

VARIOluxx

OPERATING INSTRUCTIONS



9442DE



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The products described in this manual are subject to continuous development and improvement. We therefore welcome any customer feedback, comments and suggestions regarding our product and its operating instructions that help to improve the product, service or documentation.

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Original operating instructions

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Version dieser Anleitung: 13.00

Date: 26.06.2026

1 Table of contents

1	Table of contents	4
2	Introduction and basic requirements	9
2.1	Storing the instructions	9
2.2	General information concerning the instructions	9
2.3	Structure of the operating instructions	10
2.4	Safety signs	11
2.5	Symbols	11
2.6	General important information for the operator of the measuring device	13
2.7	MRU warranty conditions	15
2.8	Disposal take-back guarantee	15
2.9	Return of devices	15
2.10	Packaging	15
2.11	Taking back parts containing harmful substances	15
2.12	The company MRU GmbH	16
3	Notes on device and safety	17
3.1	Instructions on the safe operation of the device	17
3.1.1	Visual inspection	17
3.1.2	Maintenance work	17
3.2	Data security	18
3.3	Qualification	19
4	Description of services	20
4.1	Intended use	20
5	Description of the device	21
5.1	Typenschild	21
5.2	Object	22
5.3	Schematic gas path diagram	23
5.4	Measuring device	24
5.5	Connections	25
5.6	Probes	26
5.7	Heated gas sampling probe	27
5.8	Unheated gas sampling probe	28
5.9	Gas preparation	29
5.10	Gas conveyance	29
5.11	Gas sensors	30
6	Installation MRU measuring device	31

6.1	Unpacking the device	31
7	Operation	32
7.1	User interface	32
7.1.1	User interface layout	32
7.1.2	Additional display elements	33
7.1.3	Status indicator	34
7.1.4	Information window	35
7.2	Charging the device battery	36
7.3	Switching on the measuring device	36
7.4	Switching off the measuring device	36
7.5	Display settings	37
7.6	Standby mode	38
7.6.1	Putting the measuring device into standby mode	38
7.6.2	Exiting standby mode	38
7.7	Back to start screen or measurement	40
7.8	Acquiring screenshots	40
7.9	Controlling the measuring device remotely via VNC	41
8	Settings	43
8.1	Settings menu	43
8.2	General settings	44
8.3	Device settings	47
8.3.1	Using the last valid zero point	48
8.3.2	Zero point interval	49
8.3.3	Setting the heated sample line and probe temperatures	50
8.4	Continuous averaging	51
8.5	Interval measurement	54
8.6	Configuring the analogue outputs (4-20 mA)	57
8.6.1	Configuring channel and lower/upper limits	57
8.6.2	Configuring analogue output behaviour during zero point calibration	59
8.6.3	Pin assignment of 4-20 mA interface (inputs and outputs)	60
8.6.4	Configuring the analogue inputs (4-20 mA)	61
8.7	Network settings	62
8.7.1	LAN and WLAN settings	62
8.7.2	Modbus settings	63
8.8	WLAN (WiFi connection)	65
8.8.1	Connecting the measuring device via WLAN	65
8.8.2	Displaying information about the WLAN connection	66
8.9	Factory settings	67
9	Managing plant master data and Extras	68

9.1	Data memory	68
9.2	Plants menu	69
9.2.1	Adding, editing and deleting plants	70
9.2.2	Viewing, exporting and deleting stored measurements	71
9.2.3	Managing storage	74
9.3	Extras	75
9.3.1	Extras menu	75
9.3.2	View history	76
9.3.3	System add-ons	81
9.3.4	Connections	83
9.3.5	Automatic device start	84
9.3.6	Enabling automatic device start-up	84
9.3.7	Switching the device off with automatic device start-up enabled	87
9.3.8	Leak test	88
9.3.9	Printing measurement results	91
10	Commissioning of the MRU measuring device	93
10.1	Commissioning the measuring device	93
10.2	Preparing for measurement	95
10.2.1	Safety	95
10.2.2	Set-up at the measuring location	96
10.2.3	Instructions for use of a heated hose line	96
1.	Connecting the gas sampling probe and heated sample line	99
1.	Connecting the heated sample line to the measuring device	99
10.2.4	Connecting the gas sampling probe to the heated sample line	100
10.2.5	Connecting the probe tube to the gas sampling probe	102
10.2.6	Checking the operating temperature	103
10.2.7	Ensuring the power supply	104
10.2.8	Opening the transport sleeve	106
10.2.9	Connecting the temperature sensor	107
10.2.10	Switching on	107
10.2.11	Establishing connections	109
11	Measurement	111
11.1	Opening the Measurement menu	111
11.1.1	Switching to different views	112
11.1.2	Configuring the measurement program	112
11.1.3	Moving measured value fields	113
11.1.4	Assigning measured variables	114
11.1.5	Selecting channels for depiction in chart form	115
11.1.6	List view	118

11.1.7	Zoomed-in view	118
11.2	Measuring	119
11.2.1	Starting measurement	119
11.2.2	Measurement context menu	119
12	Options	128
12.1	Option: flow meter measurement program	128
12.1.1	Connecting the measuring device to a pitot tube	128
12.1.2	Adding parameters for a flow meter	129
12.2	Option: Operating the measuring device in the extended temperature range	131
12.2.1	Precautions for operation in the extended temperature range	131
12.2.2	Connecting the heating box	132
12.3	Heated sample line booster	133
12.3.1	Technical data	133
12.3.2	Installation	133
12.4	Option: Measuring device with nickel-metal hydride (NiMH) battery	135
12.5	Option: external RS485	136
12.5.1	Electronic connections	136
12.5.2	Port settings	136
12.5.3	Modbus slave specifications:	137
12.6	OPTION: screwing the adapter onto the HPI probe	138
13	Maintenance of the MRU measuring device	139
13.1	Info menu	139
13.2	Retrieving device information	140
13.2.1	Info	141
13.2.2	Options	142
13.3	Viewing operating hours	143
13.4	Opening the Service menu	144
13.5	Service values	145
13.6	Internal logger	146
13.7	Performing a self-test	150
13.8	Maintenance	151
13.9	Cleaning and caring for the measuring device	151
13.9.1	Inspection and maintenance of the measuring device	152
13.9.2	Checking and changing the probe filter	153
13.9.3	Checking and changing the round filter	155
14	Replacement parts	157
15	Device component information	158
15.1	Device component information menu	158

15.2	Updating firmware	159
15.2.1	Updating main firmware	159
15.2.2	Updating firmware of individual modules	162
15.3	AKM-Device Info	164
15.4	GKM-Device Info	164
15.5	ECM-Device Info	164
15.6	PIN code (calibration)	166
15.7	Diagnosing measuring device faults	167
15.8	Condensate alarm	168
15.8.1	Condensate self-correction process	168
15.8.2	Start drying manually	170
15.9	Switching off the measuring device in the event of a fault	172
15.9.1	Switching off the measuring device without touch panel input	172
15.9.2	Performing a reset	172
16	Decommissioning	173
17	Technical data	174
17.1	Technical data	174
17.2	NDIR measuring values	175
17.3	Sensors	175
17.4	Gas sampling and preparation	179
17.5	Gas cooler strategy	179
17.6	Calculated values	180
17.7	Measured variables and calculation	181
17.8	Data communication	181
17.9	Fuel types	182
18	Declaration of Conformity	183
19	Appendix	184
19.1	MRU4Win	184
20	Photo credits	188
21	Customer service, service centres	189

2 Introduction and basic requirements



These instructions ensure a safe and efficient handling of the product.

The user must read these instructions carefully and understand them before starting any work.

Basic requirement for safe working is compliance with all specified safety instructions.

2.1 Storing the instructions

The instructions are an integral part of the product and must be kept in the immediate vicinity of the product and accessible to personnel at all times.

2.2 General information concerning the instructions

- These instructions enable you to understand and reliably operate this MRU measuring device.
- Read these instructions attentively!
- Become acquainted with the product before using it.
- This measuring device must only be used by competent personnel and only for the intended purpose.
- Please comply with all safety instructions and warnings to avoid injuries and damage to the device.
- Hand over the entire documentation when you pass on the measuring device to third parties.
- Empty pages in the operating instructions are not inserted by mistake but serve the reader-friendly formatting of the instructions.

2.3 Structure of the operating instructions

The operating instructions are presented in the order in which they should be applied to enable successful measurement.

This order is as follows:

1. **Safety**
Actions that must be implemented to ensure the safe operation of the measuring device.
2. **Description**
Description of the layout of the measuring device, connections, sensors, gas preparation and gas transport.
3. **Operation**
Operation of the measuring device
4. **Settings**
Description of the general, device, network and connection settings.
5. **Plants**
Description of the data memory and plant master data for storing plant measurements.
6. **Measurement**
Performing measurement

NOTE

Do not commence measurement until you have worked through all of the preceding items and completed the necessary preparations.

2.4 Safety signs

These safety instructions are based on the “SAFE principle” and are used throughout this manual:



Symbol

⚠ DANGER

Signal word and color

Specific the type and source of the hazard

Specific consequences of non compliance

- Measures to avoid the hazard

⚠ DANGER

Refers to an imminent danger that will lead to serious physical injury or death if ignored.

⚠ WARNING

Indicates an imminent danger which, if ignored, can lead to serious physical injury, damage to property or death

⚠ CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in minor injury.

ATTENTION

Indicates a potentially hazardous situation which, if not avoided, may result in damage to the device or its surroundings.

NOTE

Indicates application tips and other particularly important information.

2.5 Symbols

Symbols help to identify a danger and escape that danger. You will find the following symbols in these instructions:

Warning symbol	Figure number	Meaning
----------------	---------------	---------

	W001	General warning symbol to identify a danger
	W012	Warning of electrical voltage
	W023	Warning about corrosive substances
	W028	Warning about fire-promoting substances
	W071	Warning about substances or mixtures that are hazardous to health

Mandatory symbol	Figure number	Meaning
	M002	Observe the operating instructions
	M004	Use eye protection
	M008	Use foot protection
	M009	Use hand protection

2.6 General important information for the operator of the measuring device

MRU measuring devices are developed and manufactured in accordance with the applicable standards. Nevertheless, a failure or malfunction of individual device components is possible within the service life of the device. It is the responsibility of the operator to consider and assess the effects of malfunctions on the device and, if necessary, to limit them by taking external measures.

CAUTION

Effects of device malfunctions

Unrecognised effects on the application of the measuring device operator may arise due to device malfunctions.

- The system operator must assess the effects of device malfunctions and, if necessary, limit them by taking external measures.

Every system operator, user and technician who operates or maintains the device must be aware of the potential dangers associated with the use of the device. These dangers are explained in this manual. The information and instructions in this manual must be observed. Only trained and qualified personnel are authorised to use MRU measuring devices.

CAUTION

Non-compliance with local regulations, provisions and standards

This may result in an inadequate risk assessment.

- Always ensure that the MRU measuring device is installed and operated in accordance with local regulations, provisions and standards. Hazards must be identified and suitable countermeasures taken as part of a risk assessment.

When using the MRU measuring devices to measure other devices or systems, the manufacturer's documentation of the system or device manufacturer must be observed.

CAUTION

Non-intended use

The warranty becomes void

- Only use the MRU measuring device for its intended purpose and observe the local regulations, provisions and standards. Only use your MRU measuring device within the limits of use specified in the technical data.
-

2.7 MRU warranty conditions

For the warranty conditions for your analyser, please consult MRU's general terms and conditions.

2.8 Disposal take-back guarantee

MRU undertakes to take back all contaminated parts supplied by us that cannot be disposed of in the "normal" way.

The return delivery must be free of charge for us. Parts containing hazardous substances are: e.g. electrochemical sensors.

2.9 Return of devices

MRU GmbH is obliged to take back all analysers delivered after 13 August 2005 for proper disposal. The device must be returned to MRU with postage prepaid.

2.10 Packaging

Keep the original carton and packing material to avoid damage in transit if you need to return the analyser to the factory.

2.11 Taking back parts containing harmful substances

MRU GmbH undertakes to take back all parts supplied by us that contain hazardous substances and cannot be disposed of in the normal way.

Parts containing hazardous substances are e.g. electrochemical sensors, batteries and accumulators.

The return delivery must be free of charge for MRU.

2.12 The company MRU GmbH



From left to right: Production - Sales, administration and development - Customer service

The measuring device is manufactured by MRU GmbH in Neckarsulm-Obereisesheim, a medium-sized company that has specialised in the development, production and sale of high-quality emission analysis systems since 1984. MRU manufactures both standard types and customised special versions.

3 Notes on device and safety

3.1 Instructions on the safe operation of the device

3.1.1 Visual inspection

Before switching on the device, carry out an overall visual inspection of the device and, where appropriate, the optional attachment parts.

CAUTION

Damaged parts

Unstable operating state

- Do not put the device into operation if it is damaged. Examples of parts which can be damaged by external influences, such as unintentional damage, animal bites or weather influences are:
 - Housing and inspection glass
 - Power supply unit
 - Power supply
 - Gas feed line
- Protect the device from access by unauthorised persons.

3.1.2 Maintenance work

The faultless operation of your device is only guaranteed with the correct maintenance.

CAUTION

Incorrect maintenance

Unreliability of the device during operation

- Only carry out maintenance work and repair work that is described in the operating instructions.
- Only use original spare parts.
- Only operate the device with the power supply unit supplied.
- Do not store the device together with solvents, acids or other aggressive substances.

3.2 Data security

MRU uses internationally available standard transmission systems for data transfer.

Compliance with the local general data protection conditions must be guaranteed and is the responsibility of the user of the device.

The use of electronic safeguarding measures to maintain data security is the responsibility of the system user based on his risk assessment.

3.3 Qualification

The qualification matrix shows the activities during the life cycle of the device. Each activity is assigned a qualification level,

1. Instructed person: The person has been instructed in their task and informed about the risks and involved in carrying it out.
2. Trained specialist: The person has received training that enables them to fulfil their tasks. They are informed about all the risks involved in their work, are able to recognise risks themselves when carrying out their work and have a suitable switching authorisation.
3. You can contact the MRU service for repairs, calibrations, retrofitting and disposal issues.

Qualification \ Activity	Instructed person	Trained specialist	MRU service
Transport	X		
Unpacking	X		
Take measurement results	X		
Adjust settings		X	
Mounting		X	
Commissioning		X	
Routine maintenance		X	
Repair			X
Modification			X
Decommissioning		X	X

Qualification matrix

4 Description of services

4.1 Intended use

The **VARIOLuxx** measuring device is intended for short-term and long-term measurement in the context of emission control measurements.

The measuring device acquires the measured variables and stores them for further processing.

Any other use is **not** in accordance with the intended use. MRU is not liable for this. Any guarantee or warranty is void.

The measuring device is not intended for high oxygen concentrations in excess of 25 Vol%.

Non-compliance with the operating instructions is **not** in accordance with the intended use.

Improper installation and commissioning is **not** in accordance with the intended use.

Improper maintenance or failure to carry out maintenance is **not** in accordance with the intended use.

Modifications to the device are not permitted; retrofitting must be carried out in consultation with MRU.

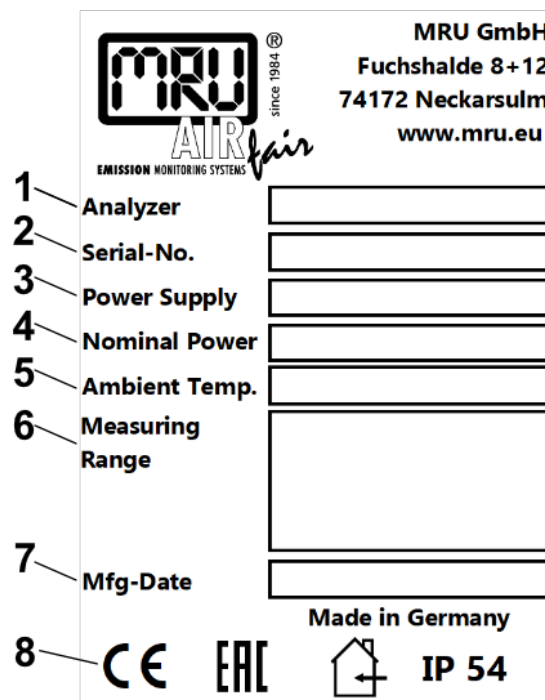
Improper disposal is **not** in accordance with the intended use. Observe the legal regulations of the country in which the device is disposed of.

The device must **not** be used as a safety-determining component whose measurement results could jeopardise the safety of persons, the system or parts thereof.

5 Description of the device

5.1 Typenschild

The respective configuration of your device can be found on the nameplate. This picture shows an example of a nameplate.



Nameplate

#	Description
1	Product name
2	Serial number
3	Power supply
4	Nominal Power
5	Permitted ambient temperature
6	Detectable measuring ranges
7	Manufacturing date
8	Labelling

5.2 Object

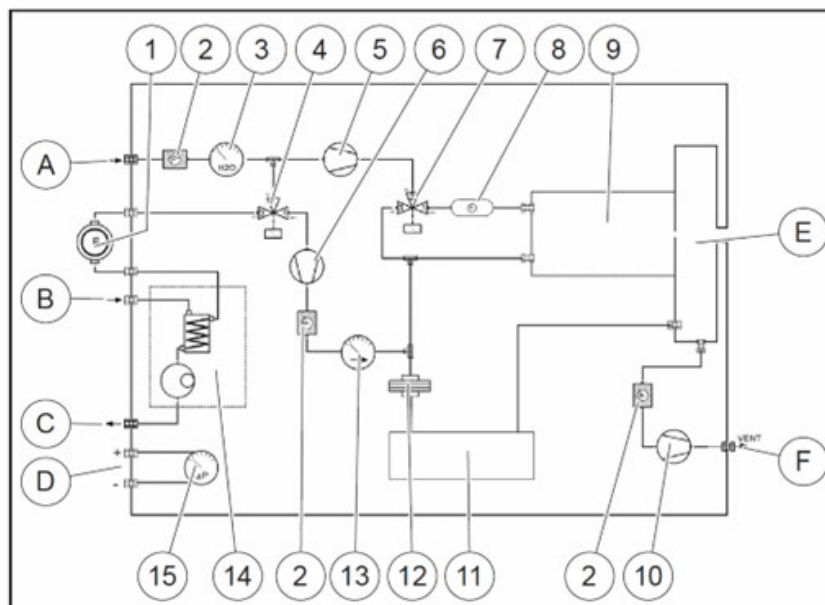
The main object of the measuring device is to analyse flue gases emitted by large combustion plants and exhaust gases emitted by combustion engines.

- i The measuring device is optimised for such measurements and its scope of function encompasses all elements from the gas sampling probe to data processing.
- i The device can also perform other measuring functions including pressure, temperature and flow velocity measurement.

A current overview of the options available can be obtained at **www.mru.eu** or by contacting **MRU Sales**.

5.3 Schematic gas path diagram

The measuring device, in combination with the flue gas probe, takes in a partial volume of the flue gas from the combustion duct and analyses it using sensors (for example electrochemical sensors or infrared measuring banks) to determine its constituent parts. Temperature and, where applicable, pressure (draft) are measured by sensors fitted at the tip of the probe.



Schematic gas path diagram

#	Designation	#	Designation
A	Fresh air inlet	6	Sample gas pump
B	Sample gas inlet	7	Solenoid valve for CO purging
C	Condensate outlet box	8	NOx protective filter
D	Differential pressure connection	9	Chamber for electrochemical sensors
E	Gas outlet box	10	Outlet pump
F	Gas outlet	11	Infrared (NDIR) bank
1	Sample gas filter (PTFE)	12	Acrodisc PTFE filter
2	Dust filter	13	Sample gas flow rate sensor
3	Moisture sensor	14	Gas cooler
4	Solenoid valve for automatic zero point calibration	15	Differential pressure sensor
5	CO purging pump		

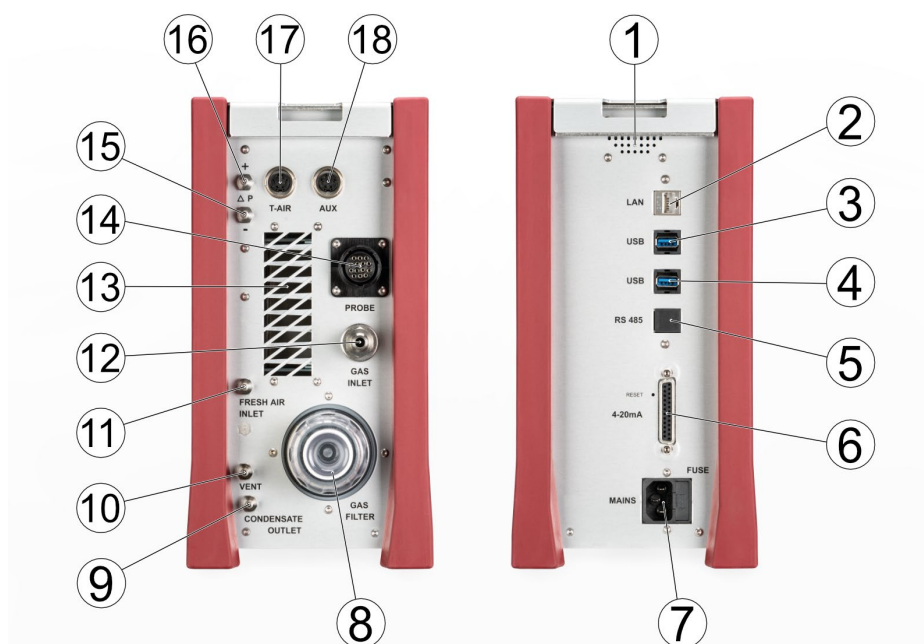
5.4 Measuring device

The measuring device takes the form of a compact and robust metal enclosure with shock-absorbing plastic corners. All electrical and pneumatic connections are located on the front of the device. The measuring device is operated via the touch-sensitive display.



Image of the measuring device

5.5 Connections



Measuring device connections

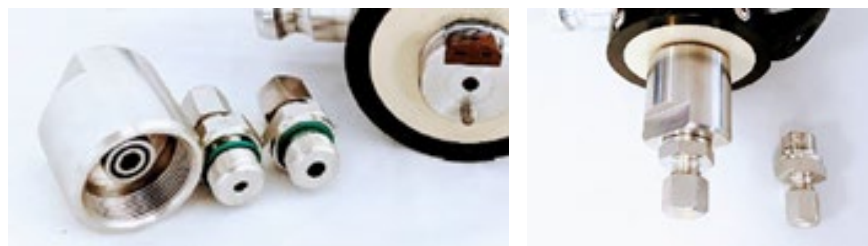
#	Designation	#	Designation
1	Loudspeaker	10	Gas outlet (VENT) hose connection DN 4/6
2	Ethernet (LAN)	11	Fresh air inlet
3	USB socket	12	Sample gas inlet
4	Second USB socket (optional)	13	Gas cooler exhaust air
5	RS485 (optional)	14	Probe connection, electric
6	Analogue outputs 4-20 mA	15	Pressure/differential pressure
7	Mains connection	16	Pressure/differential pressure (absolute pressure)
8	Gas filter	17	Combustion air temperature
9	Condensate outlet hose connection DN 4/6	18	AUX socket

5.6 Probes

Probes of various designs with fixed or interchangeable probe tubes and intended for high or low dust concentrations are offered in combination with the measuring device.

1. For flue gas temperatures up to 800°C (stainless steel)
2. For flue gas temperatures up to 1,100°C (Inconel)
3. For flue gas temperatures up to 1,700°C (Viton, Teflon)
4. With and without heated pre-filter
5. With and without heated gas sampling line
6. Probe tubes in various lengths
7. Probe adapter set HPI
for existing tubes to connect 6 or 8 mm tubes **provided by the client** to the probe handle in place of the supplied MRU probe tube.

i Flue gas temperature is not measured when using the probe adapter.



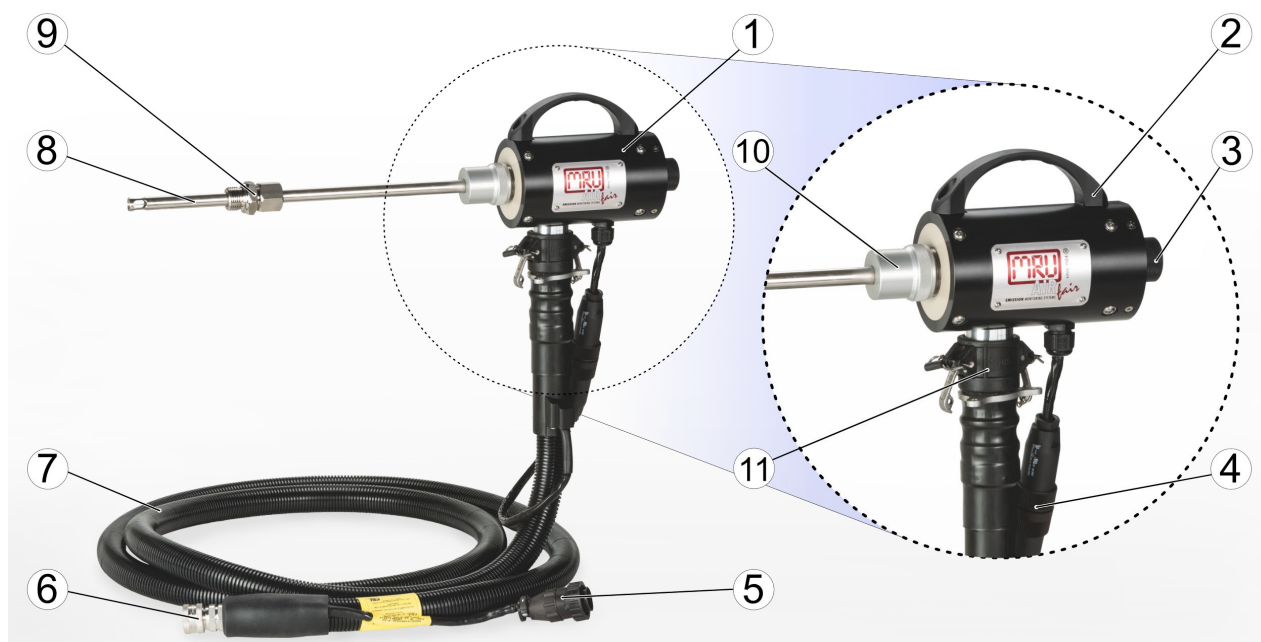
Probe adapter

NOTE

The current MRU price list provides a complete overview.

5.7 Heated gas sampling probe

The heated gas sampling probe is suitable for sampling moist sample gas. The HPI gas sampling probe has an interchangeable probe tube with flue gas temperature measurement, an integral heating element and a replaceable filter element.



Heated gas sampling probe

#	Designation	#	Designation
1	HPI gas sampling probe	7	Heated hose line
2	Probe handle	8	Probe tube
3	Filter lock	9	Probe screw connection
4	Terminal plug (5-pin)	10	Union nut
5	Terminal plug (14-pin)	11	Locking coupling
6	Fast-locking coupling		

NOTE

Heated sample lines are offered in 110 V and 230 V versions. You can operate a 230 V heated sample line at 110 V, but performance will be limited.

► Check the heated sample line power supply before commissioning.

5.8 Unheated gas sampling probe

The unheated gas sampling probe is suitable for sampling dry sample gas that cannot produce any condensation.



Unheated gas sampling probe

#	Designation	#	Designation
1	Filter lock	6	Unheated hose line
2	Locking coupling	7	Probe screw connection
3	Cable connection	8	Probe tube
4	Terminal plug (14-pin)	9	Probe handle
5	Fast-locking coupling		

5.9 Gas preparation

The sample gas drawn in is dried and filtered in the device before being fed to the sensors.

It is dried by a sample gas cooler with a Peltier element. The condensate generated there is pumped by a peristaltic pump to the condensate outlet, where it forms drops.

A hose (DN 4/6) can be connected to drain the condensate. It is also possible to connect an exhaust hose (DN 4/6, no longer than 5 m) at the sample gas outlet.

There is a round filter at the front of the measuring device for subsequent filtering.

5.10 Gas conveyance

The device includes a gas transfer pump (diaphragm pump).

The flow rate through the pump is measured and is controlled by the device to match the setpoint. An alarm is triggered if the pump output is not adequate to achieve the flow rate setpoint.

If the flow rate does not reach the setpoint despite an increase in pump output, the pump is switched off after a set length of time to protect the measuring device.

5.11 Gas sensors

The measuring device has three types of gas sensor:

1. The measuring device operates with **electrochemical sensors** to measure:
 O_2 (oxygen)
CO (carbon monoxide)
NO (nitrogen monoxide)
NO₂ (nitrogen dioxide)
SO₂ (sulphur dioxide)
H₂S (hydrogen sulphide)
2. The measuring device operates with **paramagnetic sensors** to measure:
 O_2 (oxygen)
3. The measuring device operates with a **non-dispersive infrared absorption system (NDIR)** to measure:
CO (carbon monoxide)
CO₂ (carbon dioxide)
CH₄ (methane)
C₃H₈ (propane)
Depending on the NDIR module installed.

6 Installation MRU measuring device

6.1 Unpacking the device



M008

⚠ CAUTION

Weight of the device

Impact and crushing injuries

- Always put the packaged device down safely.
- Unpack the device in a location where you are undisturbed.
- Observe the weight and the dimensions of the device; in case of doubt, lift the device with two persons or use a lifting device.

- ▶ Take the packaged device as closely as possible to the intended point of use of the device.

NOTE

Do not unpack the device in ex zones.

- ▶ Unpack the device. Avoid damaging the filling material.
- ▶ Retain the original packaging so that you can transport the device safely.
- ▶ Check the delivery for completeness.

CAUTION

Falling of the device

Damage to the device

- If the device falls down during use, send the device to the MRU customer service to check the device safety.

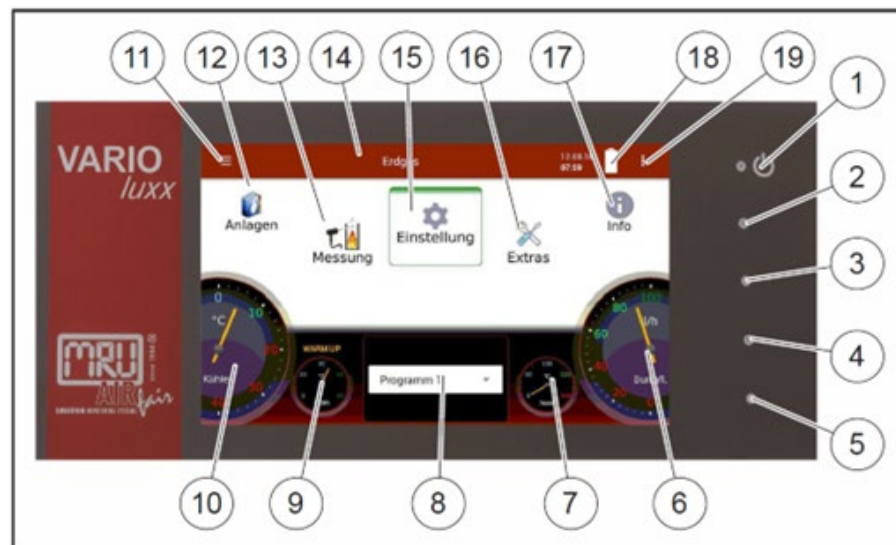
7 Operation

7.1 User interface

All functions are selected using the device touchscreen.

The touchscreen is operated and navigated by swiping with a fingertip. The various menus and windows have their own submenus for this purpose.

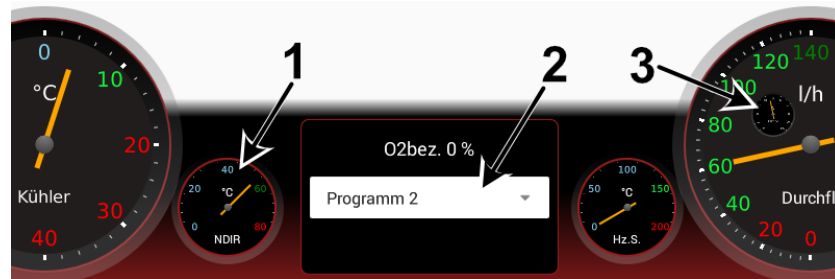
7.1.1 User interface layout



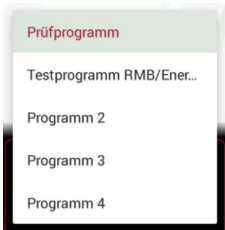
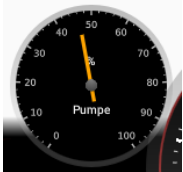
Measuring device user interface

#	Designation	#	Designation
1	Switch On/Off and Reset	11	Device information
2	Reserve	12	Plants menu
3	LED display for automatic device start-up	13	Measurement menu
4	LED display for mains operation/battery charging mode	14	Status indicator
5	Reserve	15	Settings menu
6	Current sample gas flow rate	16	Extras menu
7	Current heated sample line temperature	17	Info menu
8	Selected measurement program	18	Battery charge indicator
9	Current infrared measuring system temperature	19	Context menu
10	Current gas cooler temperature		

7.1.2 Additional display elements



Additional measuring device display elements

#	Designation
1	Analogue clock ▶ Tap twice on the display element. ✓ The analogue clock appears.  <i>Analogue clock</i>
2	Changing measurement program ▶ Tap on the display element. ✓ A selection list appears.  <i>Measurement program selection list</i> ▶ Select the required measurement program. ✓ The required measurement program is enabled.
3	Pump utilisation ▶ Tap twice on the display element. ✓ The display element is enlarged.  <i>Pump utilisation</i>

7.1.3 Status indicator

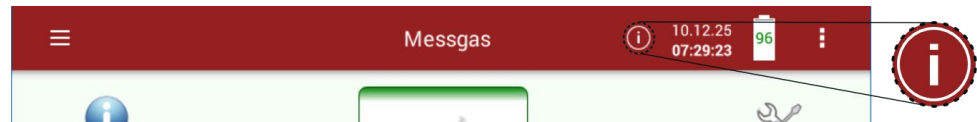
The status indicator provides information about the status of the plant. Symbols representing the current status are displayed.

Symbol	Explanation
	Logging in progress Measurement logging is currently in progress, see p.119 - Measuring.
	Interval measurement An interval measurement is currently in progress, see p. 54 - Interval measurement.
	Gas cooler cooling down, see p. 93 - Commissioning the measuring device.
	Data being copied to USB, see p. 146 - Internal logger.
	Condensate alarm The condensate alarm has been triggered, see p. 168 - Condensate alarm.
	Battery charge state
	Information about WLAN connection, see p. 65 - WLAN (WiFi connection)
	Time remaining until zero point calibration is complete
	Stored zero point The measuring device continues to operate with the stored zero point when switched on, see p. 47 - Device settings.
	Contaminated ambient air Zero point calibration is extended due to contaminated air, see p.103 - Checking the operating temperature.

7.1.4 Information window

The information window shows the history of the measuring device and the time of the next scheduled zero point, see also p.47 - Device settings.

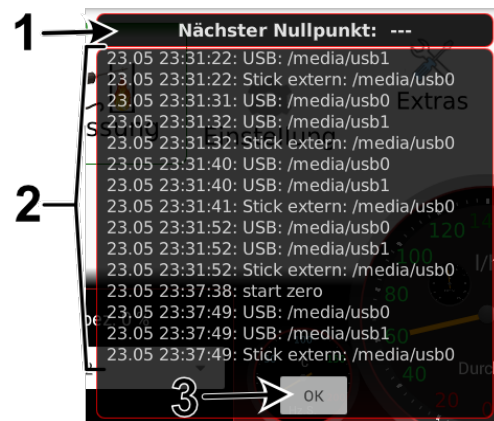
The information window can be called from any menu using the Info button .



Info button

▶ Tap on .

✓ The information window is displayed.



Information window

#	Designation
1	Next scheduled zero point  If there is no next scheduled zero point, the display shows ---.
2	Measuring device history
3	Close information window ▶ Tap on OK. ✓ The information window is closed.

7.2 Charging the device battery

The measuring device has an integral device battery.

- ▶ Connect the mains plug.
- ✓ The LED display for mains operation/battery charging mode (4) lights up blue as soon as the measuring device is connected to mains power.
- ✓ Battery charging is in progress.
 - ⓘ Charge the device battery for at least 8 hours on initial commissioning.

NOTE

The measuring device can only be used for limited purposes in battery operation mode.

1. Perform only data processing and configuration tasks in battery operation mode.
2. Never perform measurements in battery operation mode.

7.3 Switching on the measuring device

- ▶ Press the  button for at least 3 seconds.
- ✓ The LED lights up blue.
- ▶ Release the  button.
- ✓ The measuring device starts up.

7.4 Switching off the measuring device

There are two ways to switch off the measuring device:

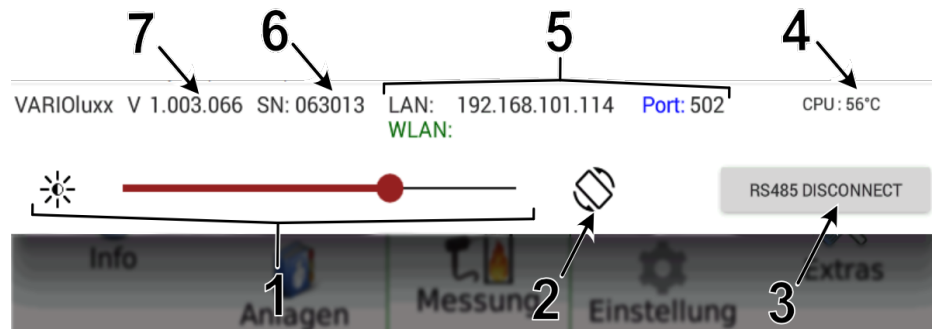
- ▶ Tap on **Switch off device** in the context menu  (19)
or
- ▶ Press the  button until a dialogue window appears.
- ✓ A dialogue window appears.
- ▶ Confirm with **YES**.
- ✓ The measuring device is shut down.

7.5 Display settings

Use **Display settings** to change the orientation and brightness of the display. Various device details are also displayed here.

▶ Tap on **Display settings** in the context menu  (19)

✓ The display settings are displayed.



Display settings

#	Designation
1	Change brightness ▶ Move the slider right/left to increase/decrease the brightness. ✓ The brightness is adjusted.
2	Rotate display ▶ Tap on  . ✓ The display rotates.
3	RS485 DISCONNECT
4	CPU temperature
5	LAN and WLAN IP and port used, see also p. 62 - Network settings
6	Device serial number
7	Device firmware version

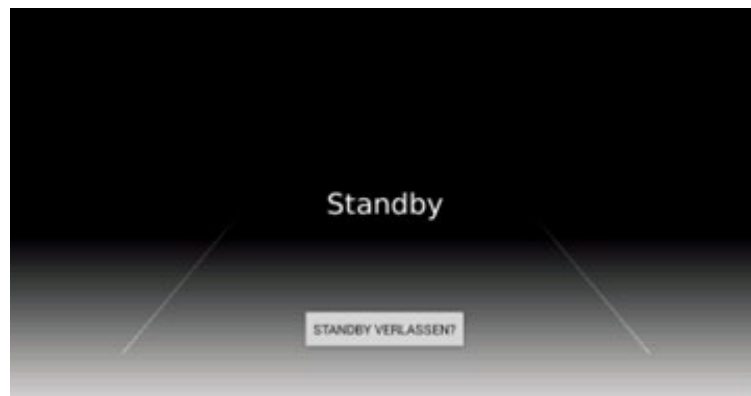
7.6 Standby mode

Standby mode reduces wear on the measuring device. Measurements cannot be performed in standby mode. Active components such as pumps and gas coolers are switched off where possible. This can extend the available operating time in battery mode.

Note that NDIR is not switched off. The measuring device is started up again when you exit standby mode. The measuring device displays a message explaining that it may be advisable to perform zero point calibration.

7.6.1 Putting the measuring device into standby mode

- ▶ Tap on **STANDBY** in the context menu  (19)
- ✓ A message appears.
- ▶ Confirm with **YES**.
- ✓ The sensors are purged.
- ✓ The measuring device is put into standby mode.

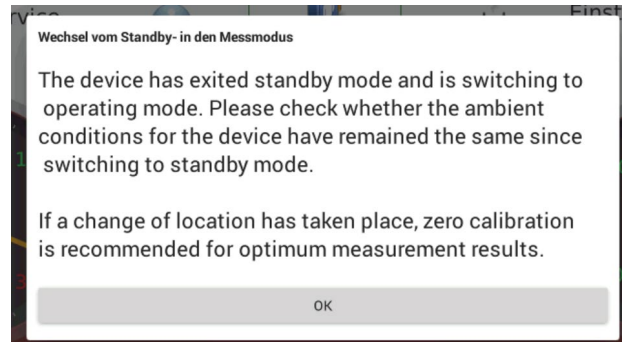


Standby screen

7.6.2 Exiting standby mode

- ▶ Tap on **EXIT STANDBY?**
- ✓ A message appears.
- ▶ Confirm with **JA**.

- ✓ A message appears.



Zero point calibration recommendation after standby

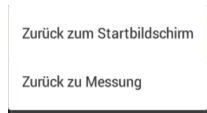
- ▶ Confirm with **OK**.
- ✓ The device is brought back into an operational state.
 - i Where appropriate, check the zero point before the next measurement.

7.7 Back to start screen or measurement

Once the Back button is displayed, you can jump straight back to the start screen or to measurement from any window.

▶ Press on  for one second.

✓ A selection list appears.



Back selection list

▶ Select **Back to start screen**

or

▶ Select **Back to measurement**

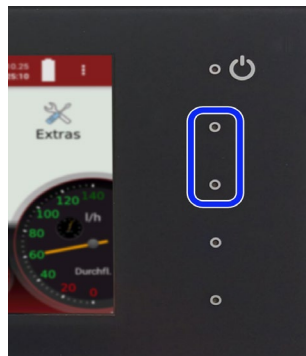
✓ You are returned to the requested point.

7.8 Acquiring screenshots

You can acquire screenshots and save them to a USB stick.

▶ Insert a USB stick into the measuring device.

▶ Press and hold **button 2** and **button 3** simultaneously for 3 seconds.



Acquiring a screenshot

✓ The **Screenshots** folder is created on the USB stick and the screenshot is saved to it in PNG format.

7.9 Controlling the measuring device remotely via VNC

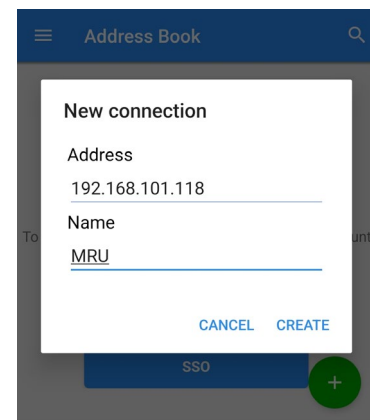
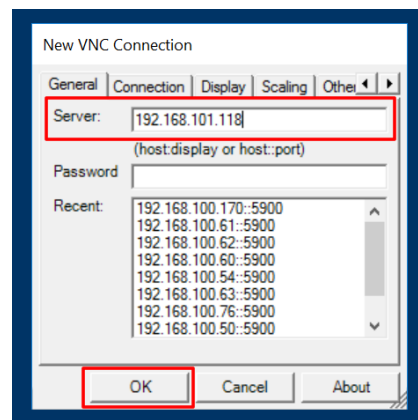
You can control the measuring device remotely from a Windows-PC or an Android smartphone or tablet via VNC.

NOTE

Ensure VNC connection is enabled in the device settings.

Further information in chapter Device settings on page 47

- ▶ Using a network cable or WLAN, connect the measuring device to the network to which your PC or smartphone/tablet is connected, see also p. Further information in chapter Network settings on page 62.
- ▶ Download and open the software you wish to use for VNC access to your device.



General examples of VNC software

- ▶ Under **Server** or **Address**, enter the **IP address** of your measuring device and confirm with **OK**.
 - ❗ You can find the IP address of the measuring device under **Display properties**, see also p. Further information in chapter Display settings on page 37
- ✓ You can now control the measuring device remotely via VNC.



VNC remote control via Windows-PC



VNC remote control via smartphone

NOTE

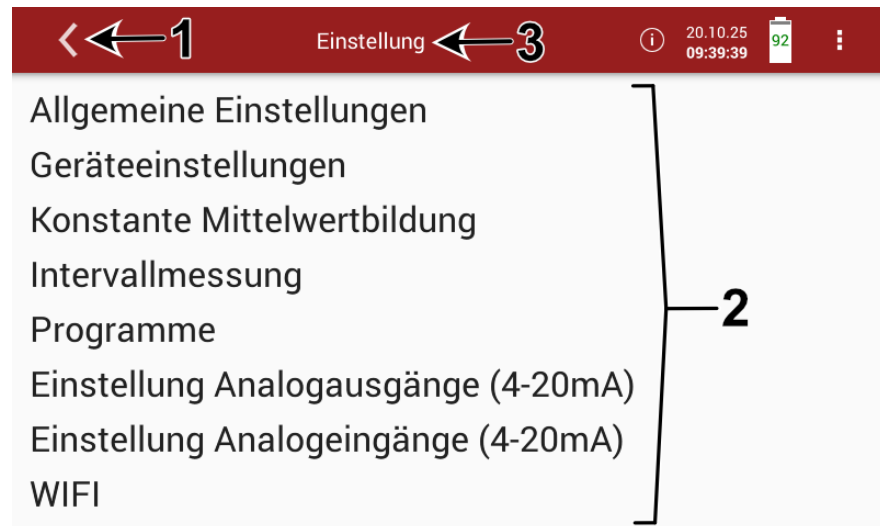
The CPU temperature of the measuring device will rise due to the increased computing power required. The VNC server will switch off automatically if the temperature rises too high.

8 Settings

8.1 Settings menu

▶ Select **SETTINGS** from the **Home** menu.

✓ The Settings menu opens.



Settings menu

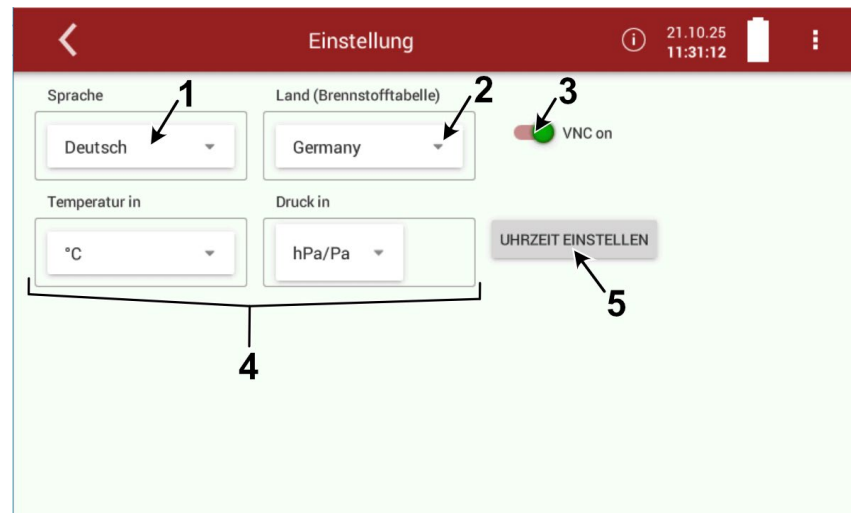
#	Description
1	Back ▶ Tap on ⏮ . You are returned to the Home menu.
2	Settings menu submenu items
3	Settings menu

8.2 General settings

Use the **General settings** menu option to change the device language, the country (fuel table), the units for temperature and pressure, and the time, and to switch VNC on/off.

▶ Select **GENERAL SETTINGS** from the **Settings** menu.

✓ A selection window appears.



General settings

#	Description
1	Change language ▶ Tap on Language. ✓ A selection list appears. ▶ Select the required language. ✓ The required language for the measuring device is selected.

2	Change country (fuel table) ▶ Tap on country (fuel table) ✓ A selection list appears. ▶ Select the required country. ✓ The specifications for the chosen country are set. - i Changing the country automatically sets country-specific specifications, defaults and measuring procedures. ▶ Ensure that the country selected is the country in which measurement is to be performed to ensure the measuring device is configured to comply with all relevant country-specific regulations.
3	VNC On/Off ▶ Tap on VNC ✓ VNC is switched on/off.  VNC on  VNC off - i VNC Viewer is used to control the measuring device remotely.
4	Change units ▶ Tap on the unit to be changed. ✓ A selection list appears. ▶ Select the unit required. ✓ The unit is changed.

5

Setting the time

▶ Tap on **SET TIME**.

✓ An input window appears.

The screenshot shows the 'Einstellung' (Settings) app interface. At the top, there is a red header bar with a back arrow, the title 'Einstellung', a Wi-Fi icon, a status bar showing '19.05.21 07:31', and a battery icon. Below the header, there are two input fields: 'Zeit' (Time) and 'Datum' (Date). The 'Zeit' field has three rows of numbers: 06, 07, and 08, with a colon and 30, 31, and 32. The 'Datum' field has three rows of numbers: 18, 19, and 20, with a dot and 04, 05, and 06, and a dot and 20, 21, and 22. At the bottom right of the input fields, there is a button labeled 'ÜBERNEHMEN' (Apply).

▶ Set the required time and date.

▶ Tap on **APPLY**.

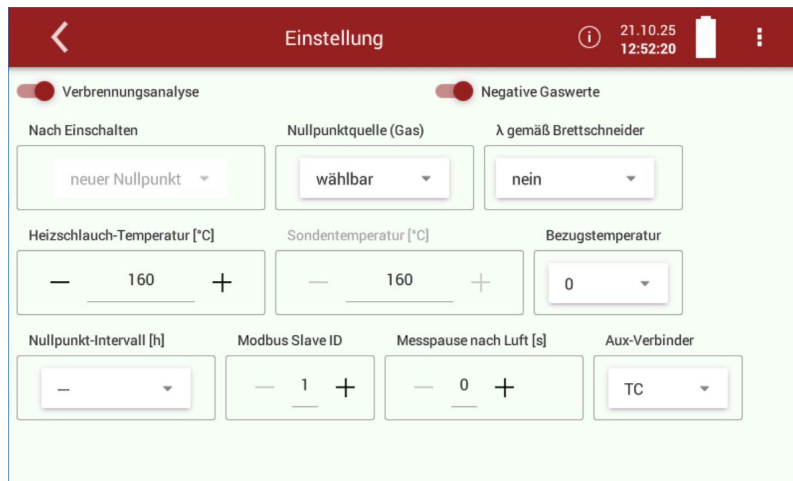
✓ The display is updated to show the required time and date.

i The time is updated automatically if the measuring device is connected to a network with internet access.

8.3 Device settings

▶ Select **DEVICE SETTINGS** from the **Settings menu**.

✓ A selection window appears.



Connecting the device

Adjustment	Range	Explanation
Combustion analysis	On/Off	Additional measured values (for example lambda, dew point, efficiency, heat loss) can be displayed if combustion analysis is switched on.
Negative gas values	On/Off	Negative gas values, which can occur as a result of temperature drift affecting a sensor, for example, are suppressed (depicted or displayed as zero).
After switch-on	New zero point/stored zero point	New zero point when device starts or last valid zero point used. See Using the last valid zero point on the following page.
Zero point source (gas)	Fresh air intake/from selection	Setting indicating which source is to be used to draw in zero point gas for zero point measurement. i The first zero point calibration after switch-on is always performed using the fresh air intake.
λ per Brettschneider method	Yes/No	Calculation of the combustion ratio (λ lambda) using the Brettschneider method
Heated sample line temperature	80°C - 200°C 176°F - 392°F	See the Setting the heated sample line and probe temperatures chapter on the following pages.
Probe temperature	120°C - 200°C 250°F - 392°F	See the Setting the heated sample line and probe temperatures chapter on the following pages.

Reference temperature	0 / 15 / 25	Calculation of the values for normal conditions at the reference temperature
Zero point interval [h]	0.5h – 7d	See Zero point interval chapter on the following page.
Modbus slave ID		Modbus address of the device for remote access via Modbus
Measurement pause after air		The analogue outputs continue to show the last value for the set length of time after zero point calibration.  The value at the time of the first zero point calibration is 2 mA.
Aux connector		Analogue input for TC, RS485

8.3.1 Using the last valid zero point

You can configure the measuring device either to establish a new zero point when it switches on or to continue operating with the last valid zero point.

 Tap on **After switch-on**.

✓ A selection list appears.

 Select the required option.

Option	Function
New zero point	A new zero point is established on switch-on.
Stored zero point	The device continues to operate with the last valid zero point when switched on.  The zero point bar in this case is orange. 

✓ The required option is applied.

NOTE

A zero point calibration step is performed for the O₂ sensor after every switch-on irrespective of this setting.

8.3.2 Zero point interval

It is possible to set zero point intervals.

The measuring device performs a zero point calibration automatically within the set time interval.

▶ Tap on **Zero point interval**

✓ A selection list appears.

▶ Set the required interval [h].

✓ The measuring device captures a new zero point within the time interval.

NOTE

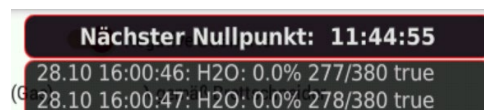
A manually initiated zero point calibration creates a new reference point for timing. Example:

You have set a zero point interval of 4h. The last automatic zero point calibration took place at 2 p.m. The next automatic zero point calibration would be at 6 p.m.. A manually initiated zero point calibration is performed at 4 p.m. This creates a new reference point for timing and the time interval is restarted. The next automatic zero point calibration would then be at 8 p.m..

The time of the next automatic zero point calibration is shown in the information window ⓘ.

▶ Tap on ⓘ.

✓ The information window is displayed.



Time of the next automatic zero point calibration

ⓘ If automatic zero point calibration is not enabled, --- is displayed instead.

8.3.3 Setting the heated sample line and probe temperatures

You can set the temperature of the heated sample line and the probe.

Heizschlauch-Temperatur [°C]	Sondentemperatur [°C]
— 160 +	— 160 +

Heated sample line and probe temperature settings

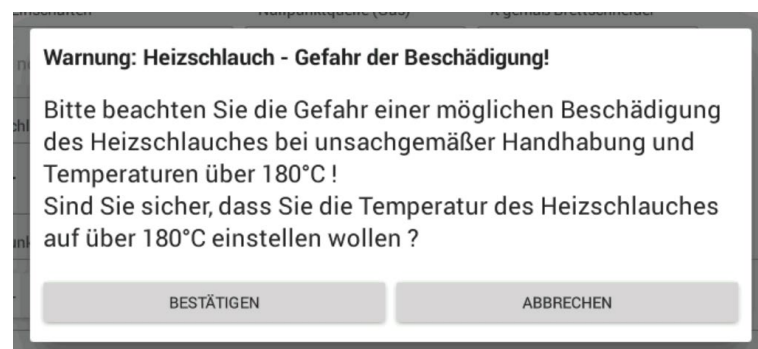
▶ Tap on + or – to set the required temperature.

✓ The chosen temperature is set.

NOTE

There is a risk of damage to the heated sample line at temperatures above 180°C. A corresponding message appears on the display.

Further information in chapter Checking the operating temperature on page 103



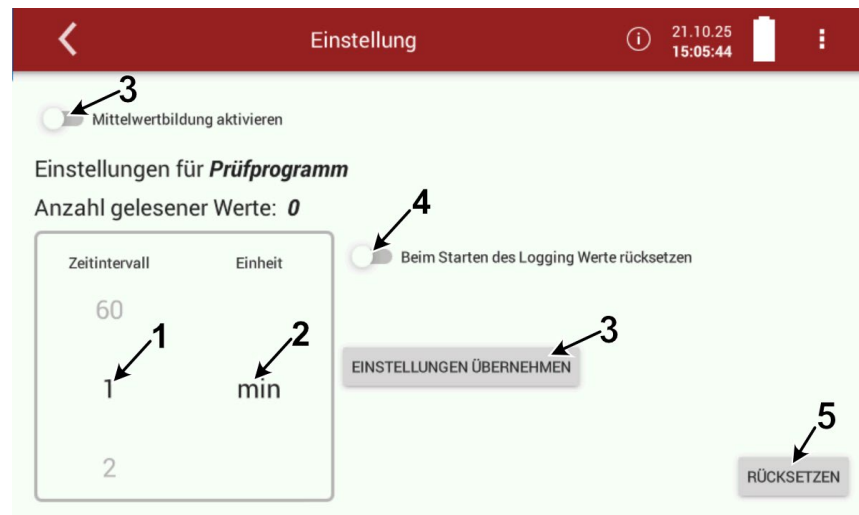
Warning if temperature above 180°C is set

8.4 Continuous averaging

You can configure the measuring device to calculate an average continuously.

▶ Select **CONTINUOUS AVERAGING** from the **Settings menu**.

✓ A selection window appears.



Continuous averaging

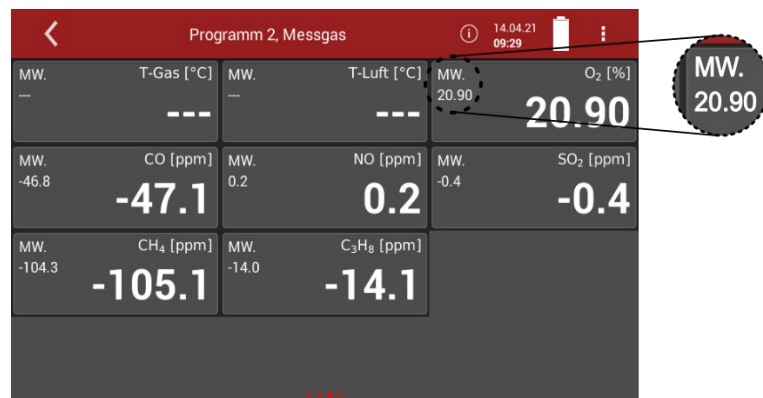
#	Designation
1	Select time unit ▶ Select the required time unit. i You have a choice of minutes [m] and seconds [s].
2	Select time interval ▶ Select the required time interval.

3	Enable/disable averaging ▶ Tap on Enable averaging ✓ Averaging is enabled/disabled Start averaging: ▶ Set the required time unit and time interval. ▶ Tap on APPLY SETTING. ▶ Enable averaging. ✓ Averaging begins. ✓ The number of values read is incremented in line with the time interval set. ✓ The number of values read remains constant once the set time interval has elapsed.
4	Reset values on start of logging ▶ Tap on Reset values on start of logging. ✓ Reset is enabled/disabled  If this function is enabled, the mean values are reset when logging begins.
5	Reset values ▶ Tap on RESET. ✓ The values are reset.
6	Statuses  enabled  disabled

NOTE

Mean values are not exported as part of a CSV export. Mean values can be displayed during logging to check a measurement for plausibility.

Mean values are displayed in the measurement window when continuous averaging is enabled.



Programm 2, Messgas							
MW.	T-Gas [°C]	MW.	T-Luft [°C]	MW.	O ₂ [%]		
---	---	---	---	20.90	20.90		
MW.	CO [ppm]	MW.	NO [ppm]	MW.	SO ₂ [ppm]		
-46.8	-47.1	0.2	0.2	-0.4	-0.4		
MW.	CH ₄ [ppm]	MW.	C ₃ H ₈ [ppm]				
-104.3	-105.1	-14.0	-14.1				

Measurement window with continuous averaging enabled

Note that mean values are displayed directly in the measured value window even if the set time interval has not yet elapsed.

The mean value in this case will be calculated from the number of values read so far. The mean value is recalculated continuously once the set time interval has elapsed, with the first value read in each case being replaced by the current value read.

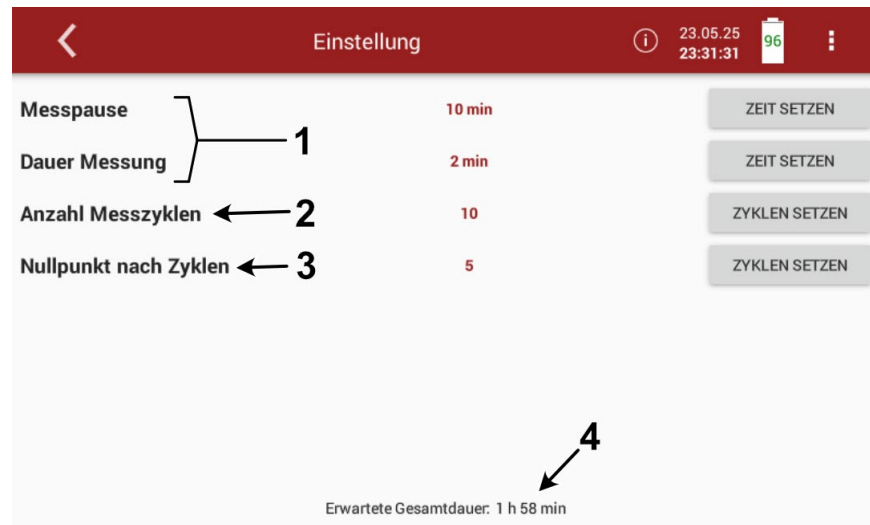
8.5 Interval measurement

You have the option to perform interval measurement. You can set the measurement duration, the standby duration, the number of measuring cycles, and the number of measuring cycles before a new zero point is determined.

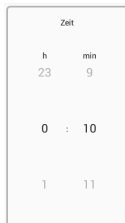
The measuring device is put into standby mode between intervals.

▶ Select **INTERVAL MEASUREMENT** from the **Settings** menu.

✓ A selection window appears.

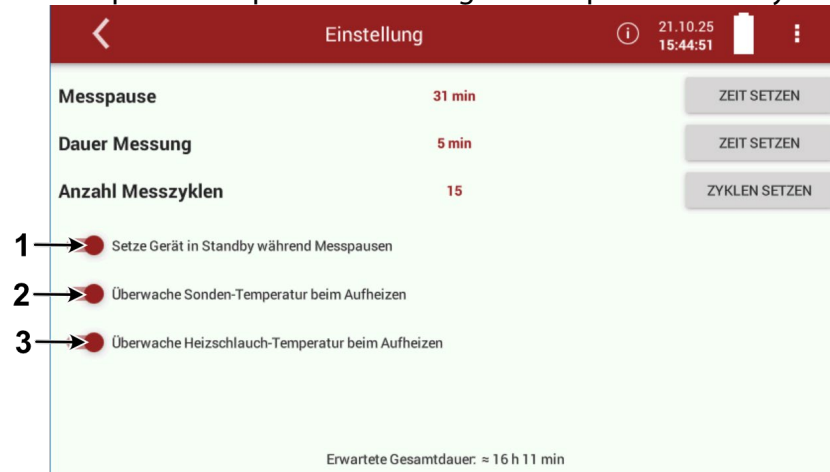


Interval measurement

#	Designation
1	Set the measurement pause duration and the measurement duration ▶ Tap on SET TIME. ✓ An input window appears.  ▶ Select the required time. ✓ The relevant time is applied. i If the set measurement pause duration is longer than 30 minutes, the Device in standby mode in measurement pauses option appears.

2	Set the number of measuring cycles ▶ Tap on SET CYCLES. ✓ An input window appears.  <i>Set cycles</i> ▶ Select the required number. The number of measuring cycles is set.
3	Set zero point after measuring cycles ▶ Tap on SET CYCLES. ✓ An input window appears.  <i>Set cycles</i> ▶ Select the required number. The number of measuring cycles is set. i Zero point after cycles specifies the number of measuring cycles completed before a new zero point is determined.
4	Expected total duration of interval measurement i The expected total duration comprises the set number and duration of measurements, the set number and duration of standbys and, where applicable, the set number and duration of zero point calibration processes.

If the set measurement pause duration is longer than 30 minutes, the **Device in standby mode in measurement pauses** option appears. If standby is enabled, there is also the option to monitor the heated sample line and probe temperatures during warm-up after standby.



Interval measurement with set measurement pause over 30 minutes

#	Designation
1	Device in standby mode during measurement pauses ☐ Tap on Device in standby mode during measurement pauses . ☒ The function is enabled/disabled. ☐ If this function is enabled, the Monitor probe temperature on warm-up and Monitor heated sample line temperature on warm-up functions appear.
2	Monitor probe temperature on warm-up ☐ Tap on Monitor probe temperature on warm-up . ☒ The function is enabled/disabled.
3	Monitor heated sample line temperature on warm-up ☐ Tap on Monitor heated sample line temperature on warm-up . ☒ The function is enabled/disabled.
	Statuses ☒ enabled ☐ disabled

8.6 Configuring the analogue outputs (4-20 mA)

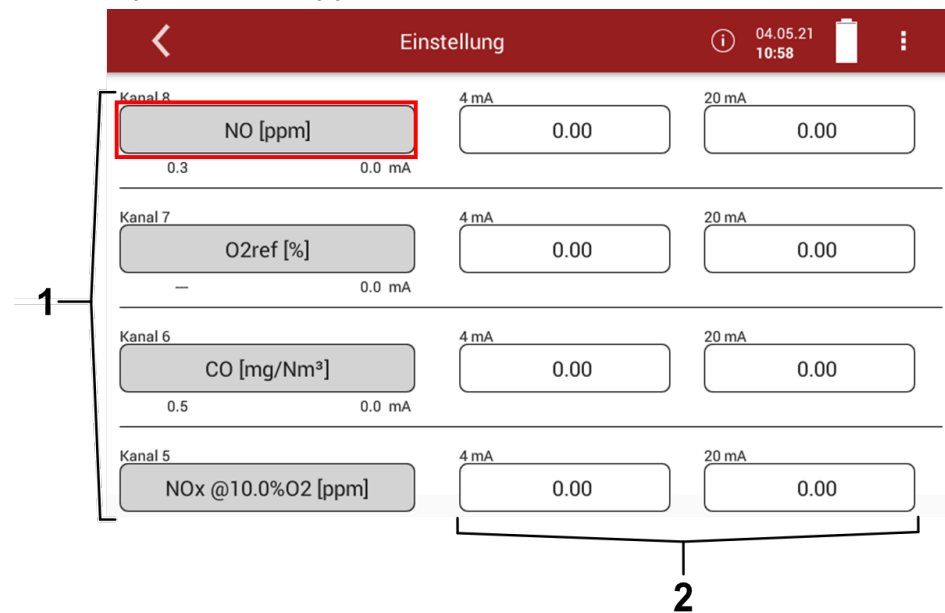
There are 8 analogue outputs available (4-20 mA).

Each analogue output (channel) has a measured variable and an output range assigned to it.

8.6.1 Configuring channel and lower/upper limits

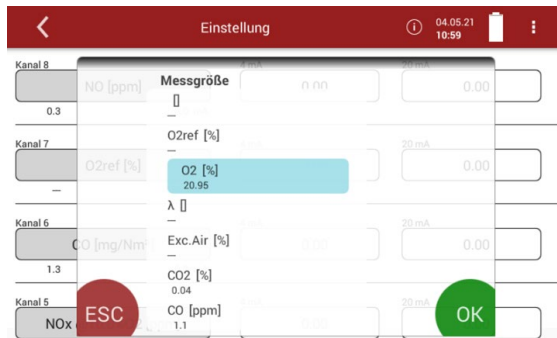
☐ Select ANALOGUE OUTPUTS (4-20 mA) from the **Settings** menu.

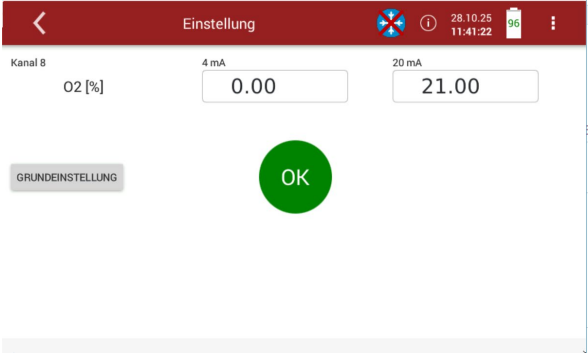
✓ An input window appears.



Kanal	Messgröße	4 mA	20 mA
Kanal 8	NO [ppm] 0.3 0.0 mA	0.00	0.00
Kanal 7	O2ref [%] — 0.0 mA	0.00	0.00
Kanal 6	CO [mg/Nm³] 0.5 0.0 mA	0.00	0.00
Kanal 5	NOx @10.0%O2 [ppm]	0.00	0.00

Analogue output configuration

#	Designation
1	Select measured variable ☐ Select the required channel. ✓ A selection list appears.  <i>Select measured variable</i> ☐ Select the required measured variable.

	☐ Confirm with OK. ✓ The measured variable is assigned to the chosen channel.
2	Set lower/upper limit ☐ Tap on the 4 mA field or the 20 mA field for the chosen channel. ✓ An input window appears.  <i>Setting limits</i> ☐ Enter the required values for the lower and upper limits. ☐ Confirm with OK. ✓ The values for the lower and upper limits are assigned to the chosen channel. or ☐ Tap on BASIC SETTINGS to restore the preset values for the lower and upper limits. ✓ The preset values for the lower and upper limits are assigned to the chosen channel.

NOTE**Set lower limit (4 mA)**

This setting specifies the lower range value, corresponding to 4 mA. If the measured value drops below the value set, the analogue output remains at 4 mA.

Set upper limit (20 mA)

This setting specifies the upper range value, corresponding to 20 mA. If the measured value rises beyond the value set, the analogue output remains at 20 mA.

8.6.2 Configuring analogue output behaviour during zero point calibration

Zero point calibration begins automatically. An indication appears on the display. The time remaining to the end of zero point calibration is also displayed. You can configure how the measuring device is to behave during zero point calibration under **DURING ZERO POINT CALIBRATION**.



During zero point calibration

- ▶ Select **ANALOGUE OUTPUTS (4-20 MA)** from the **Settings menu**.
- ✓ An input window appears.
- ▶ Scroll down to **DURING ZERO POINT CALIBRATION**.

▶ Select the required option:

Option	Behaviour of the analogue outputs
Freeze	The outputs retain the last value prior to zero point calibration during the zero point calibration process.
2 mA	The outputs output a value of 2 mA during zero point calibration so that the values during zero point calibration do not affect the analysis.

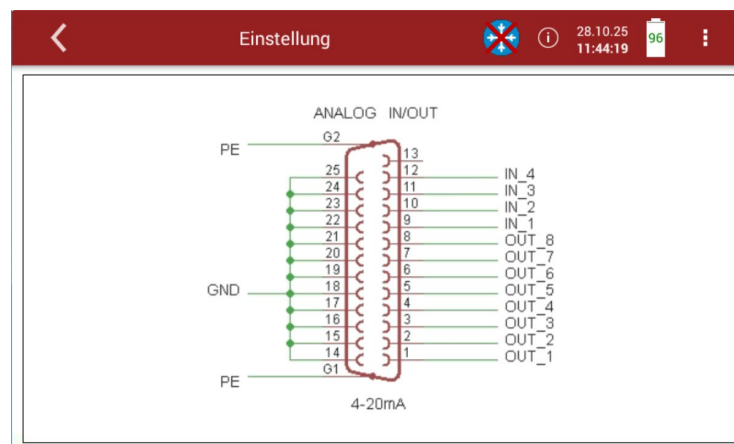
✓ The setting is saved.

8.6.3 Pin assignment of 4-20 mA interface (inputs and outputs)

▶ Select **ANALOGUE OUTPUTS (4-20 MA)** from the **Settings** menu.

✓ An input window appears.

▶ Scroll down to the diagram showing the pin assignment for the 4-20 mA interface.



Pin assignment diagram

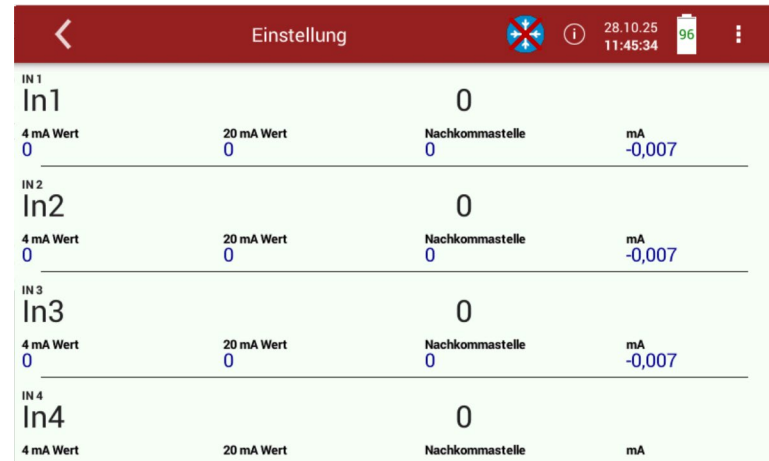
8.6.4 Configuring the analogue inputs (4-20 mA)

There are four analogue inputs available (4-20 mA).

Each analogue input (channel) has a measured variable and an output range assigned to it.

▶ Select **ANALOGUE INPUTS (4-20 MA)** from the **Settings** menu.

✓ An input window appears.

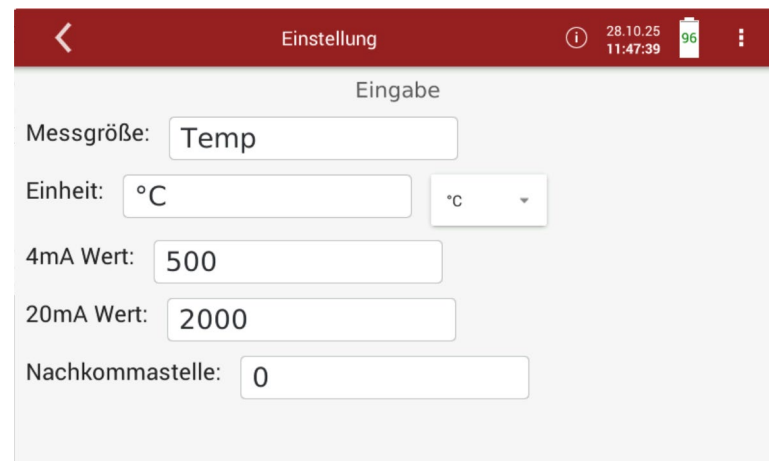


Channel	4 mA Wert	20 mA Wert	Nachkommastelle	Output Range
In1	0	0	0	-0,007
In2	0	0	0	-0,007
In3	0	0	0	-0,007
In4	0	0	0	-0,007

View of analogue inputs

▶ Select the required channel.

✓ An input window appears.



Parameter	Value
Messgröße	Temp
Einheit	°C
4mA Wert	500
20mA Wert	2000
Nachkommastelle	0

Analogue input configuration

▶ Enter the required values.

▶ Tap on **⏮** to return to the previous menu option.

✓ The values appear in the selection list.

✓ The incoming measured variable is displayed.

8.7 Network settings

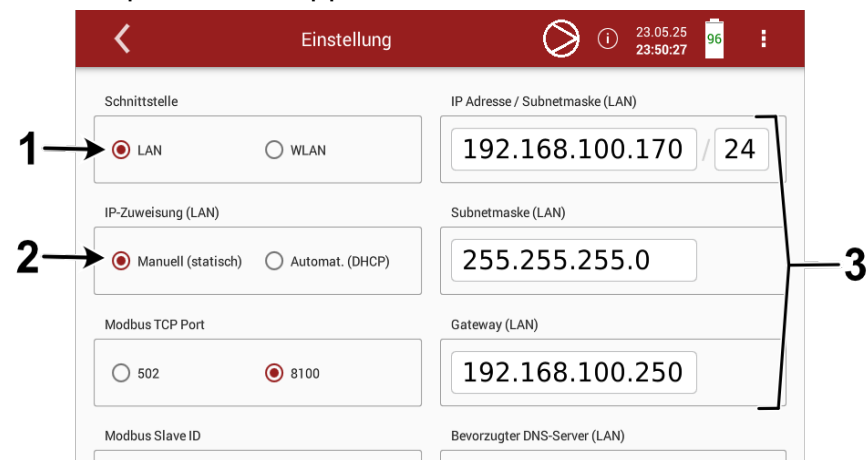
This menu enables you to adjust the **network** (LAN and WLAN) and **Modbus settings**.

You can select an active WLAN in the **WLAN menu**, see also p.65 - WLAN (WiFi connection).

8.7.1 LAN and WLAN settings

▶ Select **NETWORK** from the **Settings menu**.

✓ An input window appears.



LAN and WLAN settings

#	Designation
1	Interface You can establish a connection via LAN or WLAN . ▶ Select the required interface. ✓ The page settings are updated.
2	IP assignment ▶ Select whether IP assignment is to be manual (static) or automatic (DHCP). ✓ The IP is assigned accordingly.
	Statuses ☒ Selected ☐ Not selected

3	You can assign a static IP address via Ethernet or WLAN. ▶ Select Manual (static) for IP assignment (2). ▶ The input fields for IP address/subnet mask, Gateway and Primary DNS are unlocked. ▶ Enter the required values. i If Automatic IP assignment (DHCP) is configured, the input fields for IP address/subnet mask, gateway and primary DNS are locked and you cannot assign a static IP address.
---	--

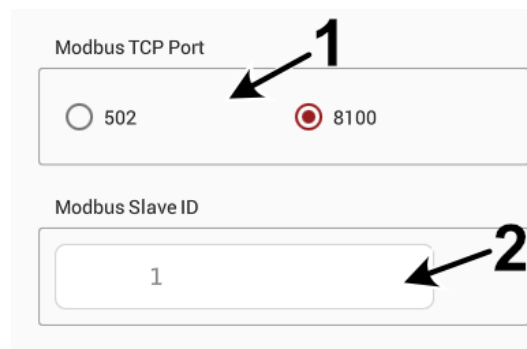
8.7.2 Modbus settings

This menu is used to adjust the Modbus settings (**TCP port** and **Slave ID**).

NOTE

Use the TCP port available in your network for Modbus connection.
Connection with MRU4Win is possible with both TCP ports.

i Scroll down to access the Modbus settings.



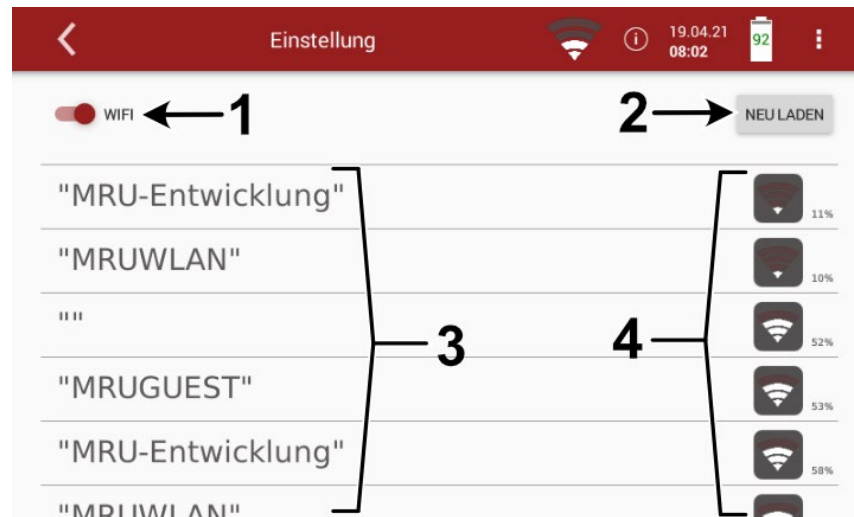
Modbus settings

#	Designation
1	Modbus TCP port You can establish a connection via TCP port 502 or TCP port 8100 . ☐ Select the required port. ✓ The page settings are updated.
2	Modbus slave ID Specification of the Modbus address of the device for remote access via Modbus ☐ Select the required ID. ✓ The ID is assigned accordingly.
	Statuses ☒ Selected ☐ Not selected

8.8 WLAN (WiFi connection)

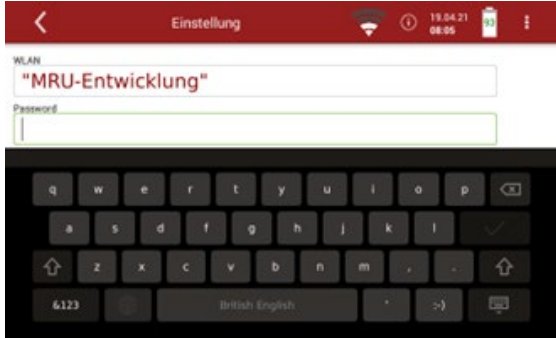
8.8.1 Connecting the measuring device via WLAN

- ▶ Insert a WLAN stick into the USB port.
- ▶ Select **WLAN** from the **Settings** menu.
- ✓ A selection window appears.



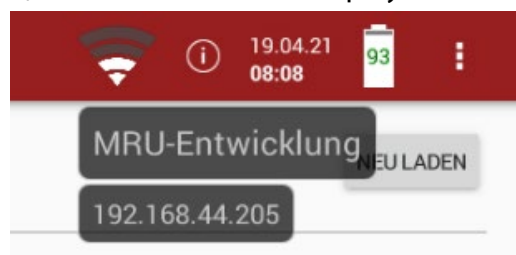
WLAN settings

#	Designation
1	Switch WiFi (WLAN) on/off ▶ Tap on WIFI to switch WiFi on/off.  WiFi on  WiFi off ✓ WiFi (WLAN) is switched on/off  Additional buttons appear when WiFi is switched on.
2	Reload WLAN connections ▶ Tap on RELOAD ✓ WLAN connections are reloaded.  Tap on RELOAD if no WLAN connections are displayed.

3	Display of available WLAN connections ▶ Tap on the required WLAN connection. ✓ An input window appears.  <i>WLAN password input window</i> ▶ Enter the WLAN password. ▶ Confirm with OK. ✓ The connection to the WLAN is established. ✓ A WLAN symbol  appears on the display.
4	Signal strength

8.8.2 Displaying information about the WLAN connection

- ▶ Tap on the WLAN symbol  to view the name of the network and the assigned IP address.
- ✓ The information is displayed.



WLAN information

- i** The IP address displayed (in this instance 192.168.44.205) is needed if the measuring device is to be used with **MRU4Win**, for example.

8.9 Factory settings

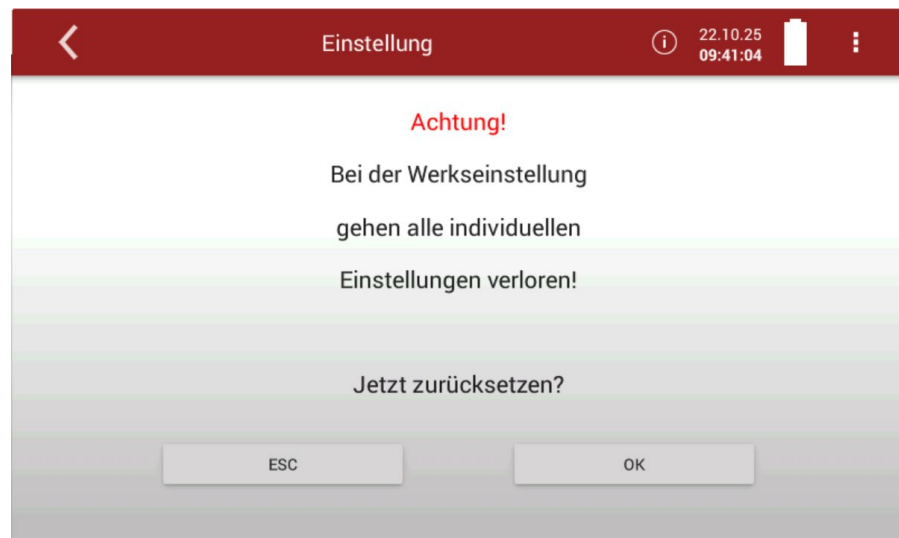
You can reset the measuring device to the factory settings.

NOTE

Resetting the measuring device to the factory settings will cause all custom settings to be lost.

▶ Select **FACTORY SETTINGS** from the **Settings menu**.

✓ A window appears.



Reset to factory settings

▶ Select **OK**.

✓ The measuring device is reset.

9 Managing plant master data and Extras

9.1 Data memory

Plants can be stored in the data memory with uniquely assigned data and measured values. Each plant consists of a unique plant number and twelve lines of text that can be used as required, for example for the plant address and customer name.

NOTE

We recommend creating a plant when preparing to perform a measurement for a customer so that the measured values acquired can be assigned to a plant straight away.

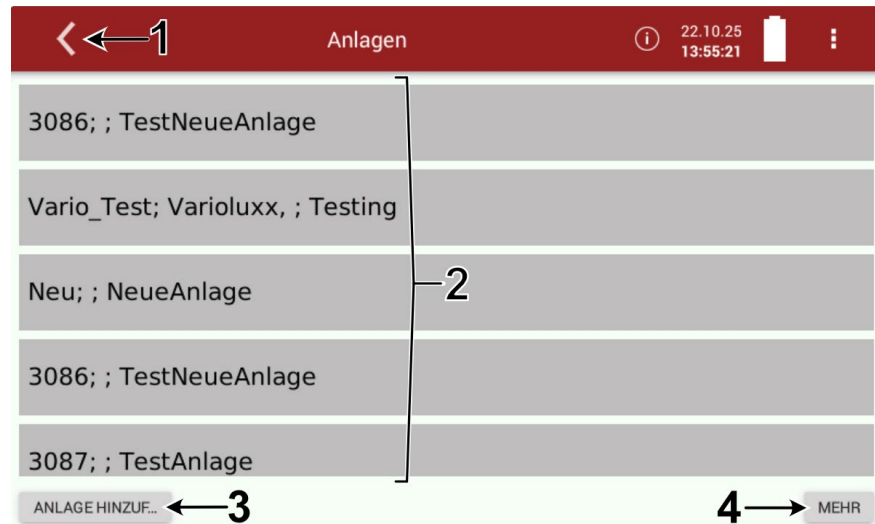
-  The device is able to store up to 1,000 different plants.
-  Plants can be created and edited on the device.
See the **Adding, editing and deleting plants** chapter on the following pages.
-  Measurements are saved by assigning them to a plant.
-  Measurements in this context can be individual flue gas measurements or other optional device measurement programs.

Use the **Plants menu** to add a new plant, edit the details of an existing plant, delete a plant or view a list of stored plants.

9.2 Plants menu

▶ Select **PLANTS** from the **Home** menu.

✓ The Plants window appears.



Plants menu

#	Description
1	Back ▶ Tap on  . ✓ You are returned to the Home menu.
2	Stored plants
3	Add plant
4	More Manage storage

9.2.1 Adding, editing and deleting plants

▶ Select **ADD PLANT** to add a new plant.

or

▶ Select an existing plant.

✓ An input window appears.

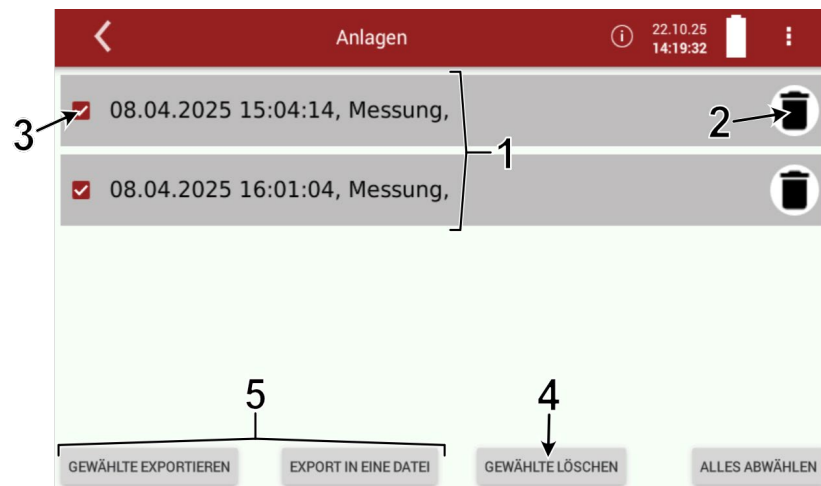


Plant details

#	Description
1	Plant details ▶ Enter the relevant data or edit existing data here.
2	Save plant details ▶ Tap on SAVE . ✓ The changes are saved. ✓ The previous menu appears again.
3	Display measurements ▶ Tap on MEASUREMENTS . ✓ The existing measurements for the plant are displayed.
4	Delete plants ▶ Tap on DELETE . ✓ The plant is deleted. ✓ The previous menu appears again.

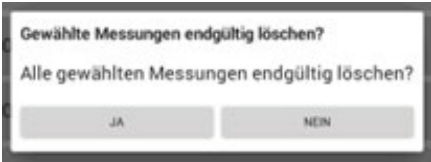
9.2.2 Viewing, exporting and deleting stored measurements

- ▶ Select **MEASUREMENTS** for the relevant plant from the **Plants** menu.
- ✓ The stored measurements are displayed.



Stored measurements display

#	Description
1	Display stored measurements ▶ Tap on the relevant measurement. ✓ The measured value window is displayed.
2	Delete individual measurements ▶ Tap on  for the relevant measurement. ✓ A message appears. Löschen? Messung löschen? JA NEIN <i>Confirm deletion</i> ▶ Confirm with JA. ✓ The relevant measurement is deleted.
3	Selection ☒ Measurement selected ☐ Measurement not selected

4	Delete multiple measurements ▶ Select the measurements you wish to delete. ✓ The DELETE SELECTED button is enabled. ▶ Tap on DELETE SELECTED. ✓ A message appears.  <i>Confirm deletion of multiple files</i> ▶ Confirm with YES ✓ The selected measurements are deleted.
5	Export data via USB (CSV file) You can export measurements in the form of individual files or with multiple measurements in the same file. The exchange format used is CSV. This is a text file in which each line represents one data record and the fields are separated with a semicolon. This format can be read and generated by spreadsheet programs and databases. ▶ i Make sure your spreadsheet or database program is able to interpret the data correctly. ▶ Insert a USB stick into the measuring device. ▶ Select the required measurements. ✓ The EXPORT SELECTED and EXPORT TO ONE FILE buttons are enabled. ▶ Tap on EXPORT SELECTED to export the selected measurements as individual files. - or ▶ Tap on EXPORT TO ONE FILE to export all measurements to a single file. ✓ A message appears.  <i>Export with or without device details</i>

☐ Select **YES** to export the data with device details.

Geräteinformationen: MGAprime 063450						
Anlageinformationen: Testanlage Mustermann						
Datum	Zeit		O2 %	Taupunkt °C ?	ETA kond. %	CO ppm
30.06.2020	11:33:30	---	20,96	---	43,2	0
30.06.2020	11:33:31	---	20,96	---	43,2	0

Export with device details

or

☐ Select **NO** to export the data without device details.

Datum	Zeit		O2 %	Taupunkt °C ?	ETA kond. %	CO ppm
30.06.2020	11:33:30	---	20,96	---	43,2	0
30.06.2020	11:33:31	---	20,96	---	43,2	0
30.06.2020	11:33:32	---	20,96	---	43,2	0

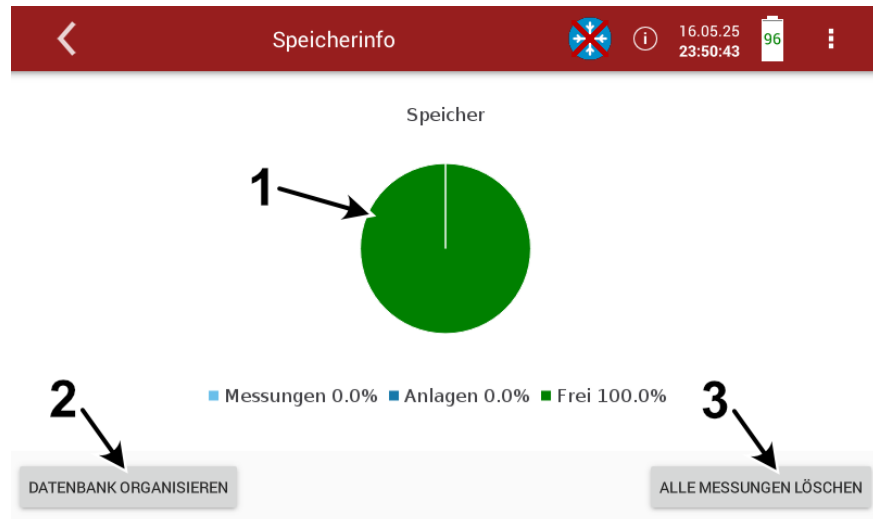
Export without device details

✓ The **1113Export** folder is created on the USB stick and the data is saved to this folder.

9.2.3 Managing storage

▶ Select **MORE**.

✓ A window appears.



Storage management

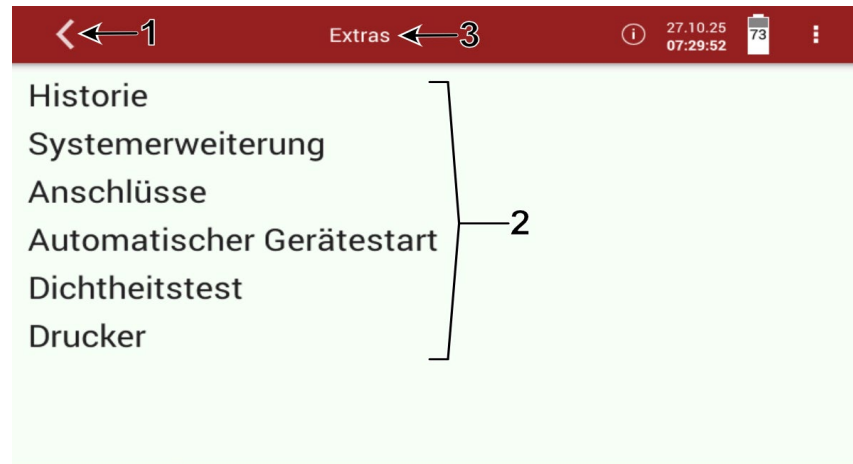
#	Description
1	Storage diagram
2	Organise database ▶ Tap on ORGANISE DATABASE. ✓ A message appears. ▶ Confirm with JA. ✓ The database is checked.
3	Delete all measurements ▶ Tap on DELETE ALL MEASUREMENTS. ✓ A message appears. ▶ Confirm with JA. ✓ All measurements are deleted.

9.3 Extras

The **Extras** menu option contains device settings such as history, system add-ons, connections, automatic device start, leak test and the printer.

9.3.1 Extras menu

- ▶ Select the **Extras** menu option from the Home menu.



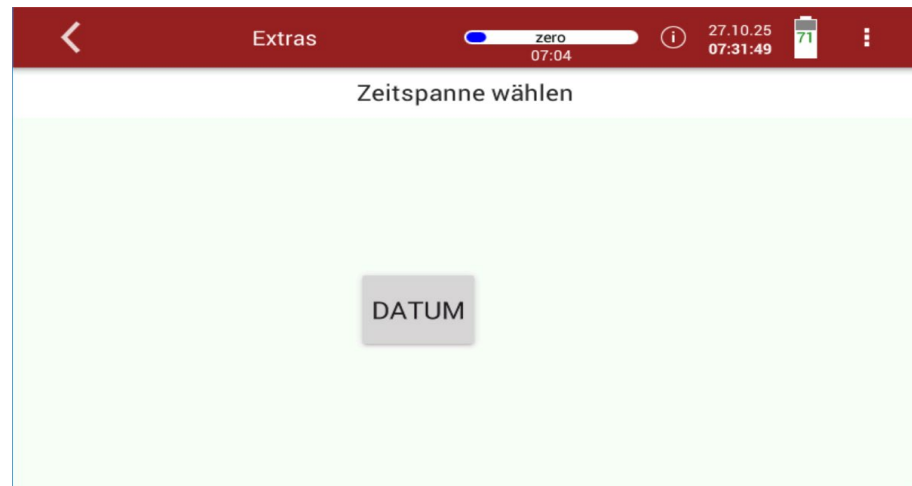
Extras menu

#	Description
1	Back ▶ Tap on  . You are returned to the Home menu.
2	Extras menu submenu items
3	Extras menu

9.3.2 View history

The **History** menu option provides access to the log files for recent measurements.

▶ Select **HISTORY** from the **Extras** menu.

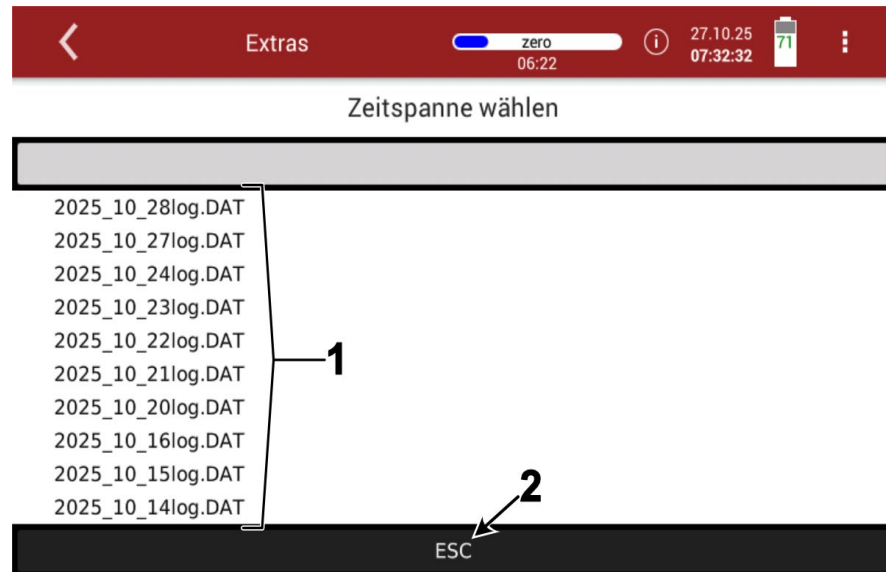


History menu

The **Date** menu option provides access to the log files for recent measurements.

▶ Tap on **Date**.

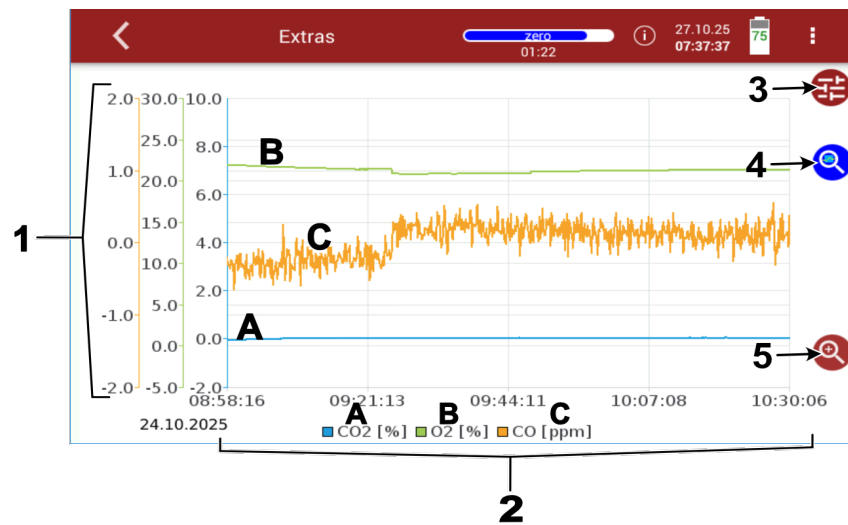
✓ A selection list opens.



Select time range

#	Designation
1	Log files list ▶ Tap on the required time range. ✓ The relevant time range is displayed in chart form.
2	Escape ▶ Tap on ESC to terminate the process and return to the previous menu.

- ▶ Select the **Date** menu option from the Extras → History menu.

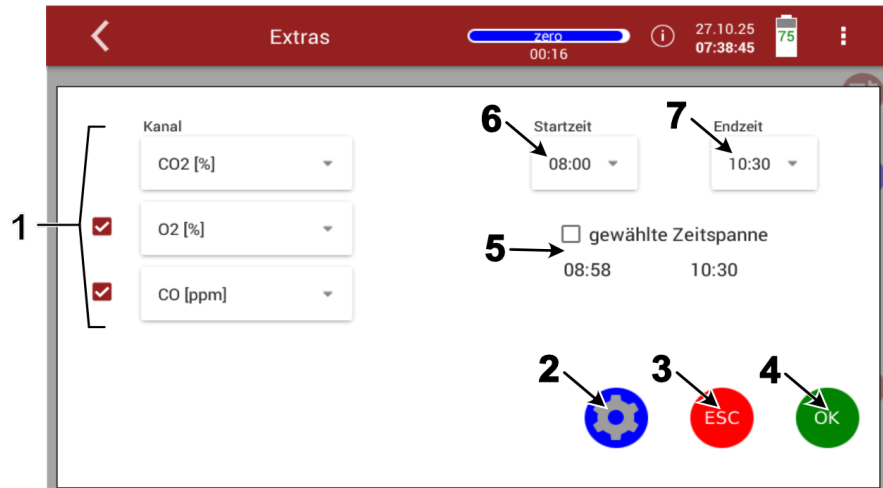


Select time range

#	Designation
1	Y-axis – measured values
2	X-axis – time range
3	Settings ▶ Tap on  to modify the display. ✓ The Settings window appears.
4	Examine measuring range ▶ Tap on  to examine the displayed range more closely. ▶ Use your fingertip to drag a box around the relevant measuring range. ✓ The measuring range is adjusted as specified.
5	Navigate ▶ Tap on  to enable navigation. ✓ Arrow keys appear ▶ Use the arrow keys to navigate in the measuring range.

Adjusting depiction

- ▶ Select the **Settings**  menu option to adjust the depiction.

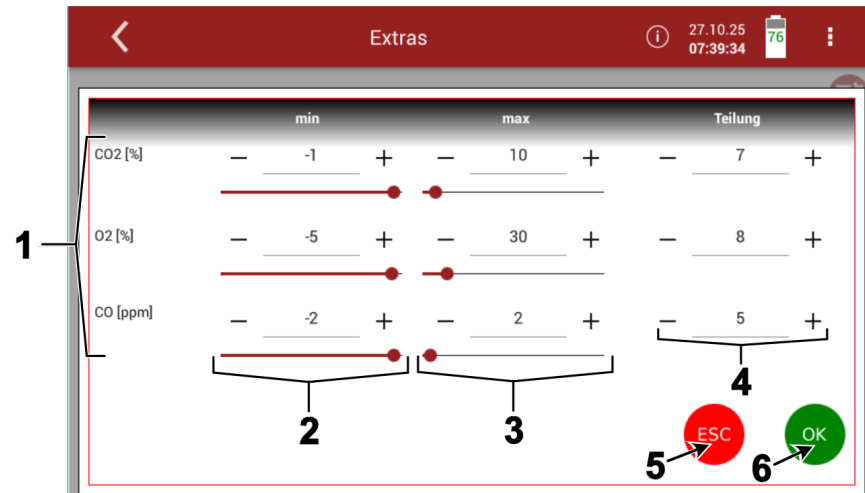


Adjust depiction

#	Designation
1	Selection of displayed channels You can change the channels displayed and have them displayed in chart form.
2	Settings ▶ Tap on  ✓ The Settings window appears.
3	Escape ▶ Tap on  to discard the changes and close the window.
4	Confirm changes ▶ Tap on  to confirm the changes and close the window.
5	Selected time range You can set the start and end times. You can enable and disable the selected time range.
6	Start time Start time setting
7	End time End time setting

Settings

▶ Select Settings 



Select time range

#	Designation
1	Channels displayed
2	Escape ▶ Tap on  to discard the changes and close the window.
3	Confirm changes Tap on  to confirm the changes and close the window.
4	Minimum for selected channel
6	Maximum for selected channel
7	Division for selected channel

9.3.3 System add-ons

There are optional add-ons available for the measuring device. MRU will provide an option file with options.

i System add-ons can be obtained on request from **MRU Customer Service** or **MRU Sales**.

▶ Copy the option file to a USB stick.

NOTE

It is also possible to store the option files in subfolders. The measuring device searches the folder structure on the USB stick down to the second hierarchical level. Store the option file higher up in the folder structure if it is not displayed.

▶ Plug the prepared USB stick into the measuring device.

▶ Select **SYSTEM ADD-ONS** from the **Extras** menu.

✓ An input window appears.

✓ The options saved on the USB stick are displayed.



System add-ons menu

#	Description
1	Available options on the USB stick
2	LOAD SELECTED ADD-ONS ☐ Tap on LOAD SELECTED ADD-ONS . ☒ The selected add-ons are loaded and a message appears.
3	RELOAD ☐ Tap on RELOAD if no options are displayed. ☒ The window is loaded again and the available options on the USB stick are displayed.



Option installed successfully

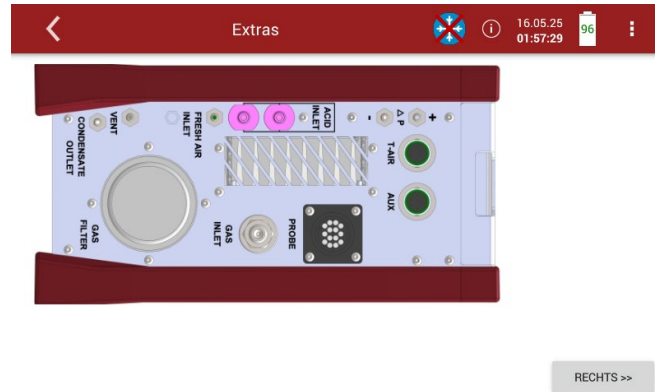
- ☒ The option has been successfully installed.
- ☐ Acknowledge the message with OK.
- ☐ Perform a restart.
- ☒ The option will be available for use after the restart.

9.3.4 Connections

You can also have the connections presented on the display.

▶ Select **CONNECTIONS** from the **Extras** menu.

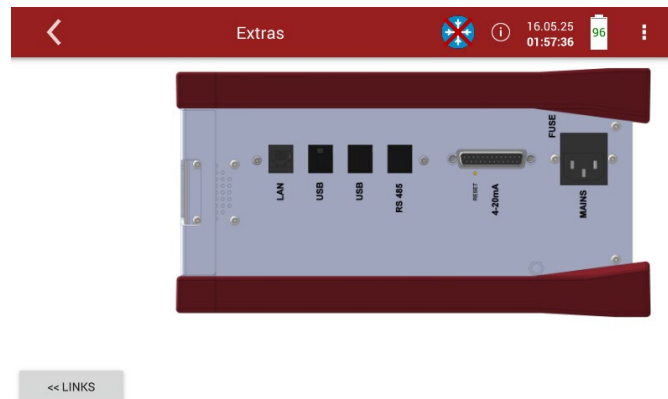
✓ The measuring device connections on the left side are displayed.



Measuring device connections on the left side

▶ Tap on **RIGHT >>** to display the connections on the right side.

✓ The measuring device connections on the right side are displayed.



▶ Tap on **<< LEFT** to return to the previous screen.

✓ You are returned to the previous screen.

9.3.5 Automatic device start

You can configure the measuring device to perform an automatic restart at a specified time.

CAUTION

Damage to device due to connected heated sample line or probe

The probe and heated sample line are heated during device start-up in mains operation.

- Ensure that this can be done without creating a hazard or remove these components from the device.

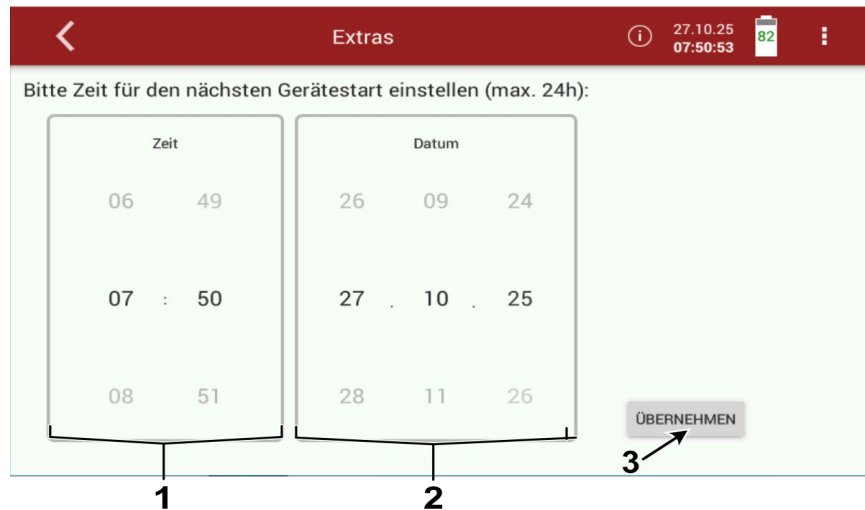
NOTE

The device performs a zero point calibration after warming up. Ensure that the device is supplied with fresh air for this purpose.

9.3.6 Enabling automatic device start-up

- ▶ Select **AUTOMATIC DEVICE START-UP** from the **Extras** menu.

- ✓ The automatic device start-up input window appears.



Automatic device start-up input window

#	Description
1	Time entry ▶ Set the required time.
2	Date entry ▶ Set the required date. ⓘ Note that automatic device start-up cannot be scheduled any more than 24 hours in advance. A message appears if the time to the scheduled start-up is too long.
3	Apply ▶ Tap on APPLY to save the details entered. ✓ A message appears.  ▶ Confirm with OK. ✓ The time of the next automatic start-up is applied and shown on the display.

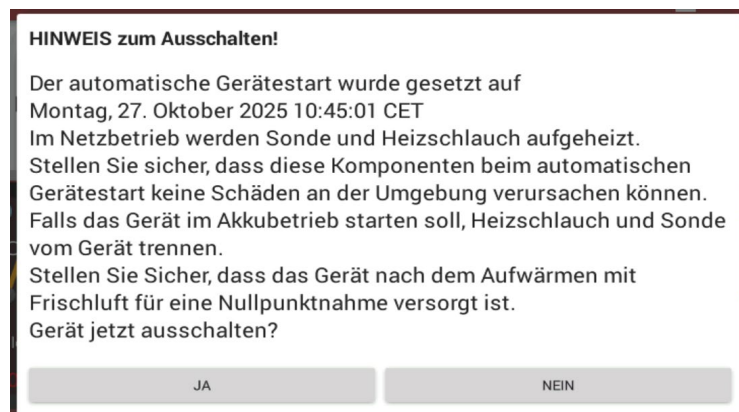
Scheduled automatic device start-up

#	Description
1	Scheduled automatic start-up display
2	Apply ▶ Tap on APPLY to save the new details entered. ✓ A message appears. ▶ Confirm the message. The time of the next automatic start-up is applied and presented on the display.
2	Delete ▶ Tap on DELETE to delete the scheduled automatic start-up.

9.3.7 Switching the device off with automatic device start-up enabled

NOTE

If you have enabled an automatic device start-up, a message appears when the measuring device is switched off.



Information when switching off the measuring device

CAUTION

Damage to device due to connected heated sample line or probe

The probe and heated sample line are heated during device start-up in mains operation.

- Ensure that this can be done without creating a hazard or remove these components from the device.

- ☐ Ensure that the heated sample line and probe can be warmed up without creating a hazard.

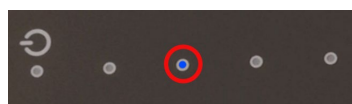
or

- ☐ Unplug the heated sample line and probe from the measuring device.

- ☐ Confirm with YES.

- ✓ The measuring device is shut down.

- ☐ Once the measuring device has shut down, an LED lights to indicate that an automatic device start-up has been configured.



9.3.8 Leak test

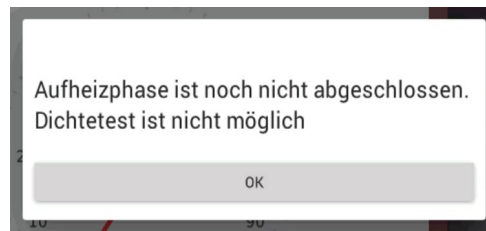
The measuring device has an integral test function to check the gas path for leaks.

Performing the leak test:

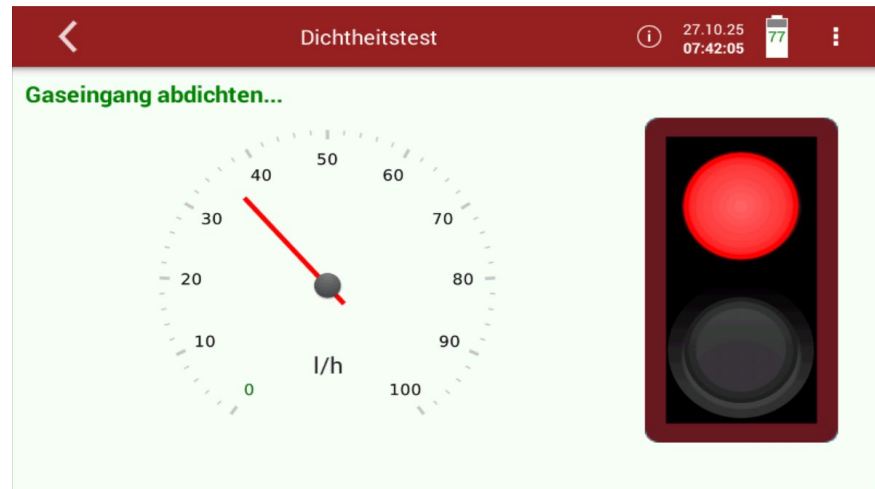
- ▶ Check that all plug connections are seated properly.
- ▶ Check all hoses and hose connections (from the tip of the probe to the gas intake on the measuring device) for leaks.
- ▶ Select **Leak test** from the EXTRAS MENU.
- ✓ The leak test window appears.
- ✓ Preparatory steps for the device leak test begin automatically.

NOTE

It is not possible to perform a leak test while the measuring device is in the warm-up phase. A corresponding message will be displayed.



- ▶ Tap on OK
- ▶ Wait for the warm-up phase to complete.
- ✓ The leak test can now be started.



Leak test starting

The device establishes a volume flow of 60 l/h for the leak test.

- ☐ **i** The device will not be able to establish an adequate volume flow if the gas inlet has already been sealed during preparations for the leak test, so do not seal the gas inlet until instructed to do so.
- ☐ **▶** When instructed to do so, seal the probe tip with a sealing cap.

NOTE

Surface deposits will prevent the sealing cap from creating a proper seal.

- ☐ **▶** Clean the probe tip prior to the leak test.

- ✓ A message appears once the leak test has been completed successfully.
 - ❏ If no leak is detected in the system, the traffic light shows green and a volume flow of 0 l/h is displayed.

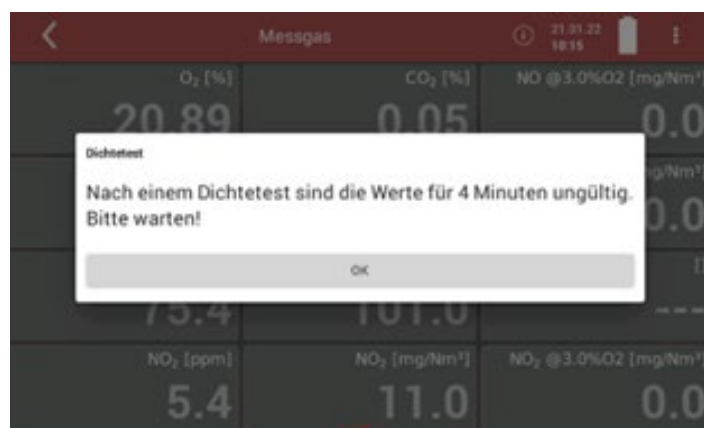


Leak test completed successfully.

NOTE

Measured values obtained in the first four minutes after the leak test are invalid.

A corresponding message will be displayed if you open the Measurement menu.



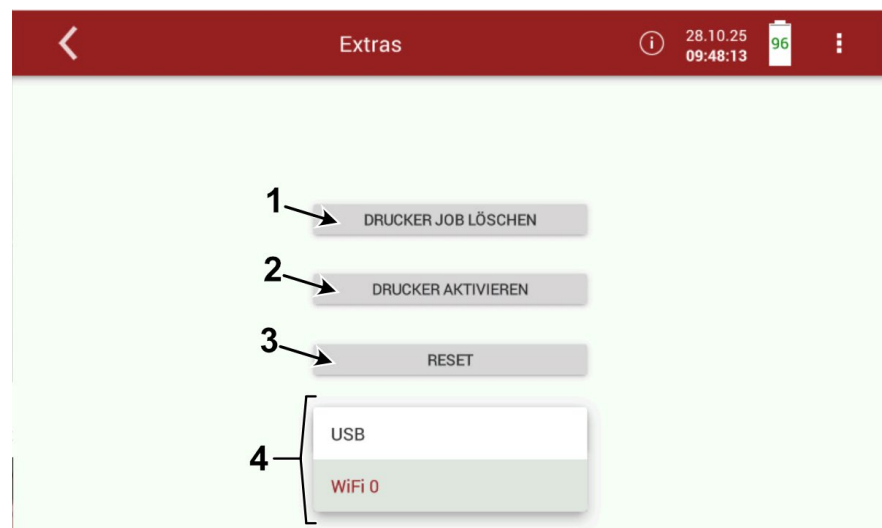
9.3.9 Printing measurement results

Measurement results can be printed using an optional printer. The measuring device can be connected to the printer via USB or WLAN.

Select printer connection

▶ Select **PRINTER** from the **Extras** menu.

✓ The data entry window for the printer appears.



Printer data entry window

#	Description
1	Delete print job ▶ Tap on DELETE PRINT JOB . ✓ The current print job is deleted from the queue.
2	Enable connected printer ▶ Select the required connection type under (4) and connect the printer accordingly. ▶ Tap on ENABLE PRINTER . ✓ The connected printer is enabled and ready for print jobs.

3	Reset settings ▶ Tap on Reset . ✓ The settings are reset.
4	Select printer connection ▶ Select USB if the printer is to be connected to the measuring device via USB. or ▶ Select Wifi-0 if the printer is to be connected to the measuring device via WLAN. ✓ The printer is connected to the measuring device using the relevant option.

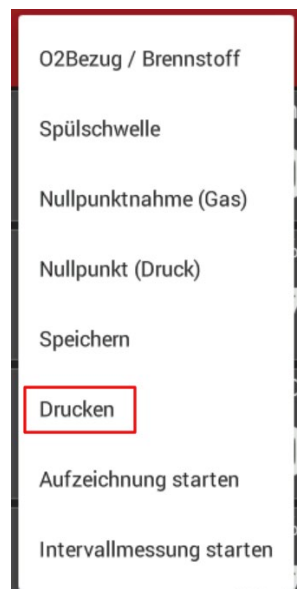
Print current or stored measurement results

▶ Select the **Measurement menu**.

or

▶ Select the required measurement from the **Plants menu**. See also p. Further information in chapter Managing plant master data and Extras on page 68

▶ Select **Print** from the context menu .



Context menu

✓ The relevant measurement results are printed.

10 Commissioning of the MRU measuring device

10.1 Commissioning the measuring device

The measuring device leaves the factory fully assembled and ready to use.

- ▶ Check the measuring device on receipt for damage and missing parts.

CAUTION

Damage to measuring device

Operating the measuring device in the horizontal position can result in a condensation alarm and damage to the device.

- Only operate the device in the upright (vertical) position.
- For information about resolving a condensation alarm see p.168 - Condensate alarm.

- ▶ Connect the mains plug.

- ✓ The measuring device switches on.
- ✓ The operating system boots.
- ✓ The LEDs for power (1) and mains operation (4) light up blue.

 The Power LED (1) lights up red in the event of a fault.

- ✓ The device performs an approximately 30-minute start-up routine comprising the following:

3. **Internal self-test of the microcontroller**
4. **Warm-up phase for the infrared measurement bank**
5. **Cooling of the gas cooler**, during which cooling appears .
6. **Zero point calibration**, the time remaining to the end of zero point calibration is also displayed .

**⚠ DANGER****Inappropriate battery handling**

Inappropriate battery handling and failure to comply with the battery user guide can result in rapid temperature increases, fire and explosion, which could cause death or serious injury.

- Observe the provisions of the battery user guide.
-

NOTE**Battery user guide**

The battery is permanently installed in the device.

Observe the following guidance:

- i** The battery is not replaceable.
 - i** The battery is designed only for the measuring device in which it is installed.
 - i** Do not charge the battery at high temperatures (over 45°C) or expose the battery to high temperatures.
 - i** Do not dispose of the battery in a fire.
 - i** The battery must not be allowed to come into contact with water.
 - i** Do not short-circuit or modify the battery or expose it to mechanical loads.
 - i** Do not crush the battery connection cable.
 - i** Do not store the battery with sharp objects.
 - i** The battery has a service life of at least 500 charging and discharging cycles.
-

10.2 Preparing for measurement

10.2.1 Safety



W002



W071

DANGER

Danger of explosion and danger of poisoning due to explosive or toxic gases or atmospheres

The measuring device is not approved for the measurement of explosive gases or for use in explosive atmospheres.

There is a danger of poisoning when measuring toxic gases. Harmful substances are drawn in by the measuring device and released to the ambient air.

- Use the measuring device only to measure **non-explosive gases**.
- Use the measuring device only in **non-explosive atmospheres**.
- Use the measuring device only in well-ventilated areas.

WARNING

Corrosive liquid

Chemical burns to the hands



- Before starting up, check whether there is any liquid visible on the housing.
- Remove the liquid.
- If the liquid is coming from inside the device, do not use the device. Contact your MRU service center.

10.2.2 Set-up at the measuring location

- ▶ Position the measuring device on a stable footing.



⚠ CAUTION

Weight of the measuring device

The measuring device is heavy and could cause overloading or crushing injuries.

- Proper care must be taken when moving the measuring device.
- Wear safety boots.



W001

ATTENTION

Damage to the device caused by vibrations

If the measuring instrument is exposed to vibrations, this may result in inaccurate readings or cause damage to the device.

- Only place the measuring device on flat, vibration-free surfaces. If you are unable to position the measuring device in a vibration-free location, take appropriate technical measures.
- Ensure that the measuring device is not exposed to vibrations during the measurement.

10.2.3 Instructions for use of a heated hose line

- i Bear the following in mind during installation to ensure safe handling of the heated hose line:

- ▶ Maintain at least the bending radius specified below.
- ▶ Uncoil the heated sample line completely before installation.
- ▶ Ensure that both ends of the heated sample line are attached correctly during installation.
- ▶ The heated sample line should be run through a cable conduit to protect it outside influences and temperature fluctuations.
- ▶ Support the heated sample line with a prop in the vicinity of the analyser inlet.
- ▶ Ensure that the heated sample line is not twisted internally.

NOTE

Heated sample lines are offered in 110 V and 230 V versions. You can operate a 230 V heated sample line at 110 V, but performance will be limited.

- ▶ Check the heated sample line before commissioning the power supply.

⚠ DANGER

Danger due to incorrect use

Danger of death due to electric shock

- Do not operate a 110V heated sample line at 230V.

⚠ WARNING

Combustion and fire hazard due to heated hose line and gas sampling probe

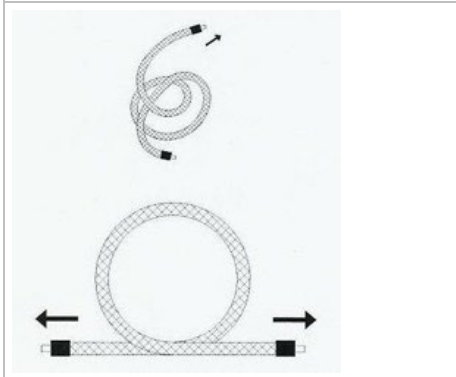
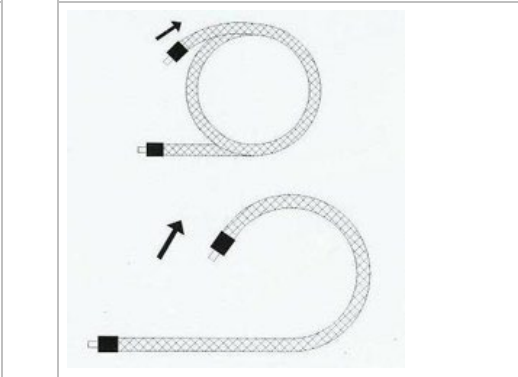
The heated hose line and the gas sampling probe become very hot in use and can cause fires, and burns and other injuries.

- Uncoil the heated hose line completely for every measurement.
- Allow hot gas sampling probe to cool after use.

Uncoil the heated sample line correctly

NOTE

Incorrect/inappropriate handling of the heated hose line can result in injury and damage. It is important to uncoil the hose line correctly, especially when using very long hose lines.

Incorrect handling	Correct handling
	
Do not pull the heated sample line from opposite ends. This will cause kinks in the hose.	Uncoil the heated sample line carefully.

Bending radius of the heated sample line

i The minimum bending radius of the heated sample line is 32 cm.

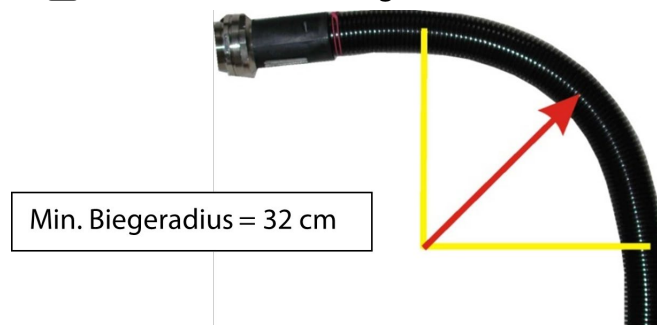


Diagram showing minimum bending radius

CAUTION

Damage to heated sample line

Reduced heated sample line service life due to incorrect handling

- Ensure the minimum bending radius of the heated sample line is maintained.

1. Connecting the gas sampling probe and heated sample line

1. Connecting the heated sample line to the measuring device

- ▶ Pull the locking ring back and insert the heated sample line into the gas inlet.
- ▶ Release the locking ring and push it firmly against the gas inlet until the lock engages audibly.
 - i The connection will only be reliably leak tight if the gas inlet has engaged audibly.
- ▶ Insert the plug connector into the probe connection on the measuring device.

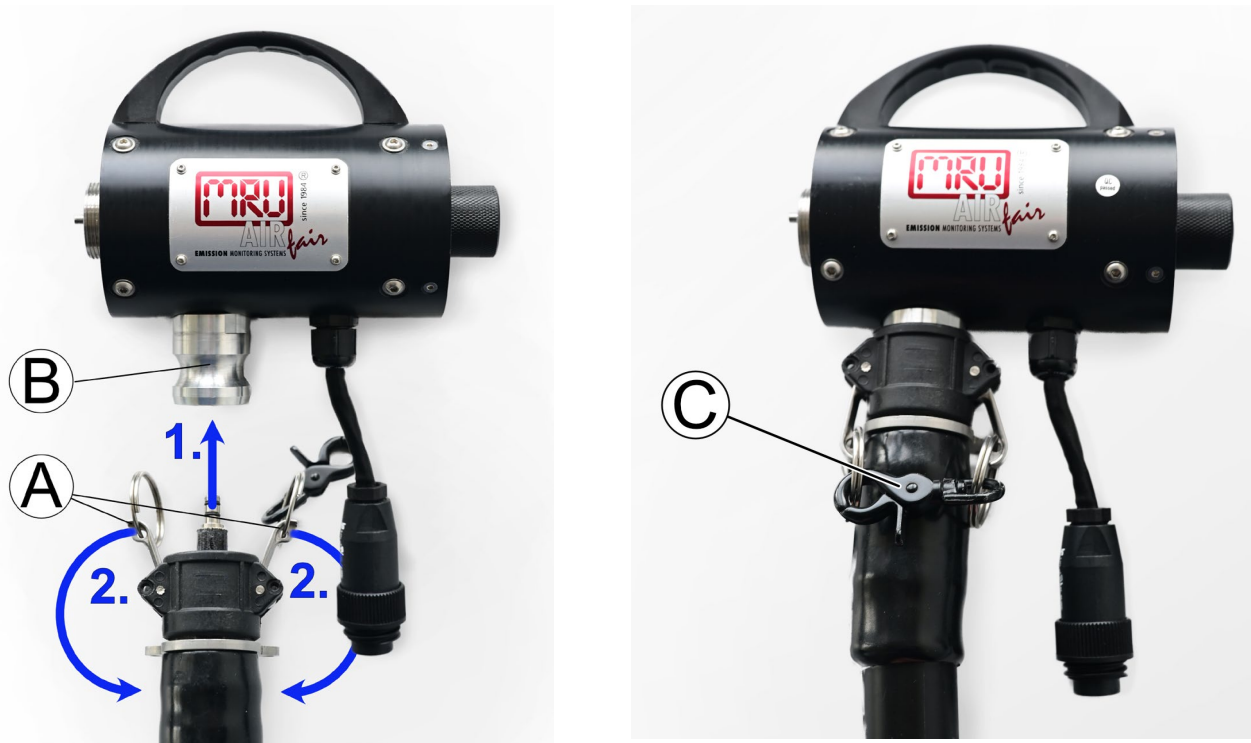
NOTE

The plug-in connection is of a mechanically coded design that cannot be connected with polarity reversed. It can only be connected in the intended position.

- ▶ Observe the mechanical coding of the plug-in connection.
-

- ▶ Hand-tighten the union nut.
- ✓ The heated sample line is connected to the measuring device.

10.2.4 Connecting the gas sampling probe to the heated sample line



Connecting the gas sampling probe to the heated sample line

- ▶ Ensure that both **levers (A)** on the hose connector are pointing away from the hose as shown in the diagram.
- ▶ Insert the **gas sampling connector (B)** into the hose connection and fold the two levers back along the hose.
- ▶ Secure the two levers with the **clip (C)** to prevent inadvertent opening.
- ▶ Push the two **plug-in connections (D)** together and hand-tighten the threaded joint.



Connecting the plug-in connections

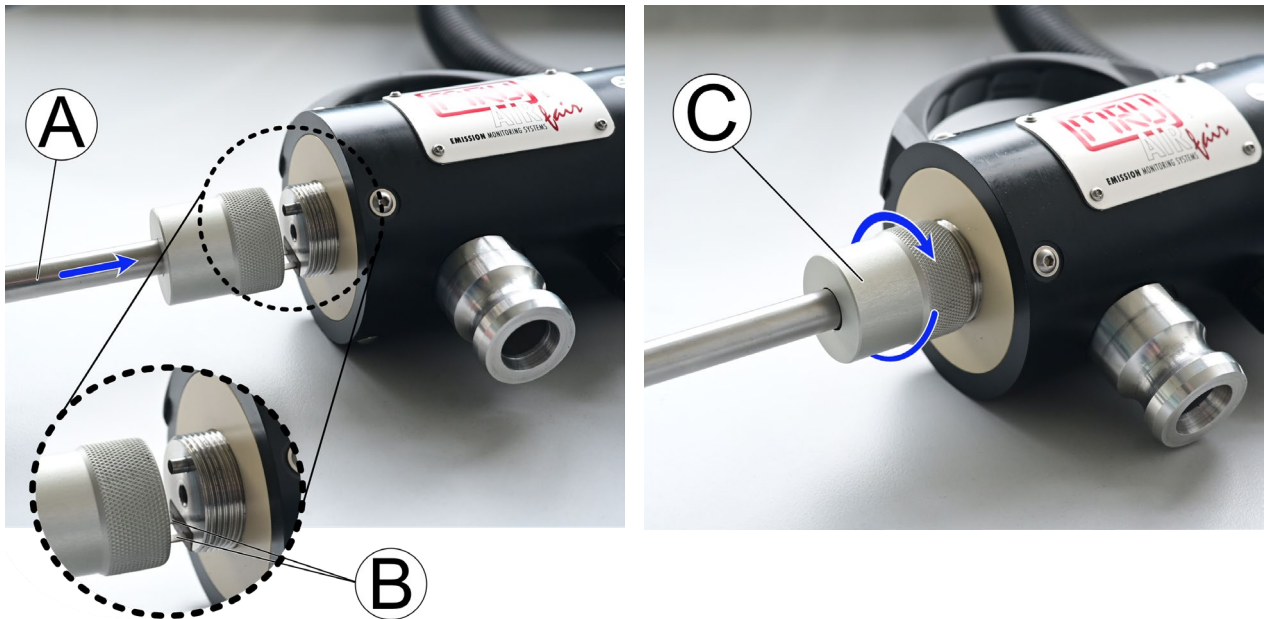
NOTE

The plug-in connection is of a mechanically coded design that cannot be connected with polarity reversed. It can only be connected in the intended position.

- ▶ Observe the mechanical coding of the plug-in connection.

- ✓ The gas sampling probe is connected to the heated sample line.

10.2.5 Connecting the probe tube to the gas sampling probe



- ▶ Insert the **probe tube (A)** into the gas sampling probe at the front, ensuring that the **electrodes (B)** go into the **mount** straight to prevent damage.

NOTE

The nature of the material used ensures that the connection between the gas sampling probe and the probe tube is leak tight.

- ▶ Ensure that the contact surfaces are clean and undamaged.
- ▶ Hand-tighten the **union nut (C)**.

CAUTION

Damage to thread

The thread on the mount can easily be damaged.

- Ensure that the union nut is aligned straight when tightening.

- ✓ The probe tube is connected to the gas sampling probe.

10.2.6 Checking the operating temperature

The working temperature of the internal gas cooler is 5°C.

CAUTION

Condensation inside the measuring device

Damage to components along the gas line

- The measuring device must not be operated at temperatures below 5°C.

NOTE

If the measuring device has been stored at very low temperatures (below 0°C), it is therefore always essential to bring it into a higher-temperature environment and allow it to warm up before use to prevent condensation.

Be aware that it will typically be necessary in such instances to wait for an hour to allow the device to warm up sufficiently, especially if moist gases are to be measured.

-  A corresponding error message is displayed if the operating temperature is outside the permissible range.

10.2.7 Ensuring the power supply



⚠ WARNING

High mains voltage

Electric shocks can occur due to incorrect connection of the measuring device to the power supply. This can result in death or serious injury.

- Do not plug in or unplug power cords and power supplies with wet hands.
- Do not use damaged cables.
- Do not connect to an overloaded power outlet using multiple power strips and extension cords.

CAUTION

Incorrect measurement operation

The Li-Ion battery is intended to provide temporary power in the event of a power failure.

Only limited measurement operation is possible under battery power. Measurement results may be unreliable if the power supply is not correct.

- Always connect the measuring device to mains power when performing measurements that require a high level of accuracy.

NOTE

The measuring device has a Li-Ion backup and an internal 230-Volt power supply unit and may only be operated with the supplied 230-Volt power supply cable.

The measuring device can be operated with the internal battery to warm it up or make use of internal device functions. The device must be connected to mains power for measurement including the heated gas sampling probe and the heated sample line.

The battery symbol  on the display shows the approximate remaining battery charge.

The charge indicator begins to flash red from the 2% remaining charge mark.

The device will then switch off if not connected to mains power within one minute to avoid discharging the battery fully.

- i The measuring device can be operated as usual even when the battery is discharged provided that it is connected to mains power.

10.2.8 Opening the transport sleeve

NOTE

There are different transport sleeves available for the measuring device:

7. **Standard transport sleeve**

This transport sleeve is intended exclusively for transporting the measuring device and is not to be used for operation.

8. **IP42 Operating sleeve (optional)**

The measuring device can be operated in the operating sleeve.

▶ Check which type of transport sleeve you have:

▶ **Standard transport sleeve:** Take the measuring device out of the transport sleeve

or

▶ **IP42 operating sleeve:** open the sleeve to access the operator panel (1) and the left side of the front (2).

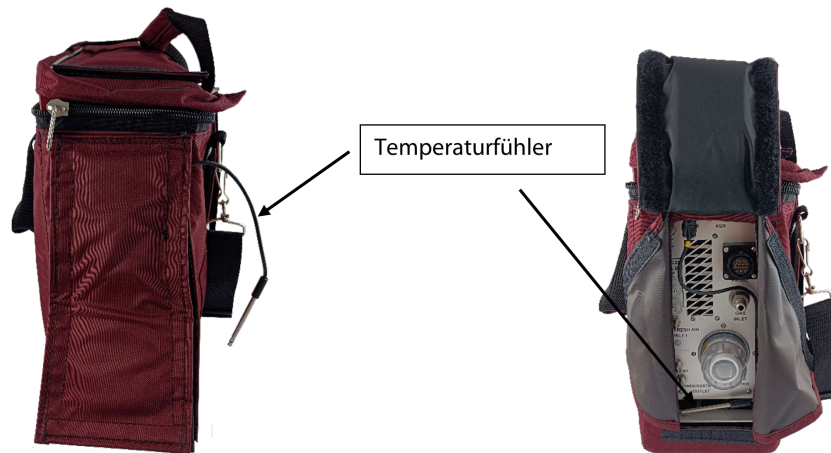
▶ Open the ventilation flap (3).



Preparing the IP42 operating sleeve for measurement

10.2.9 Connecting the temperature sensor

- ▶ Plug the temperature sensor into the T-AIR connector.
- ▶ Position the temperature sensor as shown in the diagram.



NOTE

The temperature sensor can be left plugged in, including when transporting the measuring device.

10.2.10 Switching on

⚠ CAUTION

Acid from the condensate

Weakly acidic liquids from the condensate can cause chemical burns.

- In case of contact with acid, immediately rinse the affected area with plenty of water.
- Refer to the safety data sheet for phosphoric acid (10%).



W023

CAUTION

Damage to measuring device and surroundings

Escaping condensate can damage the measuring device and its surroundings.

- Connect a condensate drain to the condensate outlet. A corresponding message is displayed when the measuring device is switched on.



Connect condensate drain to condensate outlet message

Once switched on, the device is in principle ready to operate. Gas analysis cannot though begin until the warm-up phase is complete.

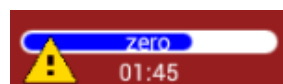
The device performs the following actions autonomously during the warm-up phase:

1. Warming up the probe and heated sample line
2. Warming up the NDIR measurement bank
3. Once the operating temperature has been reached, the device switches the gas pump on and performs a zero point calibration with fresh air.

✓ The device is fully operational once this zero point calibration has been completed.

Zero point calibration with contaminated ambient air

If the ambient air is contaminated in the last two minutes of the zero point calibration, the zero point calibration is extended by approximately 3 minutes. The zero point calibration process may be extended more than once in this situation. If it is not possible to obtain a realistic zero point even after the extension, a message appears. If this happens, check the ambient air.



Zero point calibration extended status

- i** If you have the **Switch on with stored zero point** setting enabled, the ambient air is not checked. See also p. Further information in chapter Gas cooler strategy on page 179

10.2.11 Establishing connections

- ▶ Connect the gas sampling probe to the measuring input (gas connector and round plug connector).

NOTE

Acidic condensate drains from the condensate outlet.

- ▶ Always connect a sufficiently large collecting vessel to the condensate outlet.
- ▶ Dispose of acidic condensate and phosphoric acid in accordance with national and, where applicable, local waste disposal regulations.

NOTE

Sample gas may be emitted from the device side or at the gas outlet.

- ▶ Connect an external pump to the VENT outlet if there is an electrochemical sensor installed.
 - i The pump should have a capacity of approximately 112.5 l_n/h, which is 25% larger than the typical sample gas flow rate of 90 l_n/h.

or

- ▶ Connect a hose to the VENT outlet if there is no electrochemical sensor installed

If the **active VENT** option is installed, an internal gas pump pumps all the sample gas to the VENT outlet and no sample gas enters the enclosure environment. A gas discharge hose can be connected at the gas outlet.

It may be that sample gas is transported in a mixture with ambient air at the VENT outlet. It will usually not be possible to use the sample gas for further analyses in this situation.

- ▶ Ensure that ambient air uncontaminated with harmful substances can be drawn in at the fresh air inlet. Connect a hose to supply fresh air of this quality where necessary.

The sample gas flow rate should lie within the specified area of 90 l_n/h. If it does not, please check the probe and filter for blockages. Also check for pending device alarms.

The NDIR and heated sample line temperatures should be within the specified range to ensure adequate measuring accuracy, see also p.47 - Device settings.

Checking the filters

The filters (probe filter and round filter) must be checked before and after every measurement, see also p. 174 - Technical data.

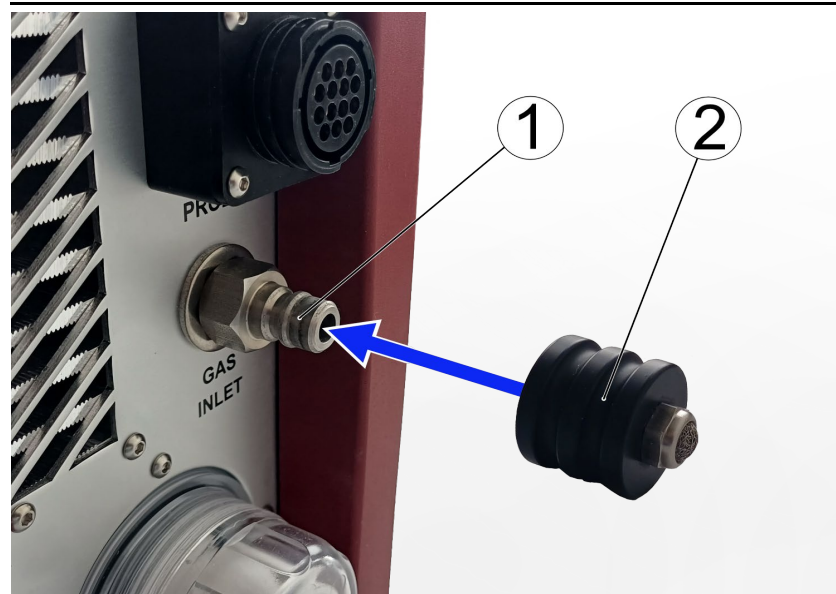
151 - Cleaning and caring for the measuring device

Fitting the plug-in filter

NOTE

Dirt can collect in the gas inlet if the measuring device is operated without a heated sample line.

- ▶ If operating the device without a heated sample line, fit the supplied **plug-in filter (2)** on the **gas inlet (1)**.



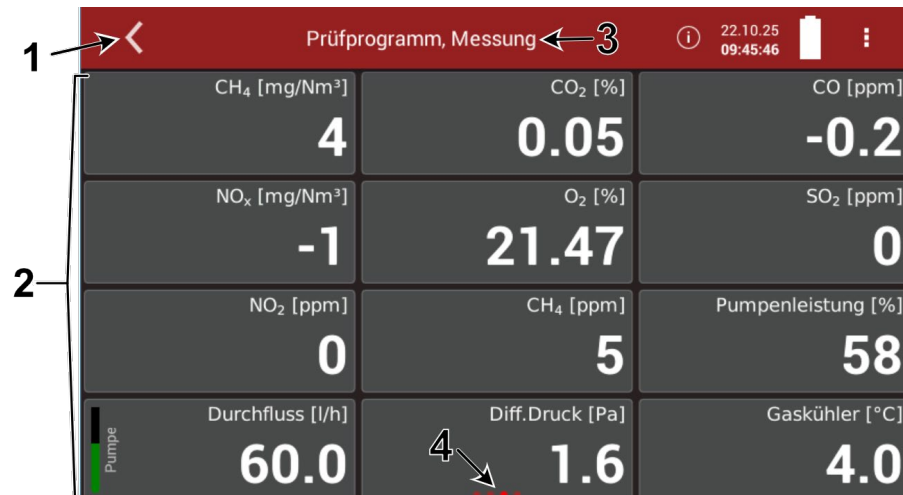
Fitting the plug-in filter

11 Measurement

11.1 Opening the Measurement menu

▶ Select **MEASUREMENT** from the **Home** menu.

✓ The **Measurement** menu opens



Measurement menu main screen

#	Description
1	Back ▶ Tap on  .
	✓ You are returned to the Home menu.
2	Measured variables
3	Current measurement program
4	Current screen

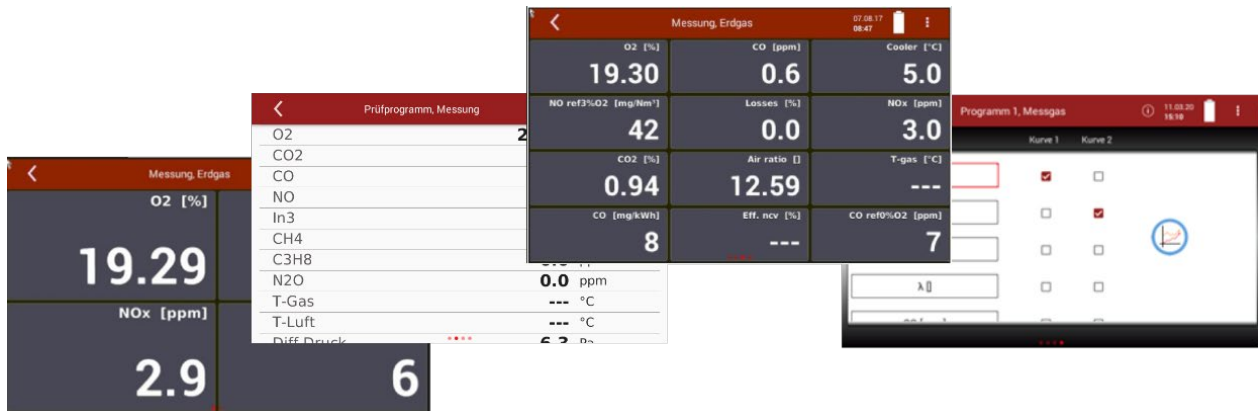
NOTE

This content of this chapter builds on the content of the preceding chapters.

It is essential for successful and reliable measurement that you have worked through the preceding chapters, configured the necessary settings and complied with all safety instructions.

11.1.1 Switching to different views

The Measurement menu option comprises several screens.



Display of the Measurement menu option screens

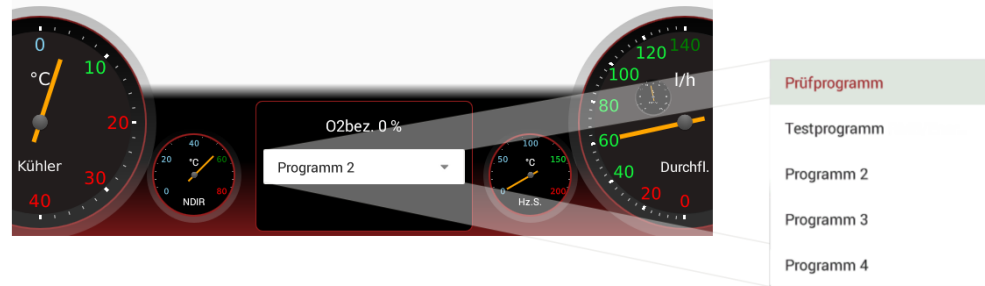
- ▶ Touch the display and drag the window to the **right or left**.
- ✓ The required screen is displayed.

11.1.2 Configuring the measurement program

The measuring device provides various measurement programs in the Measurement menu. Measurement programs are selected in the main window. Each measurement program defines attributes for the measurement window:

Designation	Description
Test program	The measured value window shows predefined values and cannot be changed. Can be used in device testing to retain standard displays that can be checked easily using calibration gases, for example.
Measurement program	The measured value window can be configured as required in terms of the measured values displayed and the relevant fuel. The purge limit for the CO sensor (where present) can be specified.

Changing measurement program



Changing measurement program

You can change the measurement program from the **HOME** menu.

- ▶ Tap on the display.
 - ✓ A selection list appears.
 - ▶ Select the required measurement program.
 - ✓ The required measurement program is enabled.
- Further information in chapter User interface on page 32.

11.1.3 Moving measured value fields

- ▶ Press and hold the required measured value field.
 - ✓ A border appears around the measured value field.
 - ▶ Move the measured value field to the required position.
 - ✓ The measurement fields swap places.
- Further information in chapter User interface on page 32.

11.1.4 Assigning measured variables

▶ Tap twice on the required measured value field.

✓ A selection list appears.



Assign measured variables

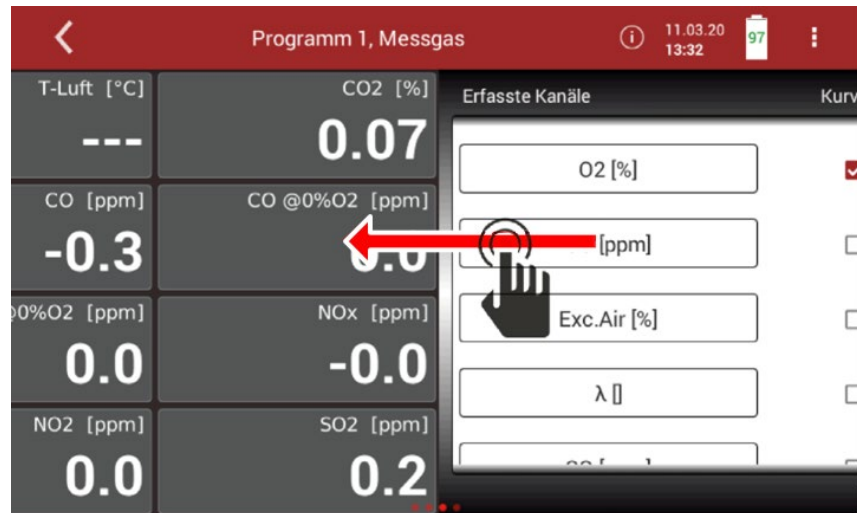
▶ Select the required measured variable.

#	Description
1	Replace ▶ Tap on Replace. ✓ The measured value field is replaced by the chosen measured variable.
2	Insert ▶ Tap on Insert. ✓ The measured variable is inserted in the position occupied by the measured value field. The measured value window previously selected changes position accordingly.
3	Escape ▶ Tap on Escape. ✓ The process is interrupted.

11.1.5 Selecting channels for depiction in chart form

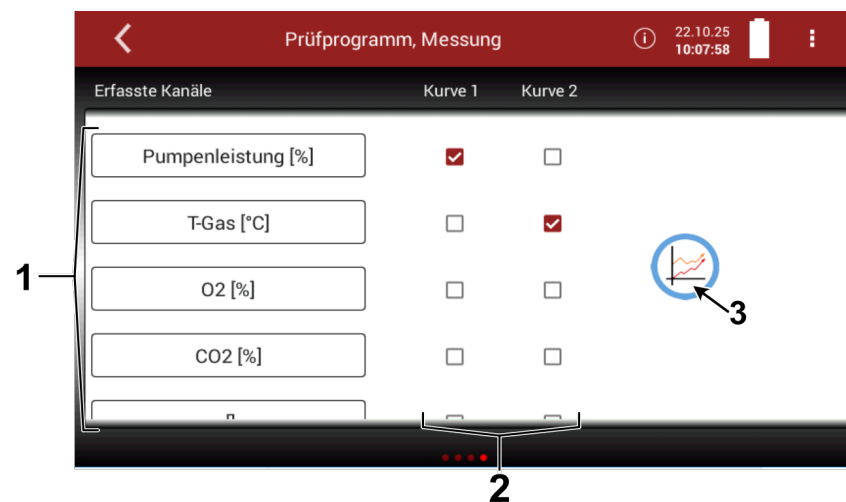
You can select up to eight channels for display two at a time in chart form.

▶ Touch the display and drag the window to the **left**.

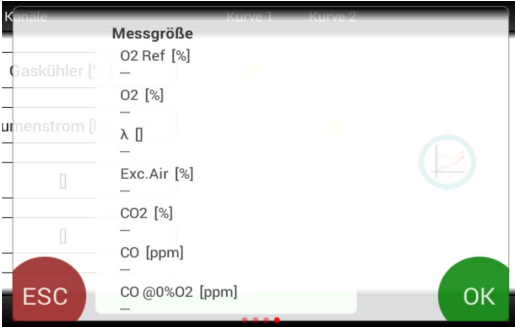


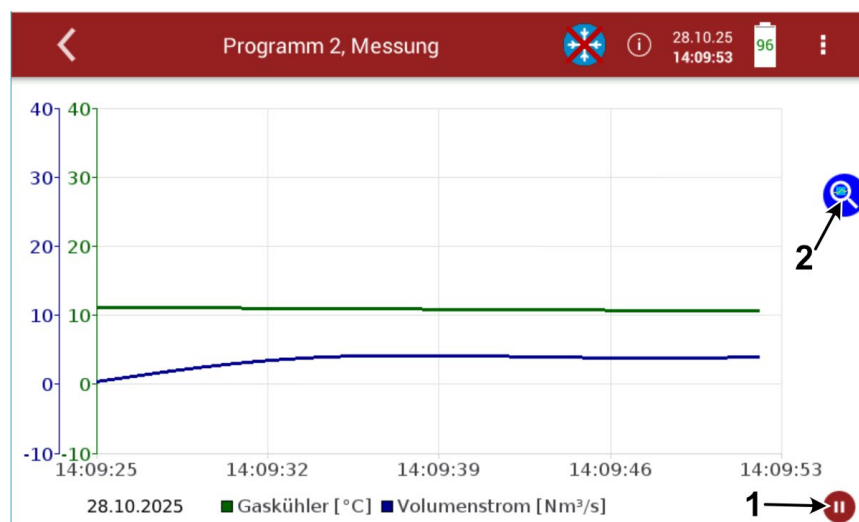
Dragging the Measurement menu window to the left

✓ The **Charts** window appears.



Charts

	Description
1	Channels acquired ☐ Select a measured variable that you wish to replace. ✓ A window appears.  <i>Select measured variable</i> ☐ Select the required measured variable. ☐ Confirm with OK. ✓ The measured variable is replaced by the chosen measured variable.
2	Measurement curves You can choose to have two measured variables displayed as curves at the same time. ☐ Select the required measured variables for curve 1 and curve 2. ☒ selected ☐ not selected
3	Display chart ☐ Tap on the chart symbol  ✓ A chart appears.



Measured value chart

#	Description
1	Pause/resume chart ▶ Tap on to pause chart. Only the chart is paused. Measurement continues in the background. or ▶ Tap on to resume chart.
2	Chart detailed view ▶ Tap on ✓ The chart is paused. Only the chart is paused. Measurement continues in the background. ✓ A selection window appears. <i>Measured variable selection</i> ▶ Select one measured variable or both measured variables. ▶ Use your fingertip to drag a box around the area you wish to view in detail.

11.1.6 List view

You can also choose to have the current measured values displayed in a list view.

▶ Touch the display and drag the window to the **right**.

Prüfprogramm, Messung		
O2	25.00	%
CO2	0.00	%
CO	0.0	ppm
NO	0.0	ppm
In3	---	
CH4	0.0	ppm
C3H8	0.0	ppm
N2O	0.0	ppm
T-Gas	---	°C
T-Luft	---	°C
Diff. Druck	6.2	Pa

List view of measured values

✓ The **list view** appears.

11.1.7 Zoomed-in view

You can also choose to have the current measured values displayed in a zoomed-in view.

▶ Touch the display and drag the window to the **right**.

Messung, Erdgas		
O2 [%]	CO [ppm]	Cooler [°C]
19.30	0.6	5.0
NO ref3%O2 [mg/Nm³]	Losses [%]	
42	0.0	
CO2 [%]	Air ratio [λ]	
0.94	12.59	
CO [mg/kWh]	Eff. ncv [%]	
8	---	

Messung, Erdgas	
O2 [%]	NO [ppm]
19.29	2.8
NOx [ppm]	NOx [mg/Nm³]
2.9	6

Zoomed-in view of measured values

✓ The **zoomed-in view** appears.

11.2 Measuring



CAUTION

Damage to device due to incorrect operation

Operating the measuring device incorrectly or exceeding the limits of the device measuring range can result in damage to the device.

- Do not exceed the measuring range of the pressure sensor.
- Do not exceed the measuring range of the gas sensor.

11.2.1 Starting measurement

▶ Select the **MEASUREMENT** menu.

✓ The measured value window appears.

Messung, Erdgas		
O ₂ [%]	CO [ppm]	Cooler [°C]
19.30	0.6	5.0
NO ref3%O ₂ [mg/Nm ³]	Losses [%]	NO _x [ppm]
42	0.0	3.0
CO ₂ [%]	Air ratio []	T-gas [°C]
0.94	12.59	---
CO [mg/kWh]	Eff. ncv [%]	CO ref0%O ₂ [ppm]
8	---	7

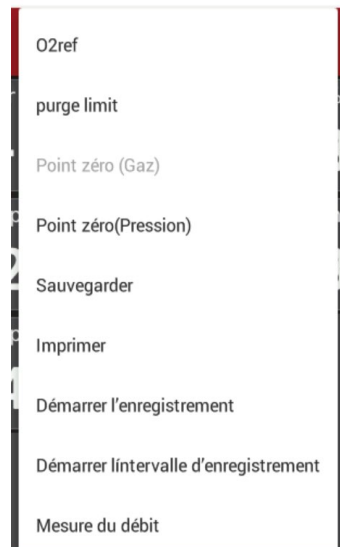
Measurement menu

✓ Measurement starts with the pre-selected parameters.

11.2.2 Measurement context menu

▶ Select the context menu 

✓ A selection list appears.



Measurement context menu

#	Description
1	Set O₂ reference and fuel ▶ Select O₂ reference/fuel ✓ An input window appears. <i>O₂ reference and fuel</i> ▶ Select the required fuel from the selection list (1). ▶ Set the required O₂ reference [%] (2): ▶ Confirm with OK (3). ✓ The fuel and O₂ reference [%] set are applied.

2

Set CO purge limit

Electrochemical sensors work within a specified measuring range and can sustain damage if overloaded.

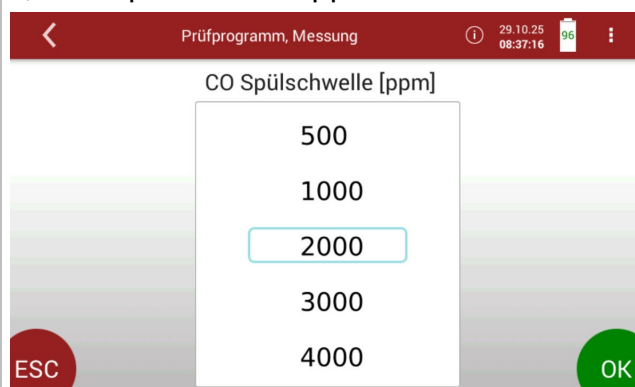
With typical flue gas applications, CO values in particular extend over a large range that can exceed the measuring range of the sensor.

The measuring device consequently has a CO sensor protection system with a shut-off valve and fresh air purging.

CO measurement can only continue during this protective trip using a different CO sensor with a higher measuring range or an NDIR bank (optional).

 Select **Purge limit**.

✓ An input window appears.



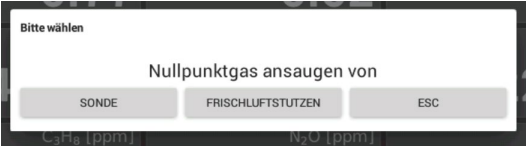
Entering the CO purge limit

 Set the required **CO purge limit [ppm]**.

 Confirm with **OK**.

✓ The **CO purge limit [ppm]** set is applied.

 The ppm value stored determines the CO trip threshold. If the measured value reaches this threshold, the second pump for fresh air purging starts and a valve isolates the CO sensor from the gas path. If the measured value drops to 20% below the threshold value on purging, the CO sensor is once again exposed to sample gas.

3	Repeat zero point calibration It is possible to initiate zero point calibration manually. i The source for the zero point calibration depends on the device settings, see also p.47 - Device settings. ▶ Select Zero point calibration (gas). If Zero point source (gas) fresh air intake is selected: ✓ A message appears.  <i>Message for zero point source fresh air intake</i> ▶ Confirm with YES. ✓ The zero point calibration (gas) via the fresh air intake begins. If Zero point source (gas) from selection is selected: ✓ A message appears.  <i>Message for zero point source from selection</i> ▶ Select the required source for zero point calibration. ✓ The zero point calibration (gas) using the selected source begins. i Zero point calibration takes approximately 8 minutes.
	Zero point (pressure) This function resets all pressure values to 0 to counter zero point drift.

4	Save measured values You can assign the measured values to the relevant plant and save them: ▶ Select Save. ✓ A selection list appears.  <i>Save measurements</i> ▶ Select the required plant. ✓ The measured values are saved. ⓘ Measurement continues until you switch off the measuring device.
5	Print measured values ▶ Connect a printer to the measuring device. See also p.91 - Printing measurement results. ▶ Select Print from the CONTEXT MENU ✓ The data is printed.

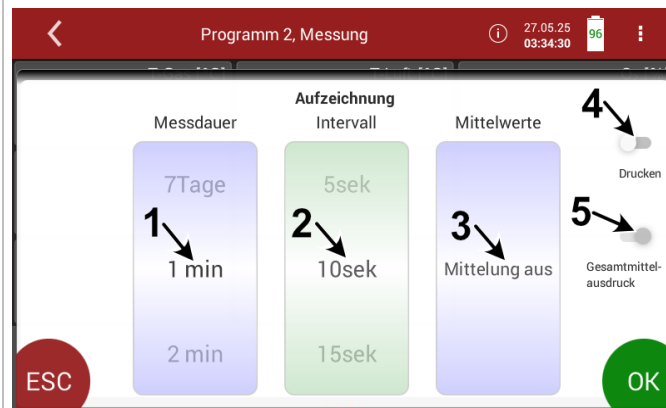
6

Start logging

You can log the measured values for a defined period and have them presented in chart form.

☐ Select **Start logging**.

✓ An input window appears.



☐ Set the required measuring time (1) and interval (2).

☐ Select whether a mean value (3) is to be determined.

☐ Select whether the results are to be printed (4) and whether the overall average term (5) is to be printed.

✓ Confirm with **OK**.

✓ A selection window appears.



☐ Select the required plant.

✓ Logging begins automatically.

✓ The  symbol, which indicates how much longer logging is to run for, appears in the status bar.

✓ Logging ends automatically when the set measuring time expires.

✓ The measurement log is displayed.

Prüfprogramm, Messung		
16.05.2025 03:29:24	Messung	1
O2	0.84	%
CO2	0.01	%
CO	9434.1	ppm
NO	37001.1	ppm
In3	---	
CH4	37.5	ppm
C3H8	4257.9	ppm
N2O	834.4	ppm
T-Gas	---	°C
T-Luft	---	°C
Diff.Druck	6.7	Pa
v-Strömung	11.2	feet/s
Volumenstrom	0.025	m³/s

Logging measurement log

Export CSV file

- ▶ Insert a USB stick into the measuring device.
- ▶ Select **Export CSV** from the **CONTEXT MENU**.
- ✓ The data is exported.

Print data

- ▶ Connect a printer to the measuring device; see also p.91 - Printing measurement results.
- ▶ Select **Print** from the **CONTEXT MENU**
- ✓ The data is printed.

- i

 If zero point calibration (initiated manually or according to a set time interval) is performed while logging is in progress, the measured values displayed remain unchanged. The actual measured values are displayed again immediately before the end of zero point calibration.

Stop logging

Logging can be stopped manually at any time.



▶ Select **Stop logging** from the **CONTEXT MENU** while a measurement is being logged.

✓ Logging is stopped.

i The **Stop logging** menu option appears only while there is a measurement in progress.

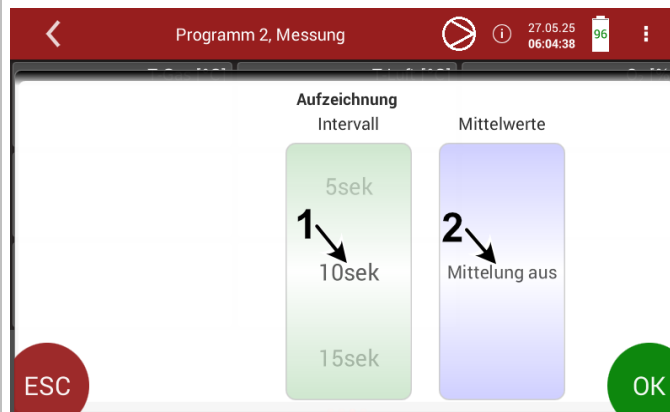
7

Start interval measurement

You can log the measured values at specified intervals and have them presented in chart form.

▶ Select **Start interval measurement**.

▶ An input window appears.



Interval measurement input window

▶ Set the required interval (1).

▶ Select whether a mean value (2) is to be determined.

▶ Confirm with **OK**.

▶ A selection window appears.



▶ Select the required plant.

▶ Confirm with **OK**.

✓ Measurement begins.

✓ The  symbol appears in the status bar.

12 Options

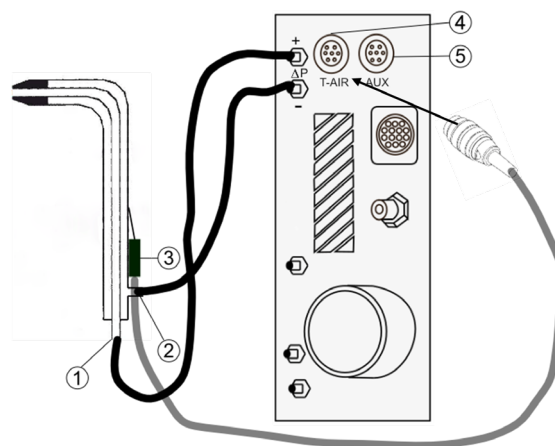
12.1 Option: flow meter measurement program

The flow meter option makes additional measured variables such as

1. flow velocity (v-flow) and
2. volume flow available.

12.1.1 Connecting the measuring device to a pitot tube

The figure below is an example illustrating the connection of the measuring device to a pitot tube with a thermocouple.



Connecting a pitot tube

Item	Designation
1	Total pressure connection
2	Static pressure connection
3	Thermocouple
4	T-AIR connection
5	AUX connection

NOTE

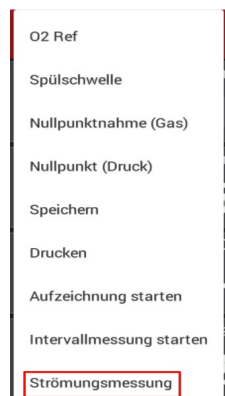
You can use either the T-AIR connection or the AUX connection to connect the pitot tube.



12.1.2 Adding parameters for a flow meter

▶ Open the **CONTEXT MENU** in the **Measurement** menu.

✓ A selection list appears.

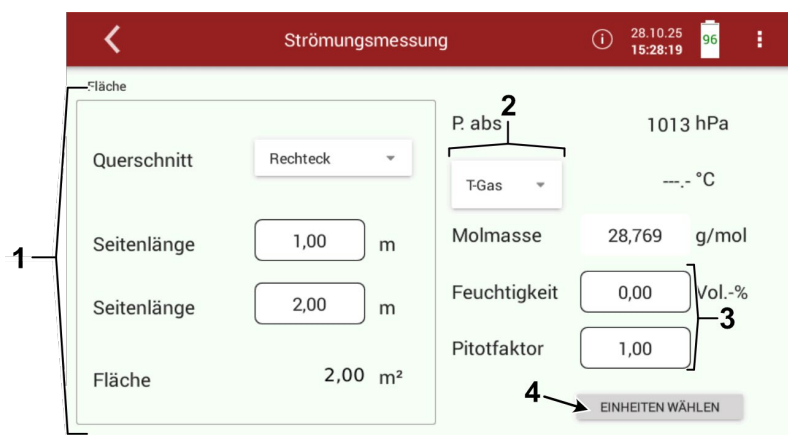


Measurements menu selection list

▶ Select **Flow meter**.

✓ The flow meter input window appears.

▶ Change the necessary parameters.



Measurements menu selection list

#	Designation
1	Calculation of the cross-sectional area
2	Temperature measurement selection i You have the following possibilities for measuring the temperature: 1. via the probe (T-Gas) 2. via the T-AIR connection 3. via the AUX connection ▶ Select the required temperature measurement.
3	Moisture and pitot factor ▶ Enter the values for moisture and the pitot factor here.
4	Select unit ▶ Tap on SELECT UNIT. ✓ An input window appears. Einheiten v-Strömung m/s ▼ Volumenstrom l/s ▼ Querschnitt m² ▼ <i>Select unit</i> ▶ Change the required unit. ▶ Tap on to return to the previous menu. ✓ The setting is saved.

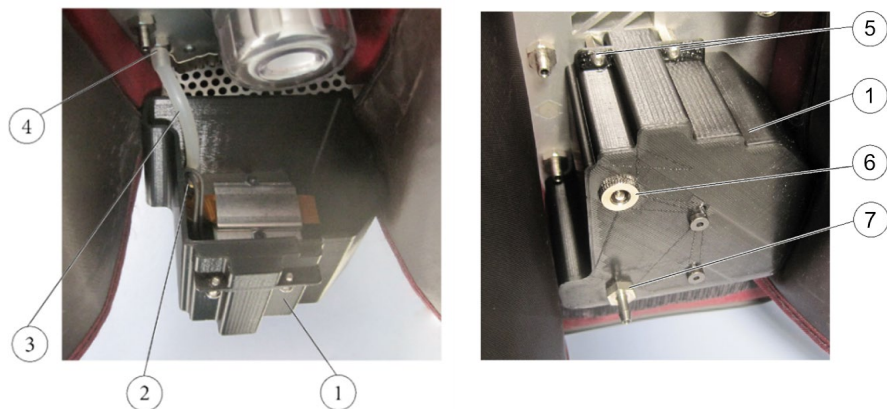
12.2 Option: Operating the measuring device in the extended temperature range

The **Operate in extended temperature range** option enables you to perform measurements down to -15 °C. With this option, the screw filter and condensate drain are heated using a heating box. The heating box is powered via an external power supply unit.

12.2.1 Precautions for operation in the extended temperature range

- ☐ Ensure that the temperature of the measuring device is at least +5°C when it is switched on, as it cannot de-ice itself.
- ☐ Ensure that T-AIR is always inserted at low temperatures so that the heating system is able to work properly.
- ☐ Ensure that all openings in the transport sleeve are closed for measurement operation.

12.2.2 Connecting the heating box



Connecting the heating box

Item	Designation
1	Heating box
2	Condensate outlet in heating box
3	Connecting hose
4	Condensate outlet on measuring device
5	Screws/spacing bolts
6	Bushing for external power supply unit
7	Condensate outlet in heating box

- ▶ Insert the connecting hose into the heating box condensate outlet (2).
- ▶ Insert the connecting hose into the condensate outlet on the measuring device (4).
- ▶ Screw the heating box to the measuring device (6).
 - ⓘ The spacing bolts have an internal thread.
- ▶ Connect the heating box to the external power supply unit (7)
- ▶ Plug the power supply unit into a socket.
 - ⓘ Ensure that a constant power supply to the heating box is maintained for the duration of measurement operation.
- ▶ Close all openings in the transport sleeve during measurement operation.

12.3 Heated sample line booster

The heated sample line booster enables you to manage long heated sample lines. You must use a heated sample line booster if the heated sample line is more than 10 m long.

12.3.1 Technical data

	Value
Voltage [V]	230 VAC
Max. current strength [A]	13 A
Heated sample line lengths [m]	10 m to 30 m

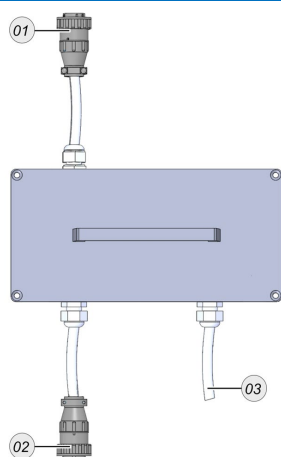
12.3.2 Installation

CAUTION

Damage to contacts due to high voltage

Voltage peaks that could damage contacts can occur when connecting the power supply and if connections are not established correctly.

- When connecting the heated sample line booster:
First connect the heated sample line connector and the device connector, then connect the power supply.
- When disconnecting the heated sample line booster:
Unplug the power supply first.



#	Description
1	Heated sample line connector
2	Device connector
3	230 VAC/13A Power supply

Steps: Connecting the heated sample line

- ☐ Connect the heated sample line connector (1) to the heated sample line.
- ☐ Connect the device connector (2) to the device.
- ☐ Connect the power supply (3) to the power source.
- ✓ The heated sample line booster is connected.

Steps: Disconnecting the heated sample line booster

- ☐ Switch off the main device.
- ☐ Remove the power supply (3).
- ☐ Remove the heated sample line connector (1).
- ☐ Remove the device connector (2).
- ✓ The heated sample line booster is disconnected.

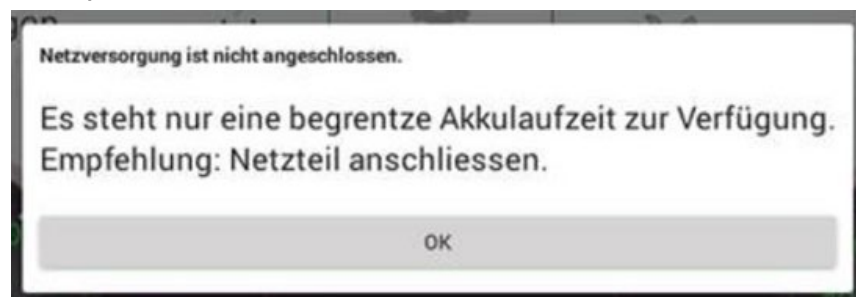
12.4 Option: Measuring device with nickel-metal hydride (NiMH) battery

NOTE

The instructions below are only relevant if the optional NiMH battery is installed in your measuring device.

The NiMH battery is installed in the measuring device instead of a Li-Ion battery. The optional NiMH battery is intended for use when flying, as the rules on transporting Li-Ion batteries by air can often be a source of difficulty.

- i Note that the NiMH battery is not intended to be used for measurement, as there is only a limited battery life of approximately 30 minutes available.
- i Use the measuring device in battery operation mode only for quick changes of measuring location and only perform measurements with a power supply unit connected.
- i If there is no power supply unit connected, the measuring device displays a message
45 seconds after switch on or
90 seconds after the power supply unit is removed in continuing operation.

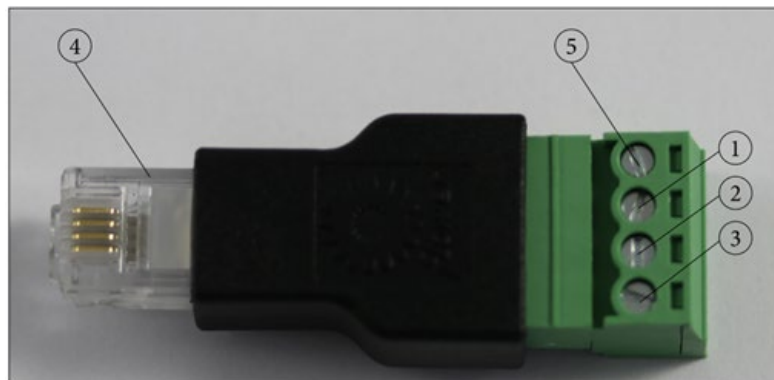


Mains supply not connected message

12.5 Option: external RS485

RS485 interface RTU protocol for data transmission via cable

12.5.1 Electronic connections



RS485 – electrical connections

Item	Connection
1	A+
2	B-
3	GND
4	RJ plug connector for optional RS485 connection
5	Not used

i A twisted cable must be provided by the user.

12.5.2 Port settings

	Value
Baud rate	19200
Data bits	8
Parity	Even
Stop bits	1
Slave ID	1

NOTE

The parameters and connection settings must be applied exactly as specified, otherwise it will not be possible to connect to the measuring device.

12.5.3 Modbus slave specifications:

The analysers can operate as Modbus slave, using the following Modbus over RS485 data types (used in the table below):

4. **a** - ASCII character
5. **u** - 16-bit unsigned integer (0...65535)
6. **i** - 16-bit signed integer (-32768...32767)
7. **ul** - 32-bit unsigned integer (0...4.294.967.295)
8. **l** - 32-bit signed integer
(-2.147.483.648...2.147.483.647)
9. **f** - 32-bit floating point number (reads -1e38 if not available)

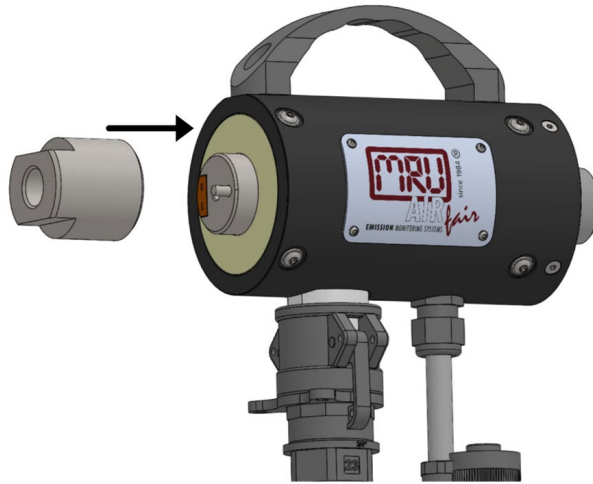
Further information about the defined registers is available on request from MRU Customer Service and on the USB stick supplied with the device.

12.6 OPTION: screwing the adapter onto the HPI probe

The adapter gives you the option of using heated probe tubes from third-party manufacturers.

The adapter is available in 3/8 inch and 3/4 inch sizes.

- i Note the size of the probe tube when screwing the adapter onto the HPI probe.



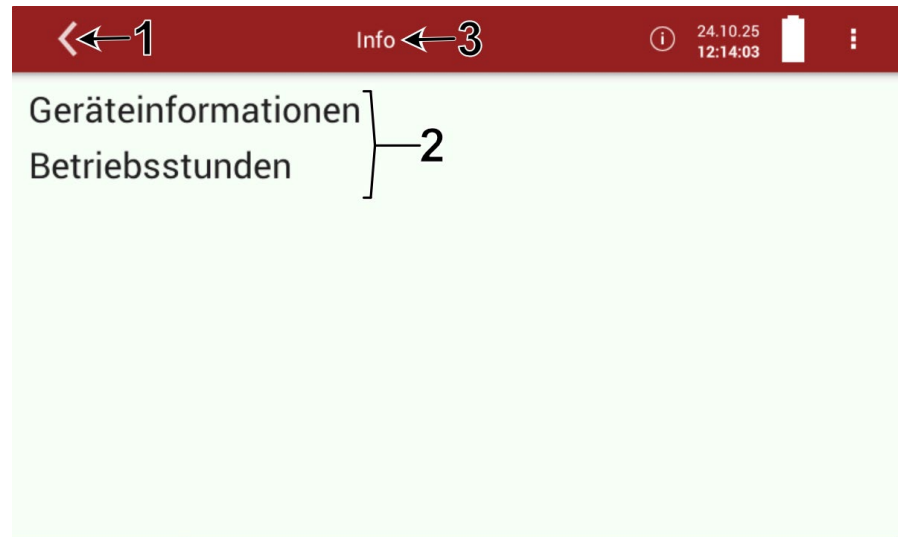
Fitting the adapter on the HPI probe

- ▶ Screw the adapter onto the HPI probe.
- ▶ Screw the probe tube onto the adapter.

13 Maintenance of the MRU measuring device

13.1 Info menu

▶ Select **INFO** from the **Home** menu



Info menu

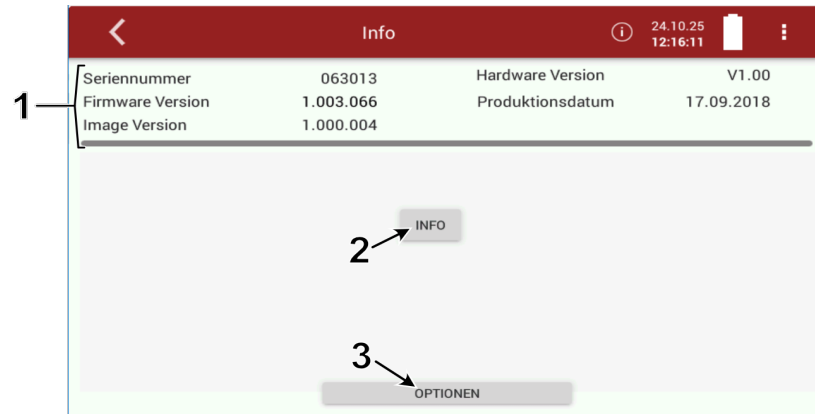
#	Description
1	Back ▶ Tap on  . You are returned to the Home menu.
2	Info menu submenu items
3	Info menu

13.2 Retrieving device information

The device information menu can be used to display details such as the serial number, the firmware version and version information for installed modules and options.

▶ Select **DEVICE INFORMATION** from the **Info menu**.

✓ The device information menu option is displayed.

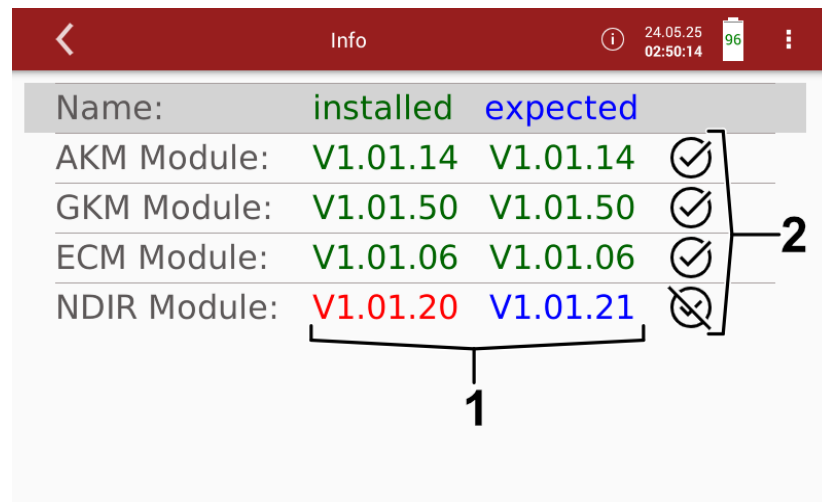


Device information

#	Designation
1	Details of the device serial number, hardware and firmware version, production date and image version
2	Info ▶ Tap on INFO to display the corresponding menu option. ✓ The Info menu option is displayed.
3	Options ▶ Tap on OPTIONS to display the corresponding menu option. ✓ The Options menu option is displayed.

13.2.1 Info

You can view the version information for the various modules under Info.



Name:	installed	expected	
AKM Module:	V1.01.14	V1.01.14	✓
GKM Module:	V1.01.50	V1.01.50	✓
ECM Module:	V1.01.06	V1.01.06	✓
NDIR Module:	V1.01.20	V1.01.21	✗

Device information

#	Designation
1	Installed version and expected version
2	Status  OK Installed version matches expected version  NOK Installed version does not match expected version

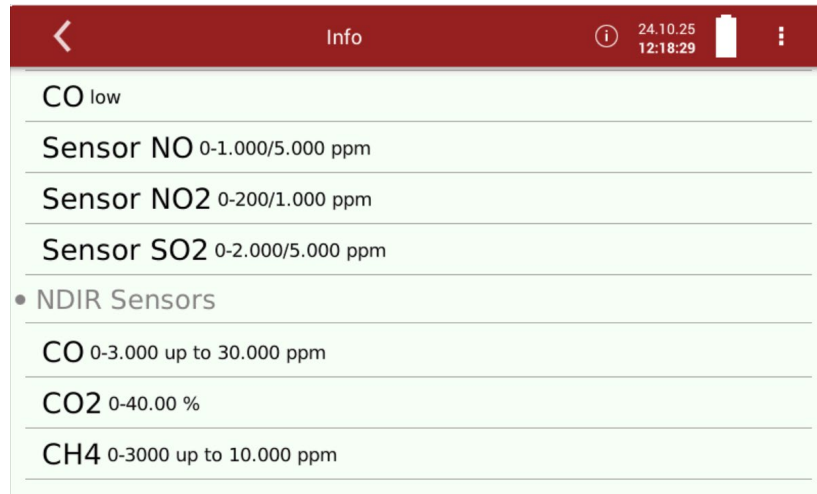
NOTE

The main firmware of the measuring device works best with the firmware intended for this version.

Please install the expected version for any module that currently has a different version installed.

13.2.2 Options

You can view the installed options under Options.



The screenshot shows a mobile application interface with a red header bar. The header contains a back arrow, the word 'Info', an information icon, the date and time '24.10.25 12:18:29', a battery icon, and a menu icon. The main content area has a light green background and lists installed options. The options are: 'CO low', 'Sensor NO 0-1.000/5.000 ppm', 'Sensor NO2 0-200/1.000 ppm', 'Sensor SO2 0-2.000/5.000 ppm', a section header '• NDIR Sensors', 'CO 0-3.000 up to 30.000 ppm', 'CO2 0-40.00 %', and 'CH4 0-3000 up to 10.000 ppm'.

<	Info	24.10.25 12:18:29	
CO low			
Sensor NO 0-1.000/5.000 ppm			
Sensor NO2 0-200/1.000 ppm			
Sensor SO2 0-2.000/5.000 ppm			
• NDIR Sensors			
CO 0-3.000 up to 30.000 ppm			
CO2 0-40.00 %			
CH4 0-3000 up to 10.000 ppm			

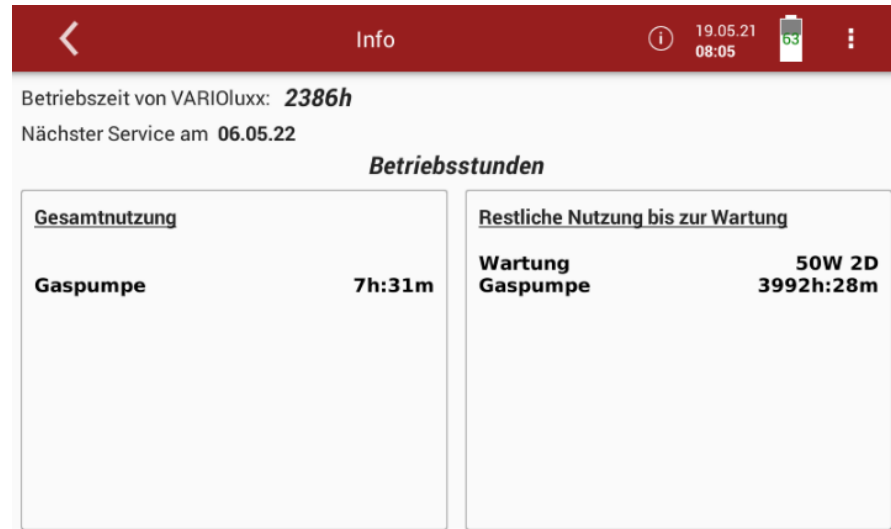
Options

13.3 Viewing operating hours

It is possible to display the operating time of the measuring device, the total usage of specific device components and the remaining usage time to the next round of maintenance.

▶ Select **OPERATING HOURS** in the **Info menu**

✓ The Operating hours menu option is displayed.



Operating hours

NOTE

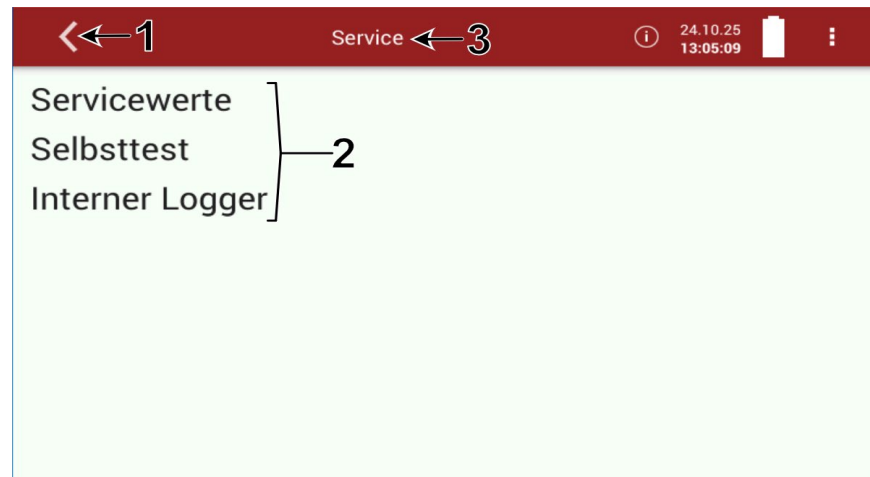
If a device component has exceeded the specified usage time, the measuring device should be presented for maintenance at a service centre without delay.

13.4 Opening the Service menu

The Service menu allows you to view the service information, perform a measuring device self-test and export data from the internal logger.

▶ Select the **SERVICE** menu option from the Home menu.

✓ The **Service menu** opens.



Service menu

#	Description
1	Back ▶ Tap on  . You are returned to the Home menu.
2	Service menu submenu items
3	Service menu

13.5 Service values

Internal parameters and their values are displayed under Service values. It can be helpful to provide these values to Customer Service if the measuring device exhibits unexpected behaviour.

If you receive an error message, contact our Customer Service or, alternatively, contact one of our worldwide service partners via www.mru.eu.

▶ Open **SERVICE VALUES** in the **Service** menu.

✓ The service values are displayed.

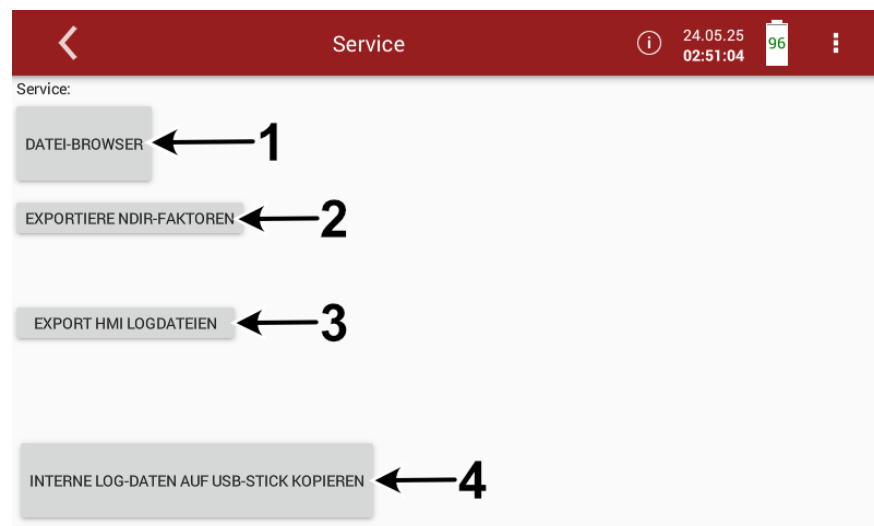
Service		
Modbus-Device:	84	<<<<<< receive
TX counter:	4992	
Errors:	0	
Modbus-Device:	85	<<<<<< receive
TX counter:	4992	
Errors:	0	
Modbus-Device:	84	<<<<<< receive

Service values

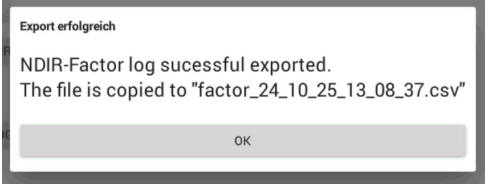
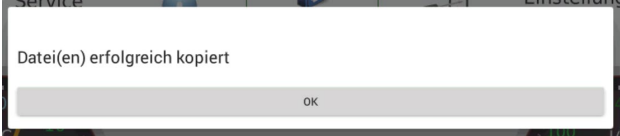
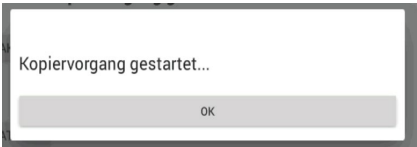
13.6 Internal logger

The measuring device saves internal parameters (log data) at regular intervals so that optimal assistance can be provided in the event of a service case. The data can be copied to a USB stick and, if necessary, sent by e-mail if it needs to be shared (for example with the manufacturer). The data is anonymised so that it cannot be linked to plants or measurement locations.

- ▶ Insert a USB stick into the measuring device.
- ▶ Select **INTERNAL LOGGER** from the Service menu.
- ✓ A window appears.



Internal logger menu

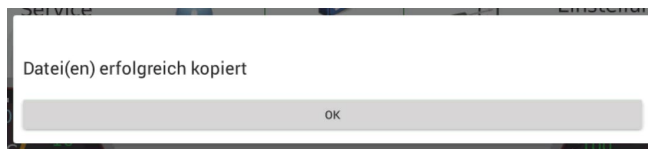
#	Description
1	File browser
2	Export NDIR factors If your measuring device has an NDIR cuvette, you can export the NDIR factors to a USB stick. ▶ Tap on EXPORT NDIR FACTORS ✓ The NDIR factors are exported. ✓ The NdirFactors folder is created on the USB stick and the data is saved to this folder. ✓ A message appears.  <i>NDIR factors exported successfully</i> ▶ Confirm with OK.
3	Export HMI log files ▶ Tap on EXPORT HMI LOG FILES. ✓ The HMI log files are exported. ✓ The HMI_Logs folder is created on the USB stick and the data is saved to this folder. ✓ The following message appears if the copy process is successful:  <i>Files copied successfully</i> ▶ Confirm with OK.
4	Copy internal log data to USB stick ▶ Tap on COPY INTERNAL LOG DATA TO USB STICK ✓ A dialogue window appears.  <i>Copying started</i>

- ▶ Confirm with **OK**.
- ✔ The copying procedure begins.
- ✔ The following symbol appears in the status bar during the copying procedure:



USB copy

- ✓ The **[serial number] log** folder is created on the USB stick and the data is saved to this folder.
- ✓ The following message appears if the copy process is successful:

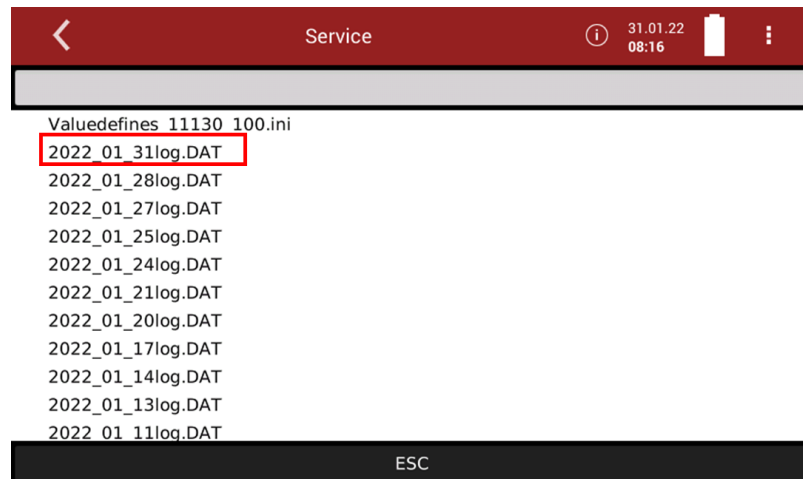


Files copied successfully

- ▶ Confirm with **OK**.
- i** The copying procedure can take a very long time after prolonged operation of the measuring device.

Copy or delete a specific log file

- ▶ Select **FILE BROWSER**.
- ✓ A selection list appears.

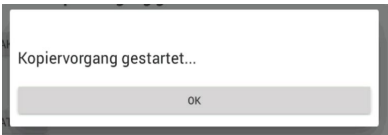


Saved log files

- ▶ Select the required log file.
- ✓ The log file selected appears in the input window.



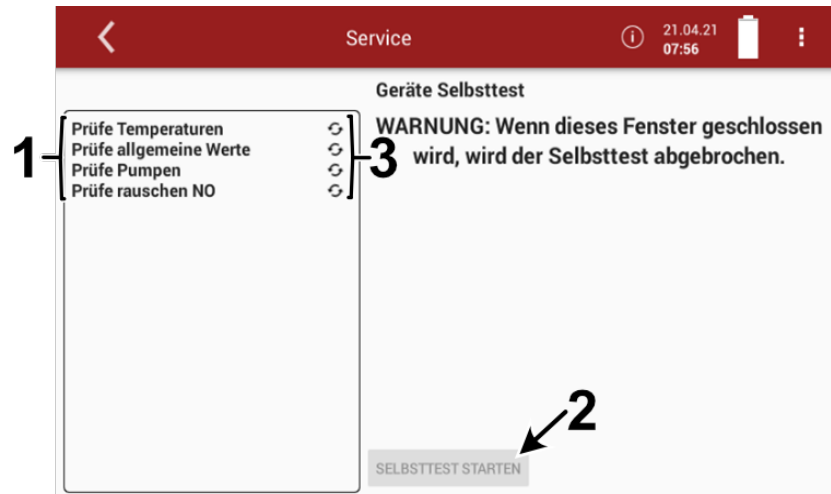
Selected log file in file browser

#	Description
1	Selected log file
2	Copy log file to USB stick ▶ Tap on Copy file to external USB stick ✓ A dialogue window appears.  <i>Copying started</i> ▶ Confirm with OK. ✓ The copying procedure begins. ✓ The following symbol appears in the status bar during the copying procedure:  <i>USB copy</i> ✓ The [serial number] Logg folder is created on the USB stick and the file is saved to this folder. ✓ The message "Files copied successfully" appears if the copy process is successful. ▶ Confirm with OK.
3	Delete log file ▶ Tap on DELETE INTERNAL FILE. ✓ The file is deleted.

13.7 Performing a self-test

The self-test process enables you to test specific measuring device parameters.

- ▶ Select **SELF-TEST** from the **Service** menu.



Self-test

#	Designation
1	Self-test parameters
2	Start self-test ▶ Tap on START SELF-TEST ✓ The self-test begins. The window must remain open during the self-test. The self-test will be terminated if it is closed. ✓ The self-test stops automatically.
3	Statuses ✓ Parameter self-test successful ⌛ Parameter self-test running ✗ Parameter self-test unsuccessful

NOTE

If a self-test is unsuccessful, contact our Customer Service or, alternatively, contact one of our worldwide **MRU service partners** via www.mru.eu.

13.8 Maintenance

We recommend that the sensors be inspected and, where applicable, calibrated annually at an **MRU service centre** to keep the measuring device working properly. Further information can be found at www.mru.eu.



W001

CAUTION

Incorrect maintenance

Failing to maintain the measuring device correctly can result in malfunctions.

- Scheduled maintenance must be performed by qualified skilled personnel.

13.9 Cleaning and caring for the measuring device

The measuring device requires only very limited maintenance to retain its full performance long term.



W001

⚠ CAUTION

Hot components

Hot components can cause burns.

- Disconnect the device from the power supply before beginning maintenance work.
- Allow hot components to cool sufficiently before beginning maintenance work.



W023

⚠ CAUTION

Acid from the condensate

Weakly acidic liquids from the condensate can cause chemical burns.

- In case of contact with acid, immediately rinse the affected area with plenty of water.
- Refer to the safety data sheet for phosphoric acid (10%).

NOTE

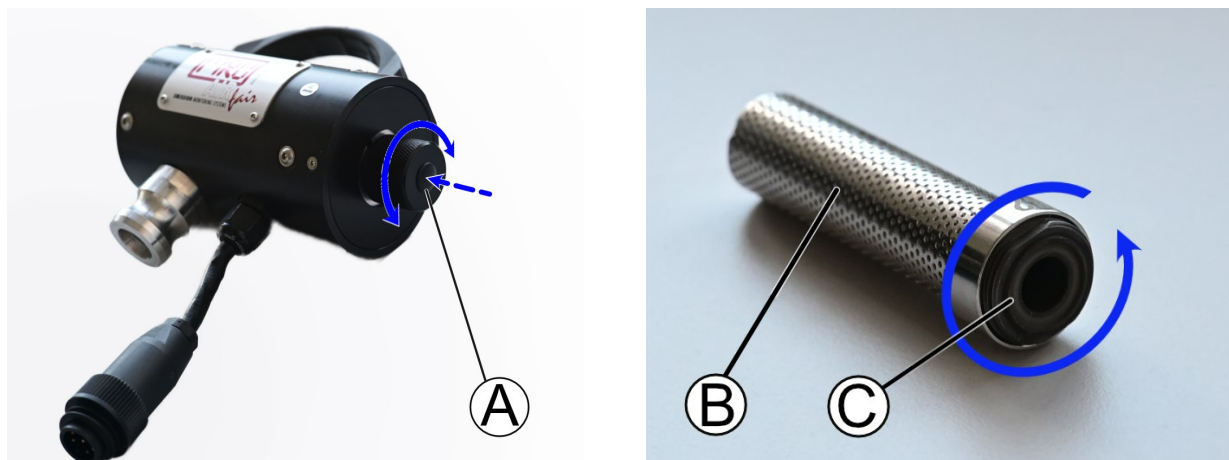
The sensors must be adjusted/calibrated regularly to ensure correct operation of the measuring device.

- ▶ Have the sensors adjusted/calibrated once or twice every year, depending on frequency of use.

13.9.1 Inspection and maintenance of the measuring device

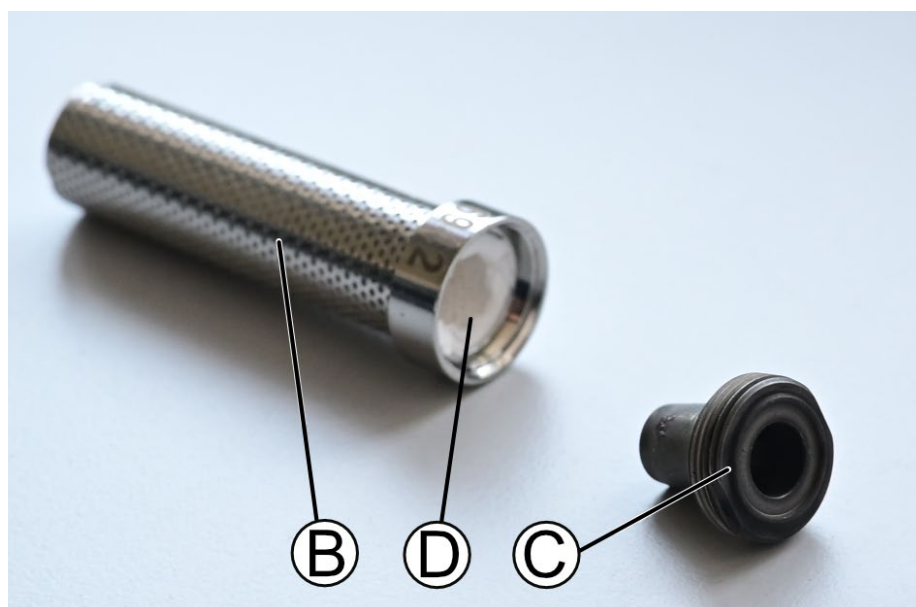
Inspection	Recommended interval	Measure
Full visual check of the measuring device and of the gas sampling probe and probe filter (gas inlet)	Before every measurement	Check for damage and dirt.
Allow hose to dry	After every measurement	Unplug the gas probe
Condition of the probe filter	After every measurement	See Checking the condition of the probe filter and changing where necessary on the following page. If the filter shows a heavy accumulation of dirt, change it.
Condensate collecting vessel	After every measurement	Empty collecting vessel
Cleanliness of probe and probe hose	If necessary	Clean the probe and probe hose.
Battery charge state	Every four weeks/ If not used for prolonged period	Charge the battery.
Round filter at the front	If necessary	See Checking the round filter and changing where necessary on the following pages. If the filter shows a heavy accumulation of dirt, change it.

13.9.2 Checking and changing the probe filter



Opening the probe and filter housing

- ▶ Depress the **knurled knob (A)** on the back of the probe and rotate the probe 90 degrees in either direction.
- ✓ The knurled knob pops out and can be removed together with the clamping element.
- ▶ Remove the **knurled knob (A)** and the **filter housing (B)**.
- ▶ Unscrew the **cover (C)** from the filter housing.

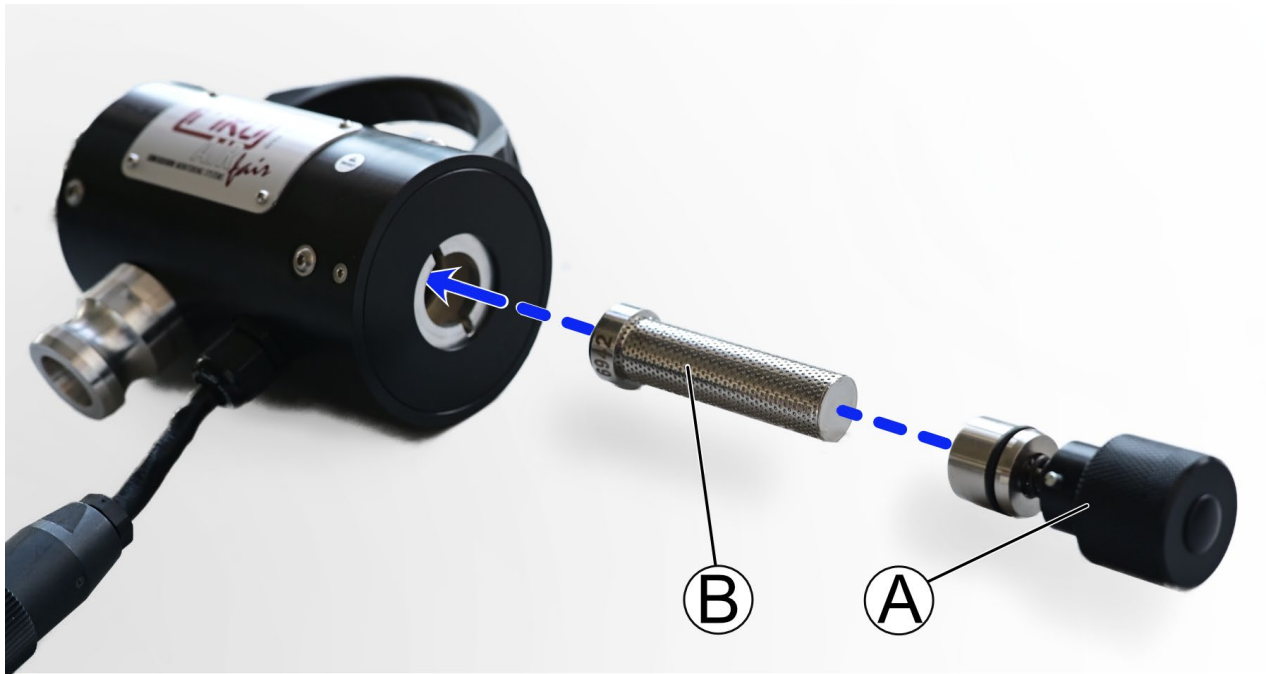


Checking the filter

- ▶ Check the condition of the **filter (D)**.
- 

We recommend changing the filter mat if there is a heavy accumulation of dirt.

- ▶ If necessary, remove the used filter with tweezers and replace it with a new one.
- ▶ Screw the **cover (C)** back onto the **filter housing (B)**.



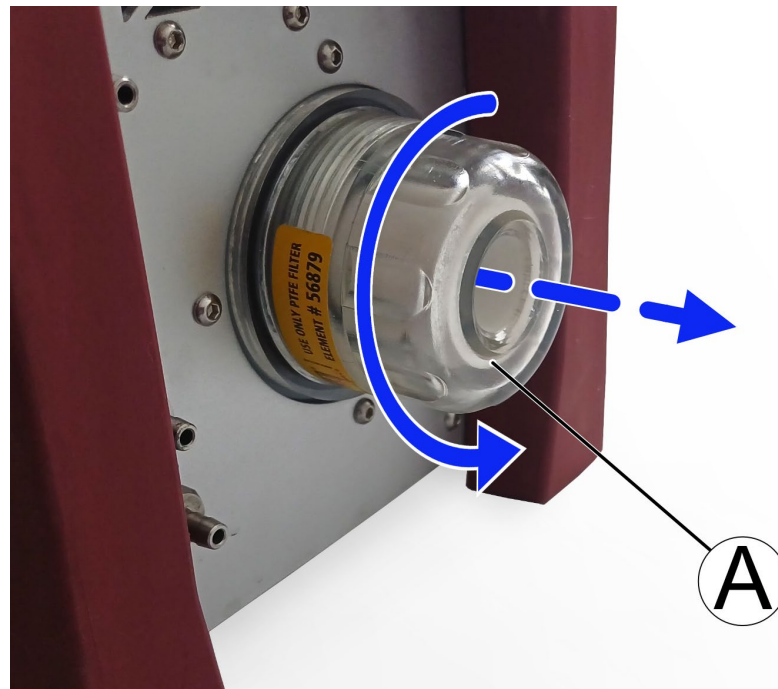
Re-inserting the filter housing

- ▶ Re-insert the **filter housing (B)** into the probe.
 - ⓘ Ensure correct alignment: the opening in the filter housing must be facing the probe tube.
- ▶ Re-insert the **knurled knob (A)** into the probe, depress it and rotate it by 90 degrees until the knurled knob audibly engages.

NOTE

The knurled knob will not engage properly if the filter housing has been inserted incorrectly.

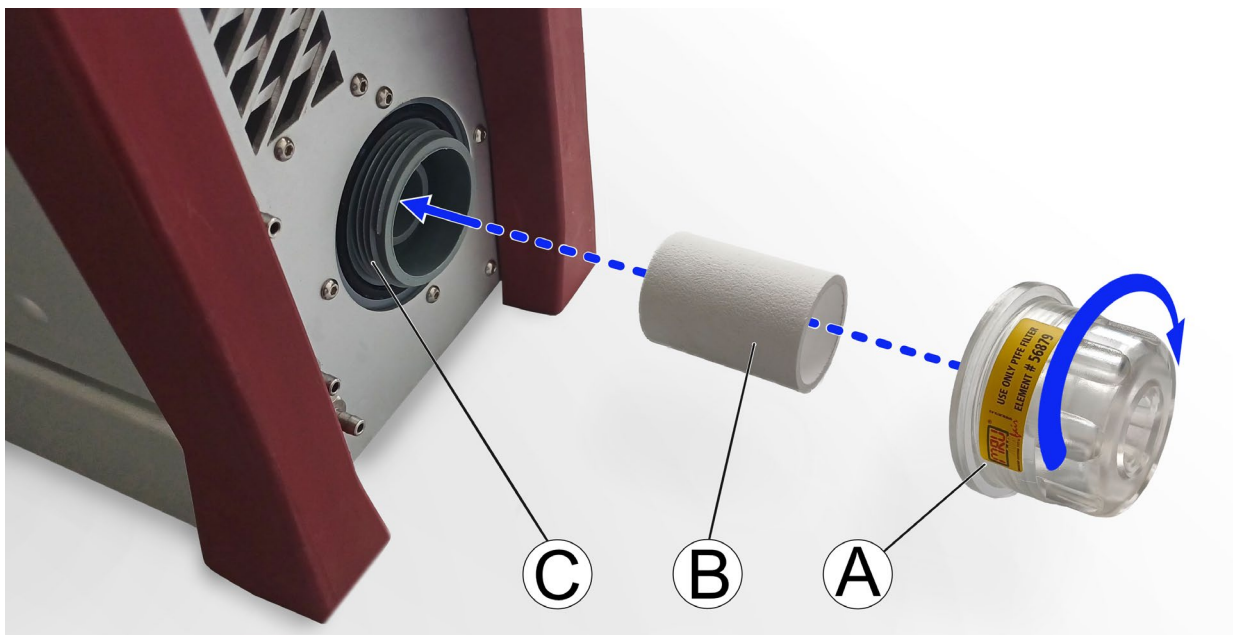
13.9.3 Checking and changing the round filter



Unscrew the filter housing for the round filter

#	Designation
A	Filter housing
B	Filter
C	Filter connector
D	O-ring

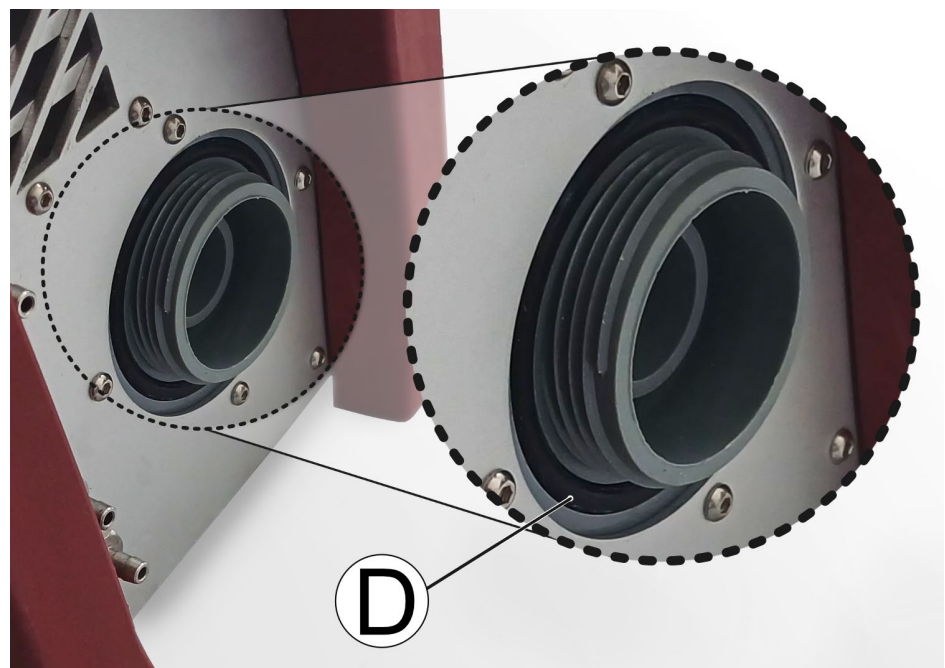
- ▶ Unscrew the **filter housing (A)**.
- ▶ Check the condition of the **filter (B)**.
 - ⓘ We recommend changing the filter mat if there is a heavy accumulation of dirt.
- ▶ If necessary, remove the used filter and replace it with a new one.
- ▶ Screw the **filter housing (A)** with the **filter (B)** back onto the **filter connector (C)**.



Fitting the filter housing

NOTE

Ensure that the **O-ring (D)** is seated in its groove correctly, as the system may leak if it is not.



O-ring seated correctly

14 Replacement parts

Part number	Replacement part
56879 A	PTFE round filter
61158	Probe filter, sintered metal 2 µm
61157	Probe filter, sintered metal 20 µm
10825	Glass wool filter element
59799	O-ring 16 x 1.5
61066	O-ring 12 x 2
61333	O-ring 10 x 2
60074	O-ring 8 x 2

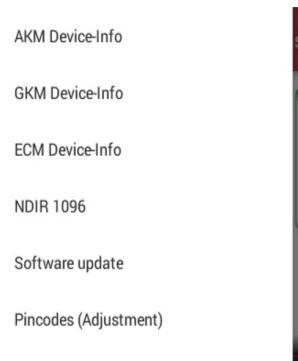
15 Device component information

Information about device components can be helpful in connection with service requests and inquiries.

15.1 Device component information menu

▶ Select  in the Home menu

✓ A selection list appears.



AKM Device-Info
GKM Device-Info
ECM Device-Info
NDIR 1096
Software update
Pincodes (Adjustment)

Device component information selection list

▶ Select the required device component information.

✓ The device component information is displayed.

15.2 Updating firmware

You may receive from the manufacturer a new, authorised data package to update the firmware and the various modules. The data package will consist of a ZIP file and will have the file extension **.mru**.

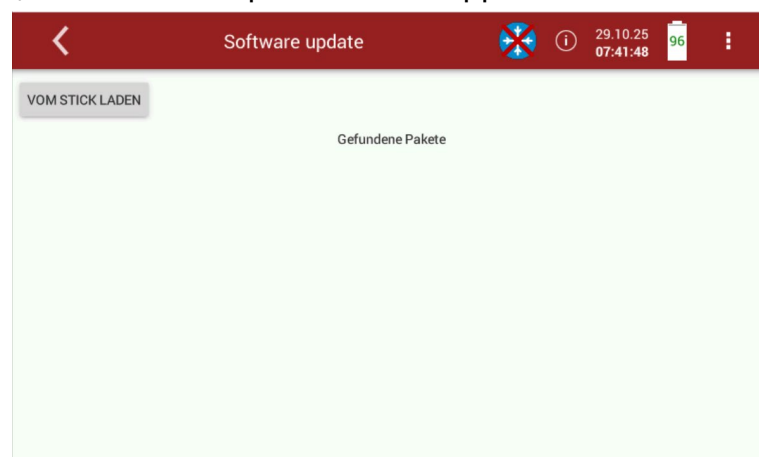
15.2.1 Updating main firmware

- ▶ Copy the data package to a USB stick.

NOTE

It is also possible to store the data package in subfolders. The measuring device searches the folder structure on the USB stick down to the second hierarchical level. If the option file is not displayed, save the data package higher up in the folder structure.

- ▶ Connect the measuring device to the mains power supply.
- ▶ Switch the measuring device on.
- ▶ Insert the prepared USB stick into a USB socket on the measuring device.
- ▶ Select  in the **Home menu**
- ✓ A selection list appears.
- ▶ Select **Software update**
- ✓ The software update window appears.



Software update

Tap on **LOAD FROM STICK** and confirm the message with **OK**

- ✓ The data is loaded from the USB stick.
- ✓ When the loading process is complete, a message appears.



Files loaded successfully

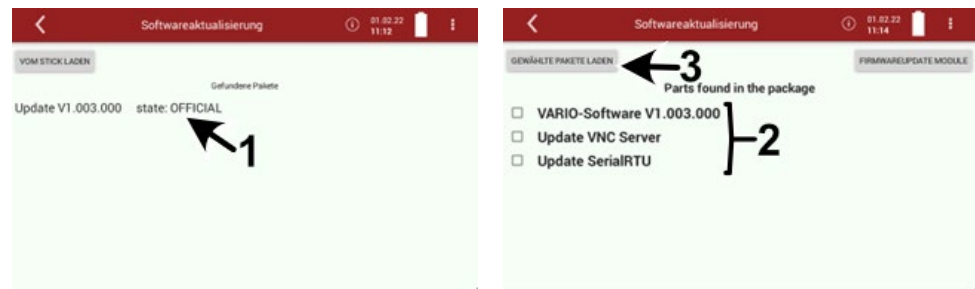
☐ Confirm with **OK**.

✓ The data packages on the USB stick are displayed.

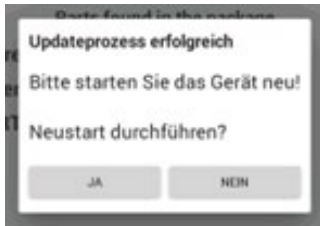
NOTE

If there are no data packages displayed, save the data package to a USB stick again.

If the data package is not displayed for a second time, contact customer service or, alternatively, contact one of our worldwide MRU Service Partners via www.mru.eu.



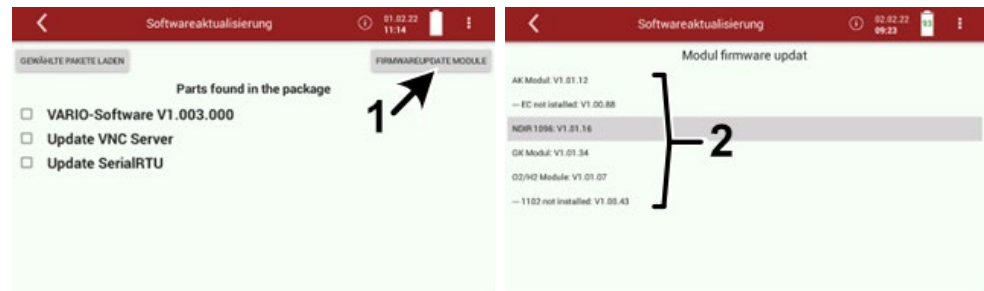
Software update – package loaded

#	Designation
1	Data packages on the USB stick ▶ Select the required data package. ✓ The items (2) contained in the data package are displayed.
2	Items contained in the data package ▶ Select the items contained in the data package that you wish to update. ☐ Item not selected ☒ Item selected
3	Load selected packages ▶ Tap on LOAD SELECTED PACKAGES ✓ Selected packages are loaded and a message appears. ✓ The measuring device must be restarted to complete the update process.  ▶ Confirm message with YES. ✓ The measuring device is restarted. ✓ The main firmware has been updated. ✓ You can now update the firmware of individual modules.

15.2.2 Updating firmware of individual modules

NOTE

You must update the main firmware first. After restarting, you can then update the firmware of individual modules.



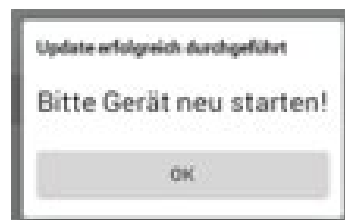
Updating software

#	Designation
1	Module firmware update ▶ Tap on MODULE FIRMWARE UPDATE ✓ The modules are displayed.
2	Module selection for updating ▶ Select the module you wish to update. ✓ A message appears.  <i>Update module</i> ▶ Confirm the message with YES ✓ The update is started.



Updating software

- ✓ A message appears once the update has been completed successfully.



Update completed successfully

- ▶ Confirm the message with **OK**.
- ▶ Restart the measuring device.
- ✓ The module firmware has been updated.

15.3 AKM-Device Info

▶ Select **AKM-DEVICE INFO** in the **Device information menu** .

✓ An information window appears.

AKM Device-Info		18.05.25 00:49:05	96	
AK-Modul		4-20mA out8	0.000	mA
Seriennummer	749999	4-20mA out7	0.000	mA
Firmware Version	V1.01.14	4-20mA out6	0.000	mA
Hardware Version	V1.05	4-20mA out5	0.000	mA
Bootloader Version	V0.00.01	4-20mA out4	0.000	mA
Produktionsdatum	30.06.2020	4-20mA out3	0.000	mA
Abgleichdatum	06.02.2106	4-20mA out2	0.000	mA
		4-20mA out1	0.000	mA
		4-20mA in1	-0.006	mA
		4-20mA in2	-0.007	mA

AKM-Device Info

15.4 GKM-Device Info

▶ Select **GKM-DEVICE INFO** in the **Device information menu** .

✓ An information window appears.

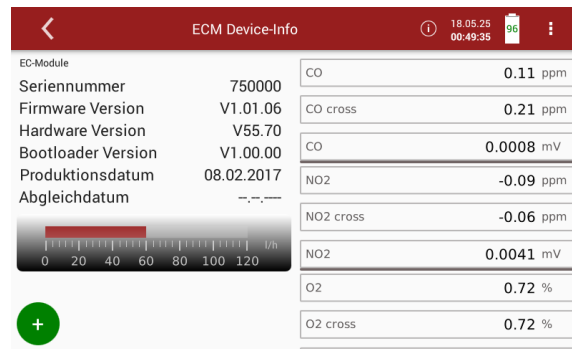
GKM Device-Info		18.05.25 00:49:18	96	
GK-Modul		max. current	2044	mA
Seriennummer	752185	Act. value Cooler R	4.00	°C
Firmware Version	V1.01.50	Cooler R setpoint	4.0	°C
Hardware Version	V2.00	Act. value Cooler L	11.43	°C
Bootloader Version	V0.00.02	Cooler L setpoint	11.4	°C
Produktionsdatum	14.07.2020	Heatsink	27.35	°C
Abgleichdatum	14.07.2020	TC aux	9999.90	°C
		TC air	9999.90	°C
		TC gas	9999.90	°C
		P probe	0.0	W

GKM-Device Info

15.5 ECM-Device Info

▶ Select **ECM-DEVICE INFO** in the **Device information menu** .

✓ An information window appears.



ECM-Device Info

15.6 PIN code (calibration)

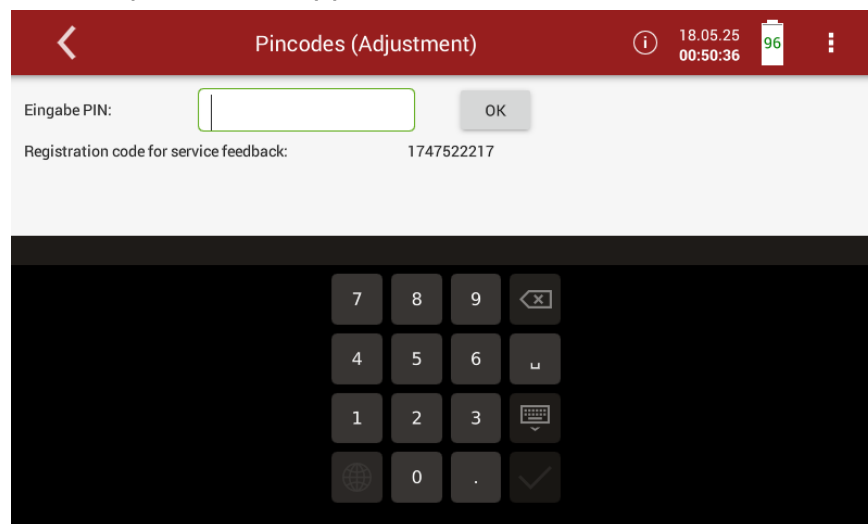
Entering a PIN code enables authorised personnel to calibrate the sensors and other functions. Manual O₂ calibration is not possible. The PIN code can be requested from MRU customer service.

NOTE

A PIN code is **not** required for regular operation of the measuring device.

▶ Select **PIN CODE (CALIBRATION)** in the **Device information menu**.

✓ An input window appears.



Pin code entry

▶ Enter the PIN code.

▶ Confirm with **OK**.

✓ The function is enabled.

15.7 Diagnosing measuring device faults

Error message	Possible cause	Remedy
Gas cooler fault Gas cooler is not operational Device shutting down	Gas cooler is defective.	Please contact MRU customer service.
Undervoltage Device shutting down	Battery is fully discharged.	Plug in mains plug and charge the device battery.
Heated sample line fault Power consumption is too high. Please check heated sample line.	Heated sample line may not be working properly.	Check heated sample line for damage. Uncoil heated sample line completely in operation.
Please wait – pump is off Warm-up phase is not yet completed.	Measurement is not yet possible because the device is still in the warm-up phase.	Wait for the warm-up phase to complete.
Flow rate Flow rate too low Please check flow rate (filter, gas path etc.)	The flow rate is below the permitted minimum. Filter/gas path is blocked. Gas pump defective Flow rate sensor defective	Check filter/gas path for blockages.
Gas cooler drying out	Typically occurs after a prolonged period (several minutes) of measuring dry calibration gas or dry ambient air rather than flue gas.	Use a calibration gas humidification system.

15.8 Condensate alarm

A condensate alarm is triggered as soon as water is detected in the gas duct. Measured values may be implausible if this happens.

There is a two-stage process to clear a condensate alarm.

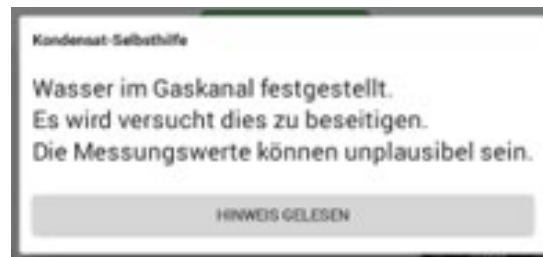
When a condensate alarm occurs, the measuring device attempts to resolve the problem itself with a **condensate self-correction process** and return to measuring mode.

- i** If the **condensate self-correction process** is unsuccessful and there is still water in the gas duct, it will be necessary to initiate a gas duct drying step manually.

15.8.1 Condensate self-correction process

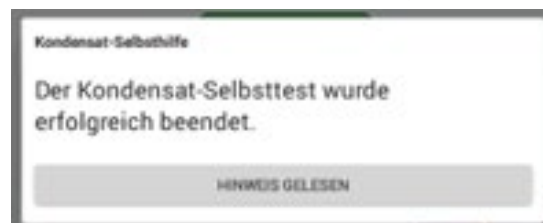
You do not actively need to initiate any steps in the **condensate self-correction process**. The measuring device completes the condensate self-correction process autonomously.

The measuring device displays a message whenever water is detected in the gas duct.



Water detected in gas duct

- ✓ The condensate self-correction process is performed.
- ✓ A message appears as soon as the condensate self-correction process has completed successfully.



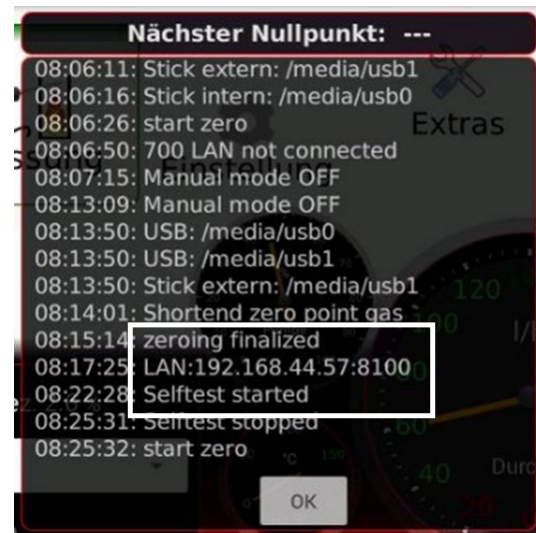
Condensate self-correction process successful

- ✓ A zero point calibration is started automatically.

You can have the start and end of the **condensate self-correction process** displayed:

▶ Select **INFO**  in the **Home menu**

✓ The information window appears.

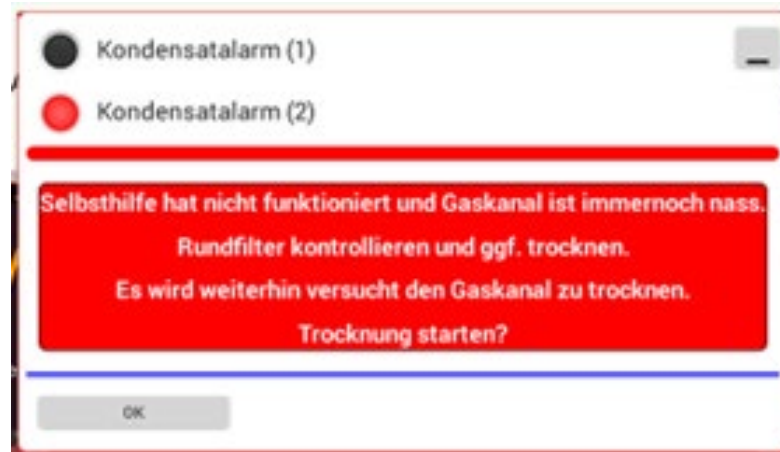


Information window

15.8.2 Start drying manually

If the condensate self-correction process is unsuccessful and there is still water in the gas duct, it will be necessary to initiate a gas duct drying step manually.

A corresponding message is displayed and an acoustic signal sounds.



Start drying manually

⚠ CAUTION

Acid from the condensate

Weakly acidic liquids from the condensate can cause chemical burns.

- In case of contact with acid, immediately rinse the affected area with plenty of water.
- Refer to the safety data sheet for phosphoric acid (10%).



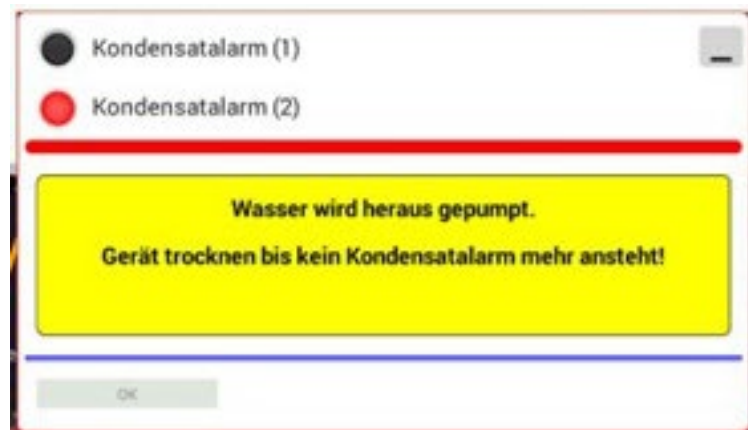
W023

NOTE

Dispose of acidic condensate and phosphoric acid in accordance with national and, where applicable, local waste disposal regulations.

Steps:

- ▶ Remove the round filter.
- ▶ Dry the round filter if necessary.
- ▶ Tap on **OK**.
- ✓ A window appears.



Drying started

- ✓ The drying process is started.
- ▶ Repeat the procedure if an error message is displayed again.
- ✓ A message appears as soon as the gas duct is dry again.



Gas duct is dry

- ▶ Tap on **CONTINUE MEASUREMENT**.
- ✓ A zero point calibration is started.
- ✓ Measurement can continue after the successful zero point calibration.

15.9 Switching off the measuring device in the event of a fault

If the touch panel does not respond to input, you can switch the measuring device off or perform a reset as explained below.

15.9.1 Switching off the measuring device without touch panel input

- ▶ Press and hold the ⏻ button for at least 30 seconds until the blue LED flashes.
- ▶ Release the ⏻ button as soon as the blue light flashes.
- ✓ The device switches off.

15.9.2 Performing a reset

The reset button can be accessed through an opening in the back of the measuring device.



Reset button opening

- ▶ Insert a thin wire into the reset opening until you reach the **Reset button**.
- ✓ The device performs a reset and starts up again.

16 Decommissioning

Irrespective of the device version, the following steps must be taken before decommissioning:

- ▶ Evacuate all remaining analysis gases from the device.
- ▶ Rinse the device with nitrogen or ambient air.
- ▶ Dispose of the device in a professional manner. Observe the legal conditions at the place of disposal of your device.
 - i Information on the disposal of your device can be obtained from your MRU Service Centre. Parts containing hazardous substances, such as electrochemical sensors, batteries or rechargeable batteries can be sent back to MRU. The return shipment must be free of charge for MRU.

The appliance must not be disposed of with household waste.



You can find the WEEE registration number in the imprint under www.mru.eu.

17 Technical data

17.1 Technical data

	Specification
Operating temperature	+5°C ... +45°C
Rel. atmospheric humidity during operation, non-condensing	90%
Storage temperature	-20 °C to +50°C
Internal battery, capacity, operating time without gas cooler and heated sample line (1 Li-Ion battery)	Li-Ion, 48 Wh, 6 h
Battery capacity, optional (2 Li-Ion batteries)	96 Wh
Battery capacity, optional (NiMH battery)	26Wh
Charging time (Li-Ion 48 Wh)	2 h = >90% 4 h = 100%
Charging time (Li-Ion 96 Wh)	3 h = >90% 5 h = 100%
Display	7 touch, <750 cd/m ² 800*480 px
Power supply (without heated sample line)	86 - 265Vac / 47 - 63Hz / 105W
Power consumption (with 5 m heated sample line)	300 W typical (600 W max.)
Weight, device (including 2 EC sensors)	7.5 kg
Weight, device in case (including 2 EC sensors)	16 kg
Dimensions without case (WxHxD)	43 cm x 29 cm x 15 cm
Dimensions including case (WxHxD)	52 cm x 51 cm x 30 cm
Enclosure material	Aluminium/TPU
Type of protection	IP20

17.2 NDIR measuring values

Art. no.	Gases	Measuring range	Resolution	Accuracy	T90 time
10561	CO	1000 - 30,000 ppm	1 ppm	±10 ppm / 2%	40s
	CO ₂	50 Vol%	0.01 Vol%	±0.1 Vol% / 2%	
	CH ₄	1000 - 10,000 ppm	1ppm	±10 ppm / 2%	
10560	CO	1000 - 30,000 ppm	1 ppm	±10 ppm / 2%	40s
	CO ₂	50 Vol%	0.01 Vol%	±0.1 Vol% / 2%	
	C ₃ H ₈	1000 - 10,000 ppm	1ppm	±10 ppm / 2%	

17.3 Sensors

	Details on measurement accuracy
Electrochemical sensor	O2 Long Life
Measuring range	0 - 25 Vol%
Resolution	0.01 Vol%
Accuracy abs.	± 0.2 Vol%
Response time T90	<20 s
Years of expected lifespan exposed to air	5
Electrochemical sensor	CO
H2 - compensated	
Nominal measuring range	0 - 10000 ppm
Overload range	<20,000 ppm
Resolution	1
Accuracy, absolute/of measured value	± 10 ppm/ 5% (0 - 10,000 ppm) 10% (>20,000 ppm)
Response time T90	<40 s
Option	CO low
Measuring range	300 ppm
Resolution	0.1 ppm
Accuracy, absolute/of measured value	2.0 ppm/5%

	Details on measurement accuracy
Electrochemical sensor	CO high
Nominal measuring range	0 - 4000 ppm
Overload range	<20,000 ppm
Resolution	1
Accuracy, absolute/of measured value	± 100 ppm/ 5% (0 - 4000 ppm) 10% (>4,000 ppm)
Response time T90	<40 s
Electrochemical sensor	NO
Nominal measuring range	0 - 1000 ppm
Overload range	< 5000 ppm
Resolution	1
Accuracy abs. /of measured value	± 5 ppm/ 5% (0 - 1,000 ppm) 10% (>1000 ppm)
Response time T90	< 30s
Option	NO low
Measuring range	300 ppm
Resolution	0.1 ppm
Accuracy abs. / of measured values	2.0 ppm/5%
Electrochemical sensor	NO₂
Nominal measuring range	0 - 200 ppm
Overload range	< 1000 ppm
Resolution	1
Accuracy abs. /of measured value	± 5 ppm/ 5% (0 - 200 ppm) 10% (>200 ppm)
Response time T90	<40 s
Option	NO₂ low
Measuring range	100 ppm
Resolution	0.1 ppm
Accuracy	2.0 ppm/5%

	Details on measurement accuracy
Electrochemical sensor	SO₂
Nominal measuring range	0 - 2000 ppm
Overload range	< 5000 ppm
Resolution	1 ppm
Accuracy abs. /of measured value	± 10 ppm/ 5% (0 - 2000 ppm) 10% (>2000 ppm)
Response time T90	<40 s
Option	SO₂ low
Measuring range	100 ppm
Resolution	0.1 ppm
Accuracy	4.0 ppm 5%
Electrochemical sensor	H₂S
Nominal measuring range	0 - 2,000 ppm
Overload range	<10000 ppm
Resolution	1 ppm
Accuracy abs. /of measured value	± 5 ppm/ 10% (0 - 500 ppm) 15% (>500 ppm)
Response time T90	<40 s
Paramagnetic sensor	O₂
Measuring range	0 - 25 Vol%
Resolution	0.01 Vol%
Accuracy	0.1 Vol%
Flue gas temperature	T_A
Measuring range with stainless steel gas sampling pipe	0 - 800°C
Measuring range with Inconel gas sampling pipe	0 - 1100°C
Short-term (up to 20 minutes)	0 - 1350°C
Accuracy abs. / of measured values	±2°C / 1%
Combustion air temperature	T_i
Measuring range	0 - 100°C

	Details on measurement accuracy
Accuracy abs.	1°C
Draft	
Measuring range	± 120 hPa
Accuracy abs. / of measured values	0.02 hPa/1%
Differential pressure	
Measuring range	± 120 hPa
Accuracy abs. / of measured values	0.02 hPa/1%
Barometric pressure	
	P _{abs}
Measuring range	300 - 1,200 hPa
Accuracy	± 3 hPa

17.4 Gas sampling and preparation

	Specification
Max. negative pressure range of gas pump	350 hPa
Typical gas flow rate	60 l/h
Single - gas cooler	•
Peltier cooler temperature (mains and battery)	5°C
Operating time in battery operation mode with gas cooler (1 Li-Ion battery pack)	1h45min
Operating time in battery operation mode with gas cooler (NiMH battery)	30min
Condensate disposal from the gas cooler	•
Automat. moisture alarm	•
Internal flow measurement	•
Gas outlet (vent connection)	
Passive, connection size	3 mm
Active (for long vent lines or backpressure)	Optional

17.5 Gas cooler strategy

The gas cooler strategy depends on the sensors used

Operating state	Battery	Mains	Sensor
VARIO/uxx ECS	max. 20°C or 5°C below ambient and min. 5°C	max. 20°C or 5°C below ambient and min. 5°C	ECS Sensor temperature
VARIO/uxx NDIR + ECS	max. 20°C or 10°C below ambient and min. 5°C	5°C	ECS Sensor temperature in battery operation mode
VARIO/uxx- paramagnetic only	4°C	4°C	Paramagnetic only
VARIO/uxx NDIR + O2 ECS only	5°C	5°C	

17.6 Calculated values

	Specification
	CO₂
Measuring range (depending on fuel)	0 - CO ₂ max
Accuracy abs.	± 0.3 Vol%
Dew point	°C
Flue gas loss qA	0 - 99.9%
Efficiency	0 - 120%
Supported units for measured values	mg/Nm ³ O ₂ Ref mg/kWh NOx: mg/Nm ³ NO ₂
Flow velocity Based on differential pressure measurement with Prandtl tube	v
Measuring range, typical	3 m/s - 100 m/s
Accuracy at 3 m/s	1 m/s
Accuracy > 12 m/s (of measured value)	± 1%
Resolution	0.1 m/s
Absolute pressure measurement	•

17.7 Measured variables and calculation

Variables measured continuously	Unit
O ₂	[%]
Air temp. (thermocouple)	[°C]
Flue gas temp. (thermocouple)	[°C]
CO	[ppm]
Draft	[hPa]

Other measured variables calculated continuously	Unit
CO ₂	[%]
Efficiency net	[%]
Efficiency gross	[%]
Losses net	[%]
Losses gross	[%]
Lambda	-
Dew point	[°C]
CO/CO ₂ ratio	[%]

17.8 Data communication

Module/protocol/connection	Specification
USB connection, Master only (connection of accessories, stick etc.)	O
Support for external SD card reader	O
Ethernet, RJ45	O
WLAN	O
Bluetooth	O
RS485 (AUX connection, non-isolated, for ext. sensor module connection)	O
RS485 (isolated, for connection to PC)	O
Analogue I/O: 4x input, 8x output, 4 - 20 mA	O

17.9 Fuel types

This list applies for Germany only.

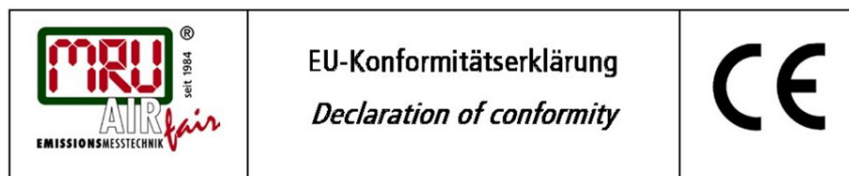
Information about fuels for other countries can be requested from **MRU**.

Website: www.mru.eu.

Fuel	CO ₂ max	A1	A2	B
Calibration gas	0.0	0.00	0.00	0.000
Natural gas (LL)	11.8	0.37	0.66	0.009
Heating oil EL	15.4	0.50	0.68	0.007
Heating oil S	15.9	0.50	0.66	0.007
Liquid gas P/B	13.7	0.42	0.63	0.008
Propane	13.7	0.43	0.66	0.007
Butane	14.1	0.45	0.67	0.007
Biodiesel	15.7	0.46	0.62	0.005
Wood, dry	20.3	0.60	0.62	0.009
Pellets	20.3	0.74	0.77	0.000
Coal	19.1	0.59	0.65	0.009
Brown coal	19.4	0.39	0.42	0.009
Peat	19.8	0.66	0.70	0.010
Coke oven gas	10.8	0.29	0.60	0.011
Town gas	11.7	0.35	0.63	0.011

* – not included, can be created under user-defined fuel if required using the values indicated in the table.

18 Declaration of Conformity



MRU Messgeräte für Rauchgase und Umweltschutz GmbH

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Bevollmächtigte Person, für die Zusammenstellung der technischen Unterlagen

Person authorized to compile the technical documents

Name / name: Dierk Ahrends
 Funktion / function: QM-Beauftragter / QM- Representative
 Firmenname / company: Messgeräte für Rauchgase und Umweltschutz GmbH
 Straße / street: Fuchshalde 8 + 12
 Ort / city: 74172 Neckarsulm
 Land / country: Deutschland / Germany

Produkt/Product

Bezeichnung / designation: Gasanalysator
 Gas analyser
 Produktname / name: VARIO/uxx
 Funktion / function: Gasanalyse / gas analysis

Hiermit erklären wir, dass das oben beschriebene Produkt allen einschlägigen Bestimmungen entspricht, es erfüllt die Anforderungen der nachfolgend genannten Richtlinien und Normen:

We declare the conformity of the product with the applicable regulations listed below:

- EMV-Richtlinie / EMV-directive 2014/30/EU
- Niederspannungsrichtlinie / low voltage directive 2014/35/EU
- RoHS-Richtlinie / RoHS directive 2011/65/EU (RoHS II)

Neckarsulm, 24.05.2017



Erwin Hintz, Geschäftsführer / Managing Director

19 Appendix

19.1 MRU4Win

NOTE

This chapter only describes how to connect the measuring device to the MRU4Win software. The full operating instructions for the software can be found on the MRU website (www.mru.eu).

Connecting the measuring device to MRU4Win

The measuring device is a Modbus device that can be connected to MRU4Win in the following ways:

10. Connection via a serial interface (RS485)
11. TCP/IP connection over LAN or WLAN

Connecting the measuring device to MRU4Win via a serial interface (RS485)

- ▶ Connect up the electrical connections of the RS485 interface, see p.136 - Option: external RS485.
- ▶ Connect the measuring device to your PC via the RS485 interface.
- ✓ You can now assign a Modbus slave ID in the measuring device and create the measuring device in MRU4Win.

Connecting the measuring device to MRU4Win via a TCP/IP connection

- ▶ Connect the measuring device to the relevant network, see p.65 - WLAN (WiFi connection).

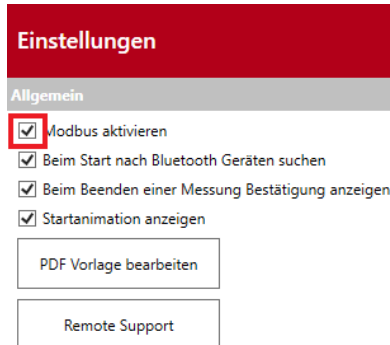
Creating a Modbus device

Modbus devices are not detected automatically in MRU4Win. You must create a Modbus device before you can connect the measuring device to MRU4Win.

- ▶ Start MRU4Win.

NOTE

Ensure that the **Enable Modbus setting** is enabled under **SETTINGS/GENERAL** in MRU4Win.



MRU4Win settings → General

- ▶ Select **LIVE MEASUREMENTS**.
- ✓ The live measurements menu appears.
- ▶ Select **Create Modbus devices**.
- ✓ The Modbus settings window appears.

NOTE

You can connect the measuring device to MRU4Win via a **serial interface (Serial)** or via a **TCP/IP (TCP)** connection.

You can select the applicable connection under **Serial/TCP**. The input window adjusts to match the connection type.

Connection via a serial interface:



Modbus settings for serial connection

▶ Enter the following parameters:

Parameters	Value
Name	1113 Device
Slave ID	Slave ID of the measuring device. In this example the Slave ID is 1.
Serial/TCP	Serial
Com Port	The converter creates a new Com Port. Please enter this Com Port. In this example the Com Port is COM4. <i>i</i> Further information can be found in MS Windows Device Manager.
Baud rate	19200
Data Bits	8
Parity	Even
Stop Bits	One

▶ Confirm with **OK**.

NOTE

The parameters and connection settings must be applied exactly as specified, otherwise it will not be possible to connect to the measuring device.

Connection via TCP/IP



Modbus Einstellungen

Name: 1113 Device

Slave ID: 1

Serial/TCP: TCP

IP: 192.168.44.38

Port: 8100

OK Abbrechen

Modbus TCP/IP settings

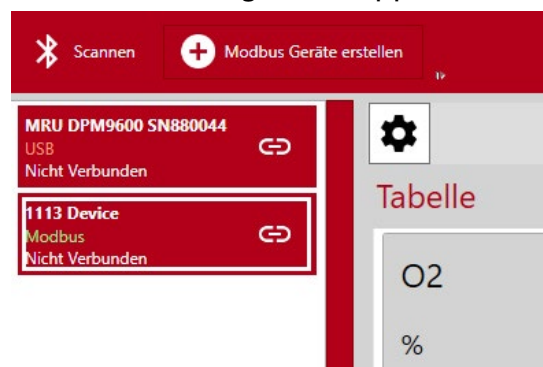
▶ Enter the following parameters:

Parameters	Value
Name	1113 Device
Slave ID	Slave ID of the measuring device. In this example the Slave ID is 1.
Serial/TCP	TCP
IP	
Port	

▶ Confirm with OK.

✓ The Modbus device has been created.

✓ The measuring device appears as an available device.



▶ Click on **Connect** .

✓ The connection is established.

20 Photo credits

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21 Customer service, service centres

MRU customer service can be contacted by telephone, fax and email:

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Fax: +49 (0) 7132 - 99 62 60

service@mru.de

To find your nearest **MRU service centre** for your **MRU products**,
please visit our website:

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