows a dialog box titled "Applications". At the top, there is a list of application types with checkboxes: "Erste Applikation", "T-nass", "T-trocken", "#1151 Kunststoff" (checked), "U\_Material\_db", and "#1128 trocken". Below this is a date and time filter: "Date from 3/13/16 3:53 PM to 3/15/17 3:53 PM". The main part of the dialog is a table with the following columns: Application-ID, Application name, Block-ID, Block name, Measurement-ID, Time, Thickness, and Status. The table contains 18 rows of data for application #1151 Kunststoff, with measurement IDs ranging from 460 to 476 and thickness values between 67.7 and 68.1. At the bottom left, it says "Total: 764". At the bottom right, there is an "Export..." button and a currency symbol icon.

Application-ID	Application name	Block-ID	Block name	Measurement-ID	Time	Thickness	Status
5	#1151 Kunststoff	1	ömer	460	2017-02-24T12:09:45	67.8	OK
5	#1151 Kunststoff	1	ömer	461	2017-02-24T12:09:54	67.9	OK
5	#1151 Kunststoff	1	ömer	462	2017-02-24T12:10:01	67.9	OK
5	#1151 Kunststoff	1	ömer	463	2017-02-24T12:10:08	68	OK
5	#1151 Kunststoff	1	ömer	464	2017-02-24T12:10:15	68.1	OK
5	#1151 Kunststoff	1	ömer	465	2017-02-24T12:10:22	67.8	OK
5	#1151 Kunststoff	1	ömer	466	2017-02-24T12:10:29	68.1	OK
5	#1151 Kunststoff	1	ömer	467	2017-02-24T12:10:36	68.1	OK
5	#1151 Kunststoff	1	ömer	468	2017-02-24T12:10:43	67.7	OK
5	#1151 Kunststoff	1	ömer	469	2017-02-24T12:10:50	67.7	OK
5	#1151 Kunststoff	1	ömer	470	2017-02-24T12:10:57	67.9	OK
5	#1151 Kunststoff	1	ömer	471	2017-02-24T12:11:05	68.1	OK
5	#1151 Kunststoff	1	ömer	472	2017-02-24T12:11:12	68	OK
5	#1151 Kunststoff	1	ömer	473	2017-02-24T12:11:19	68.1	OK
5	#1151 Kunststoff	1	ömer	474	2017-02-24T12:11:26	68	OK
5	#1151 Kunststoff	1	ömer	475	2017-02-24T12:11:33	67.9	OK
5	#1151 Kunststoff	1	ömer	476	2017-02-24T12:11:40	67.8	OK

Figure 50. Selecting the measurements to export in the stand-alone software

With the filter settings for date and time select the period for which the data should be exported and click the update button with the two arrows. Then click **Export....** A Save as dialog opens, where the path and name for the data file can be defined. Now click **Save.** The export file is now saved as XML-, CSV- or QDAS-file under the defined name and path.

## 6 Remote control

This chapter describes operation of the coatmaster using any device that connects to the coatmaster by Ethernet. This can be for example a PLC (e.g. Siemens S7) or a computer running software from a third party. The coatmaster Operating System software is using remote protocol to control the coatmaster.

The coatmaster is operated by commands that are sent from the device to the coatmaster. The result of the command is sent back from the coatmaster to the device. The coatmaster acts as a server for remote control operation. The device acts as a client.

It is possible to use either a TCP/IP or a HTTP based interface for remote control of the coatmaster.

To use the TCP/IP interface, proceed as follows:

Commands and results for the TCP/IP interface are listed in chapter 6.1.

To use the HTTP interface, proceed as follows:

Commands and results for the TCP/IP interface are listed in chapter 6.1.15.

### 6.1 TCP/IP

The commands and the results are transferred as ASCII text lines. After a command is processed, the TCP/IP connection is disconnected by the coatmaster server, to allow access by other clients. The connection has to be re-established for the next command.

Code examples using the TCP/IP protocol are available from the following link:

<https://coatmaster.com/en/integratoren.html>

#### **Important note for users of a Siemens SIMATIC S7 PLC:**

The Siemens S7 PLC is available in two different product types, which react differently with an Ethernet connection – Type PN/DP and Type DP.

**Type PN/DP:** This type has Ethernet integrated in the CPU. The opening and closing of the Ethernet connection is done automatically and requires no special commands in the software.

**Type DP:** This type does not have Ethernet integrated in the CPU. For this type, the Ethernet connection must be opened before each command and closed after each command by software.

### 6.1.1 General format of commands and results

A command line string has the following format:  
 COMMAND?ARG1=VAL1&ARG2=VAL2&...CR/LF

The elements in a command line have the following meaning:

„COMMAND“: Command name  
 „?“: Separates a command from the arguments  
 „ARGx“: Name of a command argument  
 “VALx”: Value for the command argument  
 „=“: Separator sign between command argument and value  
 „&“: Separator sign between command arguments  
 <...>: Place holder for dynamic values  
 ----: Separator line  
 „CR/LF“: ends the command (line break (Hex 0D 0A, escape sequence \r\n))

The coatmaster responds to commands with results with similar formats:

RESULT?ARG1=VAL1&ARG2=VAL2&...CR/LF

„RESULT“: Result name  
 „?“: Separates a command from the arguments  
 „ARGx“: Name of a command argument  
 “VALx”: Value for the command argument  
 „=“: Separator sign between command argument and value  
 „&“: Separator sign between command arguments  
 <...>: Place holder for dynamic values  
 ----: Separator line  
 „CR/LF“: ends the command (line break (Hex 0D 0A, escape sequence \r\n))

The argument STATUS is contained in every command result and assumes the following values:

- OK: The command was carried out correctly.
- ERROR: The command was not carried out correctly and aborted.
- WARNING: Warning, e.g. when the measuring values are not reliable
- MESSAGE=<VAL>: Description of the problem in case of an error or warning message

### 6.1.2 MEASURE command

Use the MEASURE command to trigger a coatmaster measurement. You have to select a coatmaster application for the measurement. This is specified by an ID and is only argument for the MEASURE command.

Command	Arguments	Description
MEASURE	CONFIGID	Execute a measurement using the application with ID specified by CONFIGID. The IDs of all applications stored on the coatmaster can be retrieved with the command GETCONFIGURATIONS.

#### Example usage

Command to trigger a measurement with application ID no. 1:

```
MEASURE?CONFIGID=1<CR/LF>
```

Result	Arguments	Description
RES_MEASURE	STATUS	As described in chapter 6.1.1.
	MEASURE_ID	Each measurement result receives a unique ID number (integer).
	THICKNESS	Coating thickness result (floating point number)
	TIMESTAMP	Time stamp of the measurement (integer). The value of this argument stands for „milliseconds since January 1, 1970, 00:00:00 GMT". See <a href="http://www.epochconverter.com/">http://www.epochconverter.com/</a> for further description how to convert this number into your desired time format.

#### Example result:

```
RES_MEASURE?STATUS=OK&MEASURE_ID=3&THICK-  
NESS=12.0&TIMESTAMP=1362061773072<CR/LF>
```

In this example, the measurement result is 12.0µm and the value 1362061773072 stands for the time specification 28. February 2013, 14:29:33 GMT.

#### Error and warning messages

As a result to a MEASURE command, warning and error messages could be returned. In this case, the result has the format:

```
RES_MEASURE?STATUS=ERROR&MESSAGE={error message}<CR/LF>  
RES_MEASURE?STATUS=WARNING&MESSAGE={warning message}<CR/LF>
```

The text part in the braces {...} contains a code for the warning or error:

Argument	Values	Description
MESSAGE	1	Description of error 1
	2	Description of error 2

### 6.1.3 GETCONFIGURATIONS command

Use the GETCONFIGURATIONS command to retrieve a list of all applications stored on the coatmaster. This command has no arguments.

Command	Arguments	Description
GETCONFIGURATIONS		

#### Example usage:

GETCONFIGURATIONS<CR/LF>

Result	Arguments	Description
RES_GETCONFIGURATIONS	NAME	Name given to the application by the user
	ID	Application ID for this application (integer)
	...	For each application stored on the coatmaster, the NAME and ID is returned.

#### Example result:

RES\_GETCONFIGURATIONS?STATUS=OK&ID=2&NAME=paint1&ID=4&NAME=paint2<CR/LF>

In this example, there are two applications stored on the coatmaster. Application with name “paint1” has ID 2 and the application with the name “paint2” has ID 4. IDs do not have to be consecutive numbers.

### 6.1.4 GETCONFIGIDS command

Use the GETCONFIGIDS command to retrieve a list of the IDS of all application stored on the coatmaster. This command has no arguments.

Command	Arguments	Description
GETCONFIGIDS		

#### Example usage:

GETCONFIGIDS<CR/LF>

Result	Arguments	Description
--------	-----------	-------------



RES_GETCONFIGIDS	STATUS	As described in chapter 6.1.1.
	ID	First application ID (integer)
	...	For each application stored on the coatmaster, the ID is returned.

**Example result:**

```
RES_GETCONFIGIDS?STATUS=OK&ID=2&ID=3&ID=5<CR/LF>
```

In this example, there are three applications stored on the coatmaster. They have IDs 2, 3 and 5. IDs do not have to be consecutive numbers.

**6.1.5 GETTHICKNESSBOUNDS command**

Use the GETTHICKNESSBOUNDS command to retrieve a list of the warning and error coating thickness boundaries specified in an application. See chapter 5.5.3 on page 42 for more information on warning and error coating thickness bounds.

Command	Arguments	Description
GETTHICKNESS-BOUNDS	CONFIGID	Specify the ID of the application for which you want to get the coating thickness bounds information.

**Example usage:**

```
GETTHICKNESSBOUNDS?CONFIGID=1<CR/LF>
```

Result	Arguments	Description
RES_GETTHICKNESS-BOUNDS	STATUS	As described in chapter 6.1.1.
	HAS_WARNING	Boolean variable (either TRUE or FALSE) showing if a warning range is defined for the application (see chapter 5.5.3 on page 42).
	WARNING_LOWER	Lower coating thickness bound in micrometers for warning range (integer). Only defined if warning range is active.
	WARNING_UPPER	Upper coating thickness bound in micrometers for warning range (integer). Only defined if warning range is active.
	HAS_ERROR	Boolean variable (either TRUE or FALSE) showing if an error range is defined for the application (see chapter 5.5.3 on page 42).
	ERROR_LOWER	Lower coating thickness bound in micrometers for error range (integer). Only defined if error range is active.

	ERROR_UPPER	Upper coating thickness bound in micrometers for error range (integer). Only defined if error range is active.
--	-------------	--

**Example result:**

```
RES_GETTHICKNESSBOUNDS?STATUS=OK&HAS_WARNING=true&WARNING_LOWER=50&WARNING_UPPER=60&HAS_ERROR=false&ERROR_LOWER=10&ERROR_UPPER=150<CR/LF>
```

In this example, the warning range is active whereas the error range is not active for the application. Lower boundary for warning range is 50µm, upper boundary for warning range is 60µm. The values for lower and upper boundaries for error range are irrelevant.

**6.1.6 STARTAUTOMATION command (automation mode)**

This command is intended to be used in conjunction with the automation mode of the coatmaster Operating System. See chapter 5.3.2 on page 26 for further details on the automation mode.

**6.1.7 STOPAUTOMATION command (automation mode)**

This command is intended to be used in conjunction with the automation mode of the coatmaster Operating System. See chapter 5.3.2 on page 26 for further details on the automation mode.

**6.1.8 TRIGGERAUTOMATIONSENSOR command (automation mode)**

This command is intended to be used in conjunction with the automation mode of the coatmaster Operating System. See chapter 5.3.2 on page 26 for further details on the automation mode.

**6.1.9 GETAUTOMATIONSTATE command (automation mode)**

This command is intended to be used in conjunction with the automation mode of the coatmaster Operating System. See chapter 5.3.2 on page 26 for further details on the automation mode.

**6.1.10 CREATESAMPLE command (automation mode)**

This command is intended to be used in conjunction with the automation mode of the coatmaster Operating System. See chapter 5.3.2 on page 26 for further details on the automation mode and chapter 5.3.1.15.3.3 on page 25 for further information on sample blocks.

Command	Arguments	Description
CREATESAMPLE	CONFIGID	Specify the ID of the application for which you want to generate a new sample block.

**Example usage:**

```
CREATESAMPLE?CONFIGID=12<CR/LF>
```

This will make a new sample block in application with ID 1.

Result	Arguments	Description
RES_CRE- ATESAMPLE	SAMPLE_ID	The ID of the newly created sample block (integer).

**Example result:**

```
RES_CREATESAMPLE?SAMPLE_ID=211<CR/LF>
```

The new block has the ID number 211. The block is automatically set active by the coatmaster Operating System.

**6.1.11 GETNUMBEROFMEASUREMENTS command**

Use the GETNUMBEROFMEASUREMENTS command to ...

Command	Arguments	Description
GETNUMBEROF- MEASURE- MENTS		

**Example usage:**

Result	Arguments	Description
RES_GETNUM- BEROFMEAS- UREMENTS		

**Example result:****6.1.12 GETSERVICESTATUS command**

Use the GETSERVICESTATUS command to ...

Command	Arguments	Description
GETSERVICESTA- TUS		

**Example usage:**

Result	Arguments	Description
RES_GETSERVICESTATUS		

**Example result:****6.1.13 GETAMBIENTSENSORDATA command (coatmaster Inline only)**

Use the GETAMBIENTSENSORDATA command to query the status of the ambient sensors. See also chapter on page .

Command	Arguments	Description
GETAMBI- ENTSENSOR- DATA		

**Example usage:**

GETAMBIENTSENSORDATA <CR/LF>

The format of the result depends on the STATUS.

STATUS=OK:

Result	Arguments	Description
RES_GETAMBI- ENTSENSOR- DATA	STATUS	OK
	SENSOR-STATUS	NORMAL
	TEMPERATURE	Temperature of the cooling liquid in °C (floating point number).
	WATER-FLOW	Flow of the cooling liquid in l / min (floating point number).
	WATER-LEVEL	Level of the cooling liquid in the tank in % (floating point number).

STATUS=ERROR: This is the case if any one of the sensor values falls below pre-defined thresholds. The sensor that is below the threshold level is indicated after the SENSOR-STATUS-... field:

Result	Arguments	Description
--------	-----------	-------------

RES_GETAMBIENTSENSOR-DATA	STATUS	ERROR
	SENSOR-STATUS-TEMPERATURE	CRITICAL (only present if this sensor is in critical level)
	SENSOR-STATUS-WATER-FLOW	CRITICAL (only present if this sensor is in critical level)
	SENSOR-STATUS-WATER-LEVEL	CRITICAL (only present if this sensor is in critical level)
	TEMPERATURE	Temperature of the cooling liquid in °C (floating point number).
	WATER-FLOW	Flow of the cooling liquid in l / min (floating point number).
	WATER-LEVEL	Level of the cooling liquid in the tank in % (floating point number).

**Example result with STATUS=OK:**

```
RES_GETAMBIENTSENSORDATA?STATUS=OK&SENSOR-STATUS=NORMAL&TEMPERATURE=3.0&WATER-FLOW=7.0&WATER-LEVEL=600.0<CR/LF>
```

**Example result with STATUS=ERROR:**

```
RES_GETAMBIENTSENSORDATA?STATUS=ERROR&SENSOR-STATUS-WATER-FLOW=CRITICAL&SENSOR-STATUS-WATER-LEVEL=CRITICAL&WATER-FLOW=1.0&WATER-LEVEL=0.0<CR/LF>
```

**6.1.14 GETCOATMASTERSTATUS**

Command	Status	Description
GETCOATMASTERSTATUS	STATUS	Is Coatmaster ready? Command for TCP/IP to check if measure can be performed
	HAS_STARTUP	Is system start-up conducted
	STARTUP_WAIT_REMAINING	How long (ms) the start-up takes
	FLASH_READY	Is light source ready to be used
	FLASH_WAIT_REMAINING	How long (ms) the charging take
	READY	Are light source and start-up conducted

	CURRENT_ACTIVITY	“Measure”, “Evaluation” or “None”. During “Measure” the device should not be moved, during “Evaluation” the device can be moved to new position, during “None” the device is ready to be used.

### 6.1.15 GETOBJECTTEMPERATURE

Command	Status	Description
GETOBJECTTEMPERATURE?CONFIG_ID=XXX&MEASUREMENT_ID=YYY		Config_ID is the name of the application and measurement the corresponding measurement number in this application
	STATUS	OK, if measurement successful
	TEMPERATURE	Measured temperature value

### 6.1.16 GETLASTOBJECTTEMPERATURE

Command	Status	Description
GETLASTOBJECTTEMPERATURE	STATUS	OK, if measurement successful
	TEMPERATURE	Returns the last measured temperature

## 6.2 HTTP

### Start a measurement:

Request URI: `http://{host:port}/measurementserver/measure?configID={Appl-ID}`

Request method: POST

Request headers: {Accept=[application/json], Content-Length=[0]}

{host:port} must be replaced by TCP/IP address and port, e.g. `http://192.168.1.100:1234/measurementserver/` etc.

{Appl-ID} stands for the application used for the measurement. The application IDs of all applications defined within the coatmaster are stored in the application list under their application name.

### Query application list:

Request URI: `http://{host:port}/measurementserver/configurations`

Request method: GET



Request headers: {Accept=[application/json], Content-Length=[0]}

## 7 Maintenance / Service

Maintenance / Service may be conducted by authorized personnel only! Unauthorized personnel risk personal injury and damage to the coatmaster!

Use only coatmaster AG consumables and spare parts for maintenance and repair to assure system performance and reliability. Any modifications to the spare parts are only allowed with the prior written permission of coatmaster AG.

### 7.1 General

	 <b>WARNING</b>
<p><b>Risk of burns by electric current.</b> Serious injuries or death can result.</p> <p>Prior to any maintenance and service, switch off the device and unplug the mains cable. Maintenance work may be conducted by authorized personnel only!</p>	

Do not open the housing of the coatmaster, even when the coatmaster is not connected to the mains. Exception: Unmounting the the rear cover for cleaning or exchanging the filter pads (see section 7.3). Opening the coatmaster will void any liability and annuls the guarantee.

Put the coatmaster into operation at least once every six months.

If the light source reaches 0% or after one year since the last service (also if the device is not in use) the coatmaster has to be serviced by a trained service engineer (see chapter 5.3.5).

The Operating System software monitors the replacement parts of the coatmaster. As soon as the state of a replacement parts becomes critical or it has reached or exceeded its intended operating margin, a corresponding message is displayed (see chapter 5.3.4).

### 7.2 Software maintenance

With the coatmaster Web Client, the embedded software on the coatmaster and the corresponding coatmaster Operating System can be upgraded. In addition, it is possible to download log files for detailed failure analysis. To proceed, connect the computer to the coatmaster (see chapter 4.3 and following). Use a web browser to access the coatmaster Web interface.

Enter the IP address for the corresponding connection interface into the URL-line of the browser (see chapter 4.4.1). In the main menu of the coatmaster Web Client select Administrator.

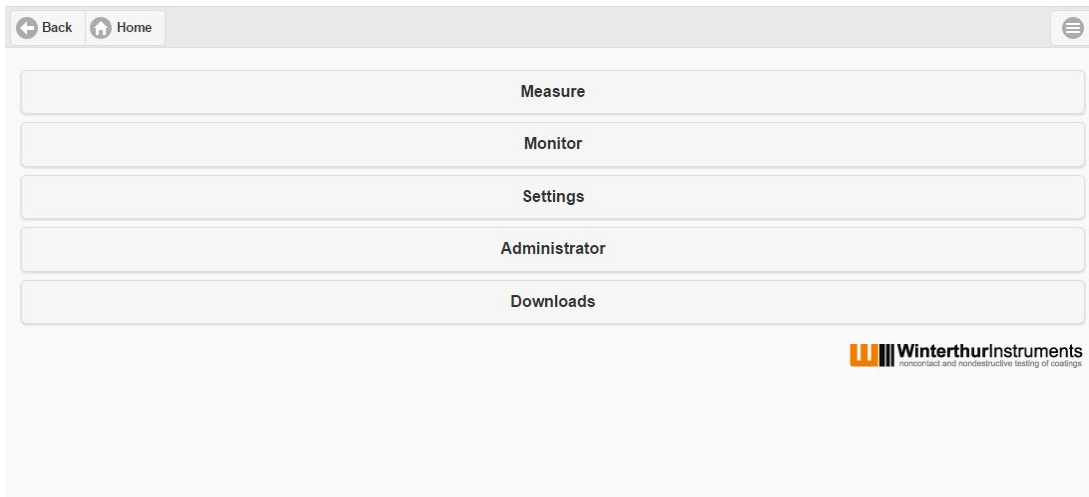


Figure 51. Homepage in the web client

To log in as administrator, use the User *admin* with password *admin*.

### 7.2.1 coatmaster software diagnostics

For trouble shooting the coatmaster AG support will sometimes ask you for the log files. To download the log files from the coatmaster, select *Diagnostics* from the *Administration* page of the coatmaster Web Client.

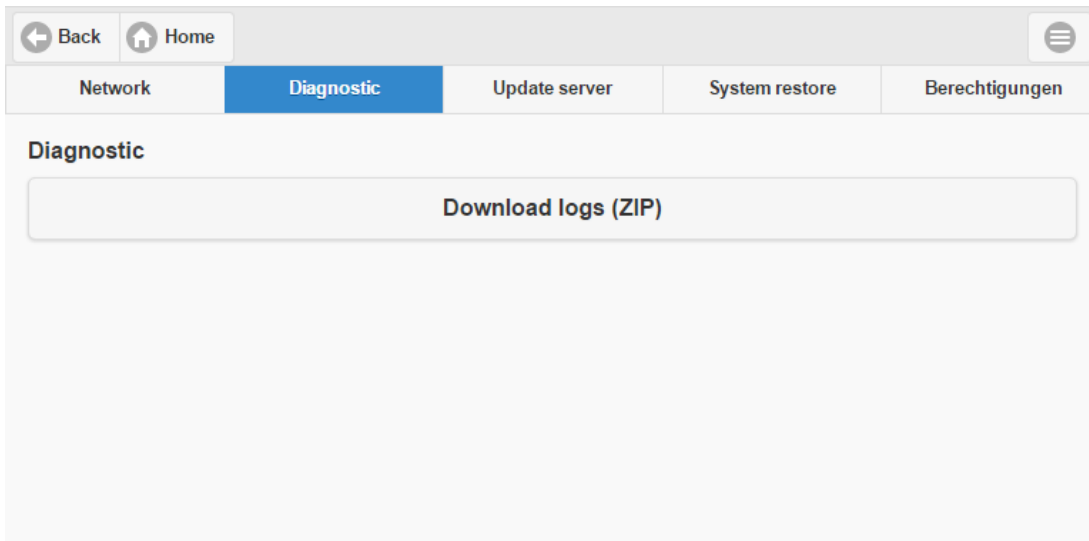


Figure 52. Downloading diagnostics in the web client

Press the *Downlaod logs (ZIP)* to download the log file. Send the log file to coatmaster support.



### 7.2.2 coatmaster embedded software restore

To undo a software upgrade it is possible to restore a previously installed version of the coatmaster embedded software. Select *System restore* from the *Administration* page of the coatmaster Web Client.

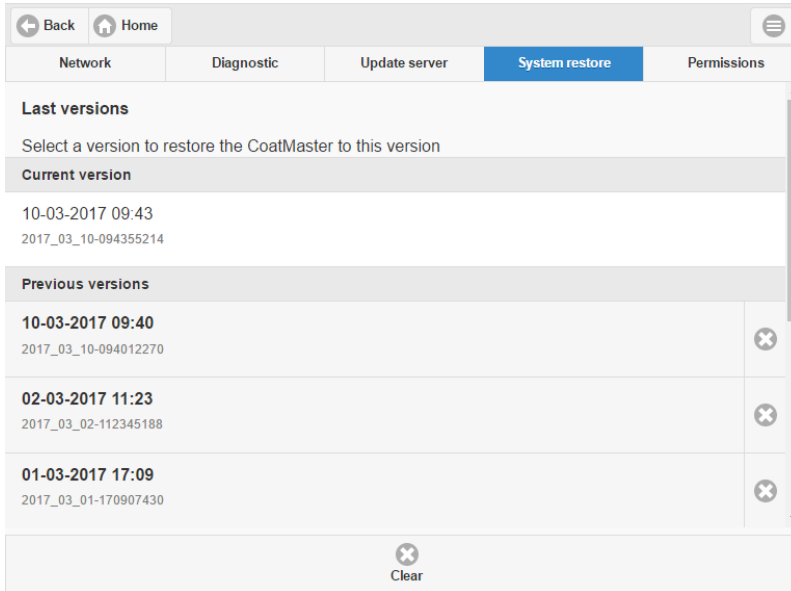


Figure 53. Restoring the system in the web client



Choose the older software version and start the restore process. Restart the coatmaster after the restore and install the corresponding coatmaster Operating System (see chapter 4.4.2).

### 7.3 Measurement window

Clean the measurement window from any contamination by oil-free compressed air to assure good coatmaster performance and reliability.

Stubborn contamination can be removed with the soft, lint-free cloth and alcohol (e.g. eyeglass cleaning cloth).

### 7.4 Refill coolant

	 <b>NOTICE</b>
	<p><b>Risk of water within the coatmaster.</b> The use of tap water as a coolant can lead to corrosion of component in contact with water. Use only de-ionized water.</p> <p>The coatmaster Coolant Refill Kit is not part of the coatmaster Inline scope of delivery. Please order separately if required.</p>

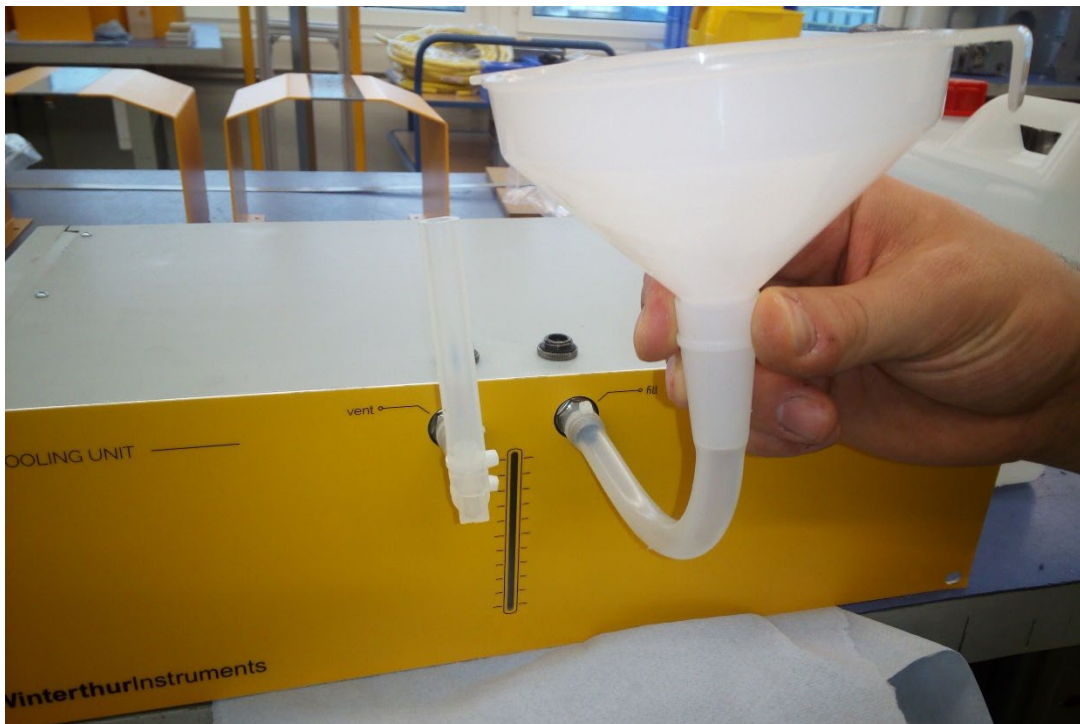
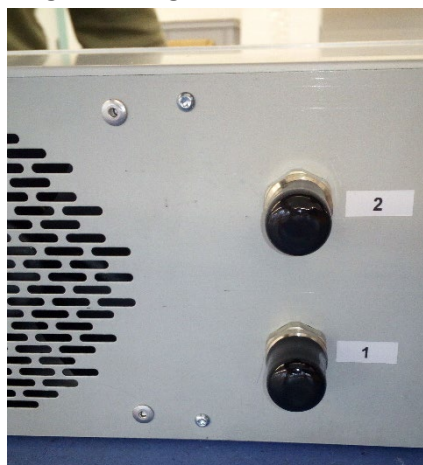


Figure 54: Refill coolant into the CM Water Cooling unit

For perfect operation of the coatmaster, the coolant of the cooling unit must be filled regularly. If coolant low-level warning or error is shown (refer to chapter 5.3.4) or if the coatmaster is delivered without coolant (when shipped at low temperatures), use the coatmaster Refill-Kit to refill coolant. The coolant consumption depends on the environmental conditions and the measuring frequency of the coatmaster.

#### Refill / fill coolant:

Step 1 : Do not connect fully discharged cooling unit with coatmaster.

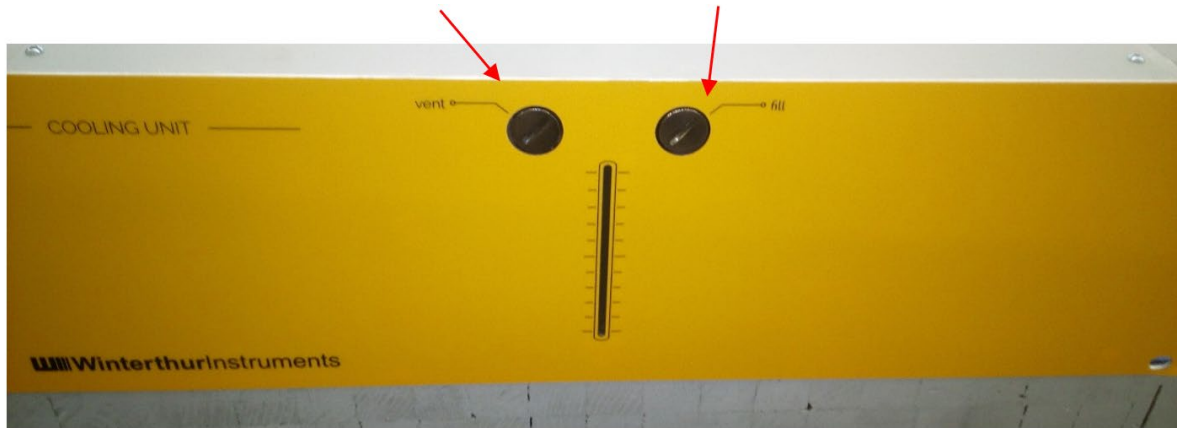


Step 2: Open both screw caps.

frontal view:

**vent:** aeration, apply angle tube

**fill:** apply funnel tube



Open both screw caps using screwdriver Nr.5.



Step 3: Connect angle tube (vent) und tube with funnel (Fill).

Attention: only tighten by hand, do not use a wrench!



Step 4: Fill.

**Use deionized water (decalcified water) as the cooling liquid!**

Fill in water with the help of the funnel (total approx. 2l) until water is visible in the angled hose (venting) for the first time. The water level can withdraw in the case air bubbles are being removed. The cooling unit is then sufficiently filled.

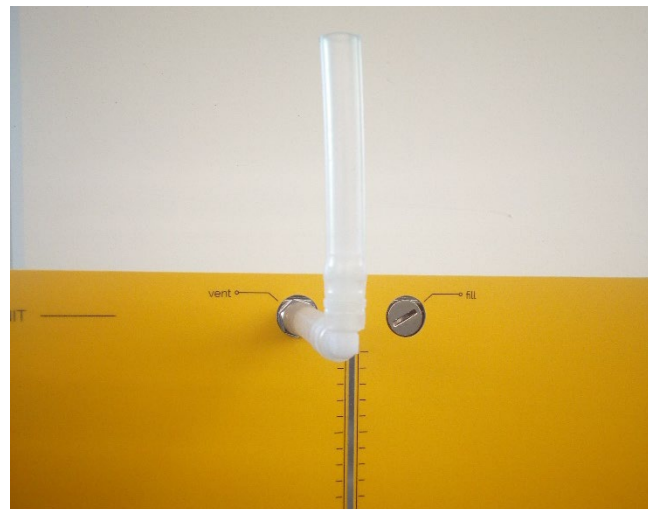


Step 5: Remove funnel with tube and angle tube.

**Attention:** Some water may leak out!

Close the connections again with the screwed caps.

**Attention:** plastic threads, low force application is sufficient!



Step 6: The cooling unit can now be connected to coatmaster and put into operation.

If the tubes and the measuring head are emptied, they must first be filled with coolant as described in point seven.



#### Step 7: Fill tubes and head

If the tubes and the measuring head are also emptied, these components must also be filled with coolant before commissioning. To do this, first fill the cooling unit with water as described. Now fill the tubes by connecting them individually to the cooling unit.



Connect cooling unit electrically with coatmaster system. Do not connect the measuring head. The coatmaster is now switched on and the cooling unit starts to pump the water into the tube. Attention! The coolant level sinks very quickly. Add cooling water immediately or switch off the coatmaster before the minimum level is reached! After the level does not sink any further, let the coatmaster run for approx. 30s.

If the water does not get into the tube, it may be that the water pump has air inside. The air usually disappears when the coatmaster is turned off for approximately 10 seconds. Make sure that the tubes are slightly higher than the cooling unit so that the air can escape from the pump.

Refill the water tank and repeat the procedure for the second tube.

After filling both tubes, refill the water tank and connect the tubes with the measurement head. Turn the coatmaster on again and repeat the procedure with the two tubes and the measuring head. If the

level of the coolant no longer decreases, turn the measuring head for approx. 30 s. in a position where the front lens points downwards.

After filling the cooling unit, tubes and the measurement head let the full system run for 5 minutes. The system is now filled and the coatmaster can be shut down and properly put into operation.

## 7.5 Filter pads

### 7.5.1 coatmaster

Visually inspect the filter pads regularly. When they are contaminated, they need cleaning. For this purpose, proceed as follows:

- Unscrew the two screws on the rear of the device (see figure ).

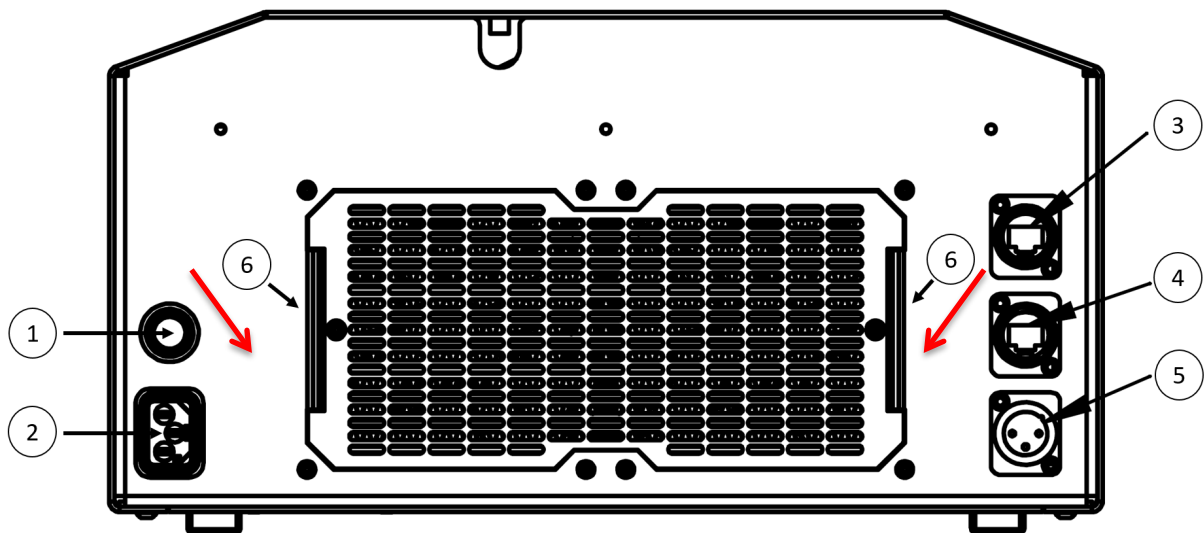


Figure 55: coatmaster – rear view. (6) Screws to access fileter pads

- Remove the filter cover.
- Take off the filter pads and clean them with compressed air.
- If the filter pads are highly contaminated, they need to be replaced.
- Remount the filter cover.

### 7.5.2 coatmaster Inline

If filter pads are installed within the rack, visually inspect them regularly. When they are contaminated, they need cleaning. For very strong contamination an exchange is necessary.

## 7.6 Blank measurement

After service work the blank measurement must be repeated. This function is found in *Preferences > device settings*.

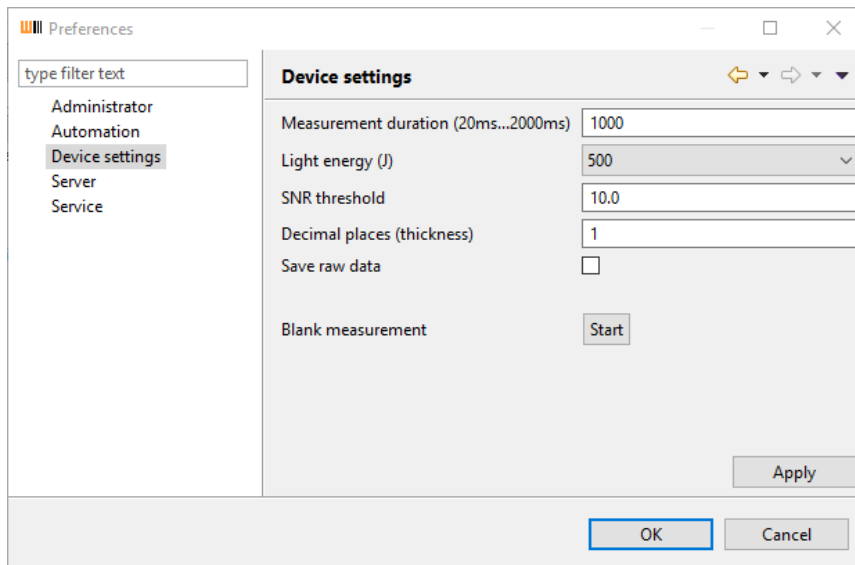


Figure 56. Conducting blank measurement in the stand-alone software

The values for Measurement duration, Light energy, SNR threshold and decim place are default values only. The default values can be corrected in the application settings.

**Measurement time (s):** Default value for duration of the measurement

**Light energy (J):** Default value for light source energy.

**SNR threshold (V):** SNR (signal-to-noise) threshold for detecting invalid measurements.

**Decimal places (thickness):** Default for desired amount of digits for the display of the thickness value

**Save raw data:** Activate the checkbox to save raw data during the measurement (only for service purposes).

### NOTICE

*The coatmaster does not require the raw data for operation. We recommend deactivating this checkbox.*

**Blank measurement:** When clicking on the *Start* button, a window opens prompting to cover the IR-lens and to start a blank measurement by clicking OK. Use a coatmaster AG blank cover to cover the IR lens before starting the blank measurements. After placing the cover on the IR lens, press OK to start the blank measurements. This blank measurement serves as reference for later sample measurements.

## **8 Troubleshooting**

If a software error occurs (error codes 1-14), restart the device. If the error persists, contact your administrator and pass the error code.


In case of hardware defect or malfunction (e.g. cooling liquid leak) proceed as follows:

1. Disconnect the device from the control unit immediately.
2. Inform the responsible person at the operating location about the fault.
3. Repairs may be conducted by authorized personnel only!



## 9 Technical data


### 9.1 Data sheet coatmaster

	<b>coatmaster 500</b>	<b>coatmaster 1000</b>	<b>coatmaster 1500</b>	<b>coatmaster 2000</b>
Energy	500 J	1000 J	1500 J	2000 J
Measurement distance	5 cm – 15 cm **	5 cm – 30 cm **	5 cm – 40 cm **	5 cm – 50 cm **
Measurement point	∅ 2 – 20 mm *	∅ 2 – 20 mm *	∅ 2 – 20 mm *	∅ 2 – 20 mm *
Measurement range:				
Powder coating uncured	1-500 µm	1-500 µm	1-500 µm	1-500 µm
Powder coating cured	1-1000 µm	1-1000 µm	1-1000 µm	1-1000 µm
Pulverlack pre-cured	1-1000 µm	1-1000 µm	1-1000 µm	1-1000 µm
Wet paint	1-1000 µm	1-1000 µm	1-1000 µm	1-1000 µm
Measurement duration	20 ms – 2000 ms	20 ms – 2000 ms	20 ms – 2000 ms	20 ms – 2000 ms
Repetition rate	1 Hz	0.5 Hz	0.4 Hz	0.3 Hz
Relative velocity of sample	50 m/min	50 m/min	50 m/min	50 m/min
Tilt tolerance	±70°	±70°	±70°	±70°
Power connection	IEC 320-C14	IEC 320-C14	IEC 320-C14	IEC 320-C14
Supply voltage	230 V AC, 50 Hz	230 V AC, 50 Hz	230V AC, 50 Hz	230V AC, 50 Hz
Fuse	10 A	10 A	10 A	10 A
Power consumption	max. 2000 W	max. 2000 W	max. 2000 W	max. 2000 W
Operating temperature	5°C – 35°C	5°C – 30°C	5°C – 30°C	5°C – 30°C
Relative humidity	< 80 %	< 80 %	< 80 %	< 80 %
Dimensions (mm)	374 x 490 x 196	374 x 490 x 196	374 x 490 x 196	374 x 490 x 196
Weight	16.8 kg	16.8 kg	16.8 kg	16.8 kg
Fixation	Guide rail	Guide rail	Guide rail	Guide rail
Interface:				
Ethernet	yes	yes	yes	yes
WLAN	optional	optional	optional	optional
External sensor	yes	yes	yes	yes

\* depending on distance / focal width

\*\* depending on coating and substrate

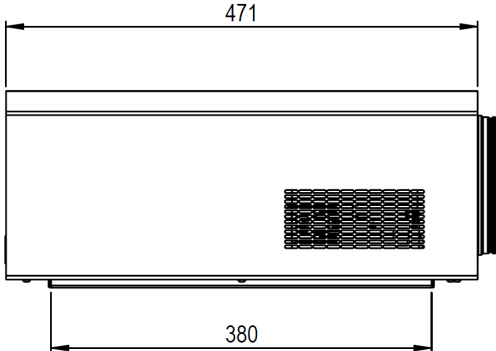
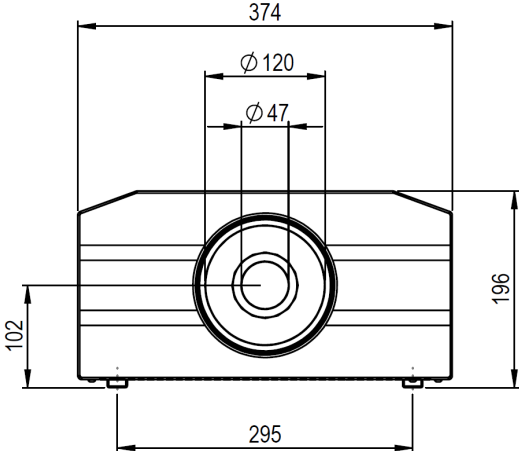
## 9.2 Data sheet coatmaster Inline

	<b>coatmaster Inline 500</b>	<b>coatmaster Inline 1000</b>	<b>coatmaster Inline 1500</b>	<b>coatmaster Inline 2000</b>
Energy	500 J	1000 J	1500 J	2000 J
Measurement distance	5 cm – 15 cm **	5 cm – 30 cm **	5 cm – 40 cm **	5 cm – 50 cm **
Measurement point	∅2 – 20 mm *	∅ 2 – 20 mm *	∅ 2 – 20 mm *	∅ 2 – 20 mm *
Measurement range:				
Powder coating uncured	1-500 µm	1-500 µm	1-500 µm	1-500 µm
Powder coating cured	1-1000 µm	1-1000 µm	1-1000 µm	1-1000 µm
Powder coating pre-cured	1-1000 µm	1-1000 µm	1-1000 µm	1-10000 µm
Wet paint	1-1000 µm	1-1000 µm	1-1000 µm	1-1000 µm
Measurement duration	20 ms – 2000 ms	20 ms – 2000 ms	20 ms – 2000 ms	20 ms – 2000 ms
Repetition rate	1 Hz	0.5 Hz	0.4 Hz	0.3 Hz
Relative velocity of sample	50 m/min *	50 m/min *	50 m/min *	50 m/min *
Tilt tolerance	±70°	±70°	±70°	±70°
Power connection	IEC 320-C14	IEC 320-C14	IEC 320-C14	IEC 320-C14
Supply voltage	230 V AC, 50 Hz	230 V AC, 50 Hz	230 V AC, 50 Hz	230 V AC, 50 Hz
Fuse	10 A	10 A	10 A	10 A
Power consumption	max. 2000 W	max. 2000 W	max. 2000 W	max. 2000 W
Operating temperature measurement head	5°C – 50°C	5°C – 50°C	5°C – 50°C	5°C – 50°C
Operating temperature cooling and generator unit	5°C – 35°C	5°C – 35°C	5°C – 35°C	5°C – 35°C
Relative humidity	< 80%	< 80%	< 80%	< 80%
Dimensions measurement head (mm)	204 x 254 x 268	204 x 254 x 268	204 x 254 x 268	204 x 254 x 268
Dimensions cooling and generator unit	483 x 133.35 x 418 (19" 3 HE)	483 x 133.35 x 418 (19" 3 HE)	483 x 133.35 x 418 (19" 3 HE)	483 x 133.35 x 418 (19" 3 HE)
Weight measurement head	5.3 kg	5.3 kg	5.3 kg	5.3 kg
Weight cooling and generator unit	17.5 kg	17.5 kg	17.5 kg	17.5 kg
Fixation	guide rail	guide rail	guide rail	guide rail
Cable length between measurement head and cooling and generator unit	max. 10 m	max. 10 m	max. 10 m	max. 10 m
Height difference between measurement head and cooling and generator unit	max. 5 m	max. 5 m	max. 5 m	max. 5 m
Interface: Ethernet	yes	Yes	Yes	yes

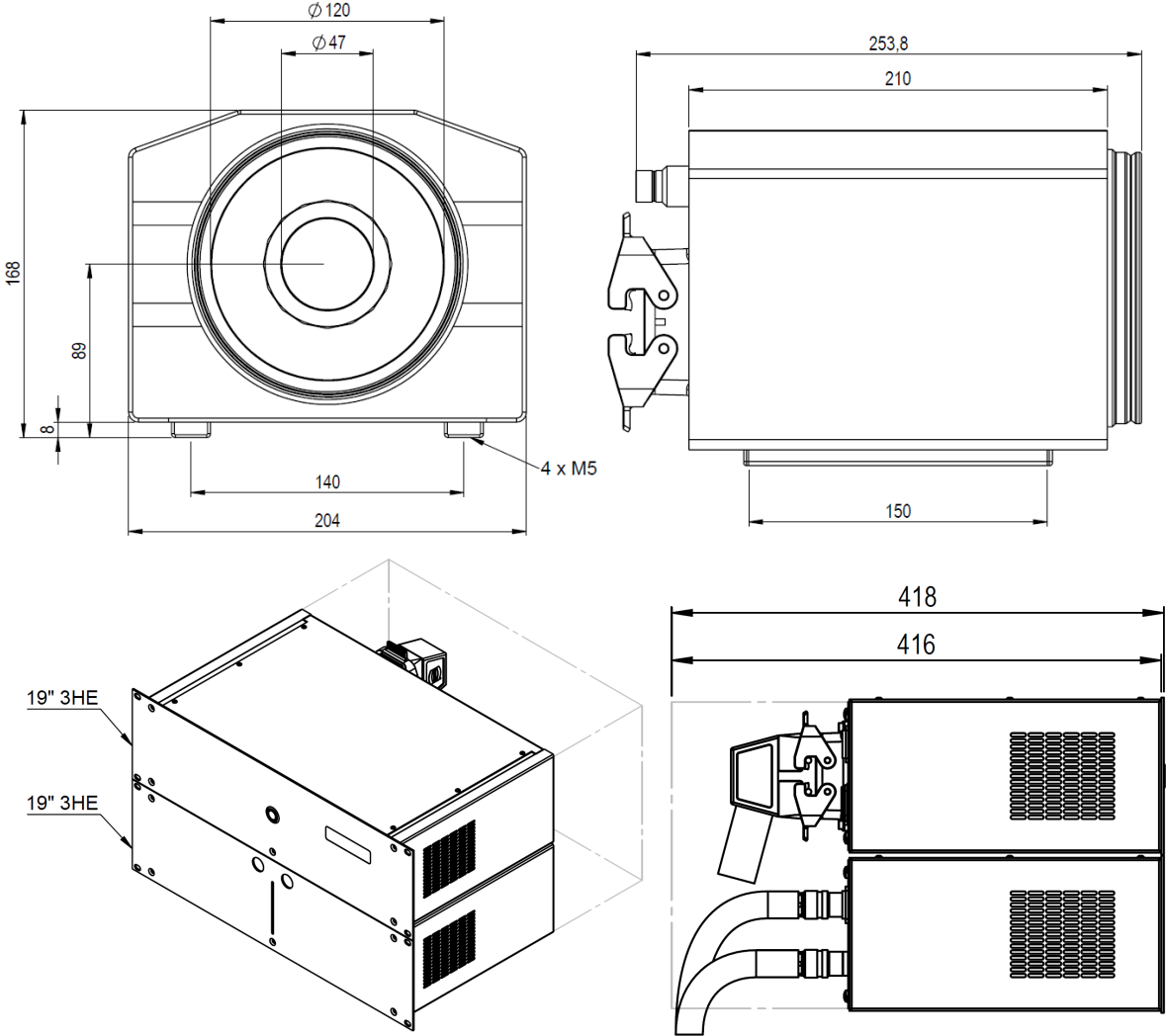
\* depending on distance / focal width

\*\* depending on coating and substrate

9.2.1 Dimension and assembly relevant information coatmaster



9.2.2 Dimension and assembly relevant information coatmaster Inline



## 10 Transport, packaging, storage

### 10.1 Transport inspection

The delivery must be checked for completeness and possible transit damage immediately at receipt. In case of externally visible damage, proceed as follows:

- Do not accept the delivery or only under reserve.
- Note extent of damages on the transportation documents or on the delivery note of the carrier.
- File complaint.

Claim any damage as soon as it is detected. Compensation claims can only be submitted within the applicable complaints periods.

### 10.2 Packaging

Dispose of packaging material in accordance with the respective valid laws and local regulations. Environmental damage caused by incorrect waste disposal! Packing materials are valuable raw materials and can continue to be used in many cases or sensibly reconditioned and recycled.

- Dispose packaging material environmentally friendly.
- Adhere to the valid local regulations for disposal. If necessary employ a special waste disposal company to dispose of packing material.

### 10.3 Storage

Possibly, there are instructions on the packaging for storage that exceed the requirements mentioned here. These must be adhered to.

Store packages under the following conditions:

- Do not store outdoors
- Store dry and dust-free
- Do not expose to aggressive media
- Protect against solar radiation
- Avoid mechanical shock and vibration
- Storage temperature: 15 to 35 °C
- Relative humidity: max. 60 %

For storage exceeding 3 months:

- Check the general condition of all parts and the packing regularly
- As necessary, renew or replace the conservation