SMARTMAC 400 Handbook

Control and calibration unit for digital SMARTPAT sensors

The documentation is only complete when used in combination with the relevant documentation for the sensor.

KROHNE

IMPRINT

1.1 Certifications

CE marking

The device meets the essential requirements of the EU directives. The CE marking indicates the conformity of the product with the union legislation applying to the product and providing for CE marking.

For full information of the EU directives and standards and the approved certifications, please refer to the EU declaration on the KROHNE website.

Hazardous areas

- ATEX II 2 G Ex ia IIC T4 Gb
  IECEx ia IIC T4 Gb
  QPS Ex ia IIC T4 Gb / Class I, Zone 1 AEx ia IIC T4 Gb
  UKEX II 2 G Ex ia IIC T4 Gb

Other approvals and standards

- NAMUR recommendation NE 6, NE 21, NE 43, NE 53, NE 107
- Shock resistance IEC 60721-3-4 class 4M4
- Vibration resistance IEC 60721-3-4 class 4M4
- Vibration resistance IEC 61298-3 low vibration control room

1.2 Software history

INFORMATION!
In the table below, "_" is a placeholder for possible multi-digit alphanumeric combinations, depending on the available version.

Changes and effect on compatibility

1	Downwards compatible changes and fault repair with no effect on operation (e.g. spelling mistakes on display)	
2-_	Downwards compatible hardware and/or software change of interfaces:	
	H	HART®
	P	PROFIBUS
	F	Foundation Fieldbus
	M	Modbus
	X	all interfaces
3-_	Downwards compatible hardware and/or software change of inputs and outputs:	
	I	Current output
	F, P	Frequency / pulse output
	S	Status output
	C	Control input
	CI	Current input
	X	all inputs and outputs
4	Downwards compatible changes with new functions	
5	Incompatible changes, i.e. electronic equipment must be changed.	

Release date	Electronic revision	Changes and compatibility	Documentation
03/2022	ER 2.0.X_		MA SMARTMAC 400 R01

1.3 Intended use

DANGER!
For devices used in hazardous areas, additional safety notes apply; please refer to the Ex documentation.

CAUTION!
Responsibility for the use of the measuring devices with regard to suitability, intended use and corrosion resistance of the used materials against the measured fluid lies solely with the operator.

WARNING!
If the device is not used according to the operating conditions (refer to chapter "Technical data"), the intended protection could be affected.

INFORMATION!
This device is a Group 1, Class A device as specified within CISPR11. It is intended for use in industrial environment. There may be potential difficulties in ensuring electromagnetic compatibility in other environments, due to conducted as well as radiated disturbances.

INFORMATION!
The manufacturer is not liable for any damage resulting from improper use or use for other than the intended purpose.

The SMARTMAC 400 is a loop powered control and calibration unit for digital SMARTPAT sensors. For process control, different features like relays, an additional second current output and LEDs for status signalisation according to NAMUR NE 107 are available. Without additional accessories, the calibration and configuration of SMARTPAT sensors can be performed directly at the application. The device has been constructed for indoor and outdoor use below the maximum altitude of 2000 m / 6562 ft.

1.4 Safety instructions from the manufacturer

1.4.1 Copyright and data protection

The contents of this document have been created with great care. Nevertheless, we provide no guarantee that the contents are correct, complete or up-to-date.

The contents and works in this document are subject to copyright. Contributions from third parties are identified as such. Reproduction, processing, dissemination and any type of use beyond what is permitted under copyright requires written authorisation from the respective author and/or the manufacturer.

The manufacturer tries always to observe the copyrights of others, and to draw on works created in-house or works in the public domain.

The collection of personal data (such as names, street addresses or e-mail addresses) in the manufacturer's documents is always on a voluntary basis whenever possible. Whenever feasible, it is always possible to make use of the offerings and services without providing any personal data.

We draw your attention to the fact that data transmission over the Internet (e.g. when communicating by e-mail) may involve gaps in security. It is not possible to protect such data completely against access by third parties.

We hereby expressly prohibit the use of the contact data published as part of our duty to publish an imprint for the purpose of sending us any advertising or informational materials that we have not expressly requested.

1.4.2 Disclaimer

The manufacturer will not be liable for any damage of any kind by using its product, including, but not limited to direct, indirect or incidental and consequential damages.

This disclaimer does not apply in case the manufacturer has acted on purpose or with gross negligence. In the event any applicable law does not allow such limitations on implied warranties or the exclusion of limitation of certain damages, you may, if such law applies to you, not be subject to some or all of the above disclaimer, exclusions or limitations.

Any product purchased from the manufacturer is warranted in accordance with the relevant product documentation and our Terms and Conditions of Sale.

The manufacturer reserves the right to alter the content of its documents, including this disclaimer in any way, at any time, for any reason, without prior notification, and will not be liable in any way for possible consequences of such changes.

1.4.3 Product liability and warranty

The operator shall bear responsibility for the suitability of the device for the specific purpose. The manufacturer accepts no liability for the consequences of misuse by the operator. Improper installation or operation of the devices (systems) will cause the warranty to be void. The respective "Standard Terms and Conditions" which form the basis for the sales contract shall also apply.

1.4.4 Information concerning the documentation

To prevent any injury to the user or damage to the device it is essential that you read the information in this document and observe applicable national standards, safety requirements and accident prevention regulations.

If this document is not in your native language and if you have any problems understanding the text, we advise you to contact your local office for assistance. The manufacturer cannot accept responsibility for any damage or injury caused by misunderstanding of the information in this document.

This document is provided to help you establish operating conditions, which will permit safe and efficient use of this device. Special considerations and precautions are also described in the document, which appear in the form of icons as shown below.

1.4.5 Warnings and symbols used

Safety warnings are indicated by the following symbols.

DANGER!
This warning refers to the immediate danger when working with electricity.

DANGER!
This warning refers to the immediate danger of burns caused by heat or hot surfaces.

DANGER!
This warning refers to the immediate danger when using this device in a hazardous atmosphere.

DANGER!
These warnings must be observed without fail. Even partial disregard of this warning can lead to serious health problems and even death. There is also the risk of seriously damaging the device or parts of the operator's plant.

WARNING!
Disregarding this safety warning, even if only in part, poses the risk of serious health problems. There is also the risk of damaging the device or parts of the operator's plant.

CAUTION!
Disregarding these instructions can result in damage to the device or to parts of the operator's plant.

INFORMATION!
These instructions contain important information for the handling of the device.

LEGAL NOTICE!
This note contains information on statutory directives and standards.

- HANDLING
  This symbol designates all instructions for actions to be carried out by the operator in the specified sequence.

➲ RESULT
This symbol refers to all important consequences of the previous actions.

1.5 Safety instructions for the operator

WARNING!
In general, devices from the manufacturer may only be installed, commissioned, operated and maintained by properly trained and authorized personnel.
This document is provided to help you establish operating conditions, which will permit safe and efficient use of this device.

2.1 Scope of delivery

INFORMATION!
Inspect the packaging carefully for damages or signs of rough handling. Report damage to the carrier and to the local office of the manufacturer.

INFORMATION!
Do a check of the packing list to make sure that you have all the elements given in the order.

INFORMATION!
Look at the device nameplate to ensure that the device is delivered according to your order. Check for the correct supply voltage printed on the nameplate.

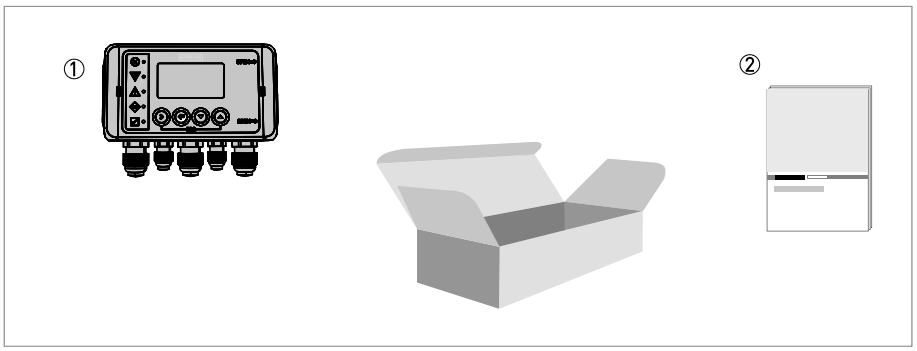


Figure 2-1: Example of the standard scope of delivery

① Ordered device
② Documentation

Optional accessories

- External HART® adapter
- Weather protection cover
- Wall mounting brackets

2.2 Device description

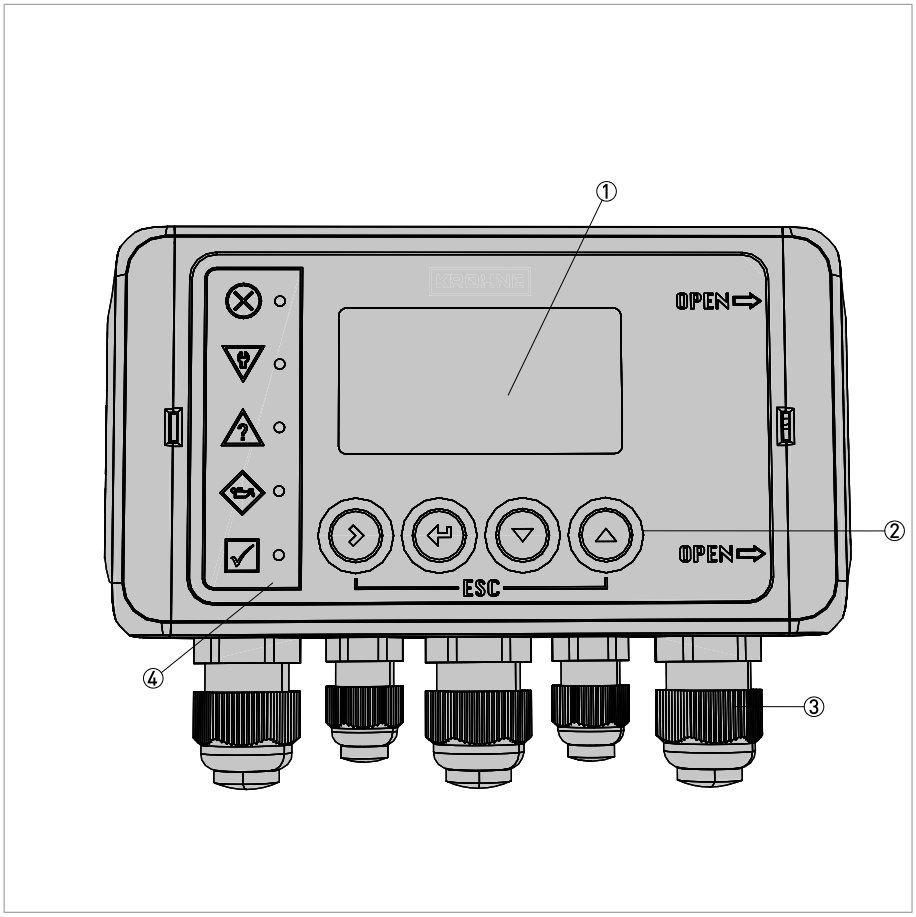


Figure 2-2: Device description

① Display
② Operation keys
③ Cable glands
④ High-brightness LEDs for NAMUR NE 107 status signalisation

This 2-wire device can be connected to digital SMARTPAT sensors. Without additional accessories, the calibration and configuration of the sensors can be performed directly at the application. The two free programmable relays and the second current output allow process control. Different customer specific measurement pages with up to 4 displayed values enable a detailed monitoring of the process. By using the second current output it is possible to use the backlight and high brightness LEDs for NAMUR NE 107 status signalisation.

2.3 Nameplate

INFORMATION!
Look at the device nameplate to ensure that the device is delivered according to your order. Check for the correct supply voltage printed on the nameplate.

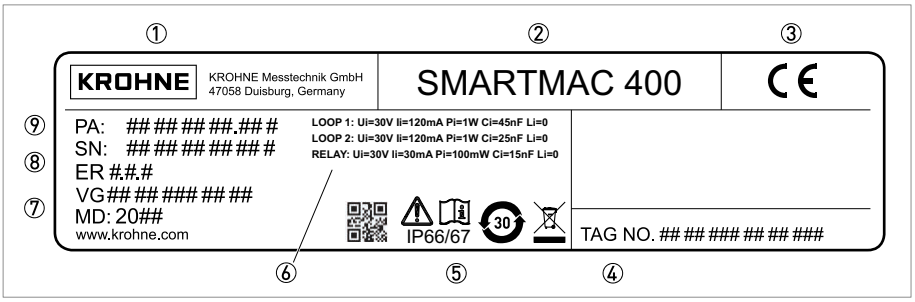


Figure 2-3: Example of a nameplate

① Manufacturer
② Device name
③ CE marking
④ TAG number
⑤ Data matrix code (serial number),
Observe the operation and installation instruction, Ingress protection
China RoHS,
Electronic / Electric device waste marking,
⑥ Power supply data,
Parameter of measuring unit
⑦ Order code,
Manufacturing date,
Internet address of manufacturer
⑧ Electronic revision,
Serial number
⑨ Production order

3.1 General notes on installation

INFORMATION!
Inspect the packaging carefully for damages or signs of rough handling. Report damage to the carrier and to the local office of the manufacturer.

INFORMATION!
Do a check of the packing list to make sure that you have all the elements given in the order.

INFORMATION!
Look at the device nameplate to ensure that the device is delivered according to your order. Check for the correct supply voltage printed on the nameplate.

3.2 Storage and transport

CAUTION!
Do not make any mechanical modifications to the device. This can result in the loss of proper functionality, as well as the rights under the device warranty.

- *Store and transport the device in a dry, dust-free environment.*
- *Store and transport the device in an environment with a temperature between -30...+70°C / -22...+158°F.*
- *The original packing is designed to protect the equipment. It has to be used if the device is transported or sent back to the manufacturer to prevent damage of the device.*

3.3 Point-to-Point connection - analogue / digital mode

With the SMARTMAC 400, you have direct access to all sensor functions. In case a sensor connection via PC or HART field communicator is nevertheless desired, please note the correct master settings.

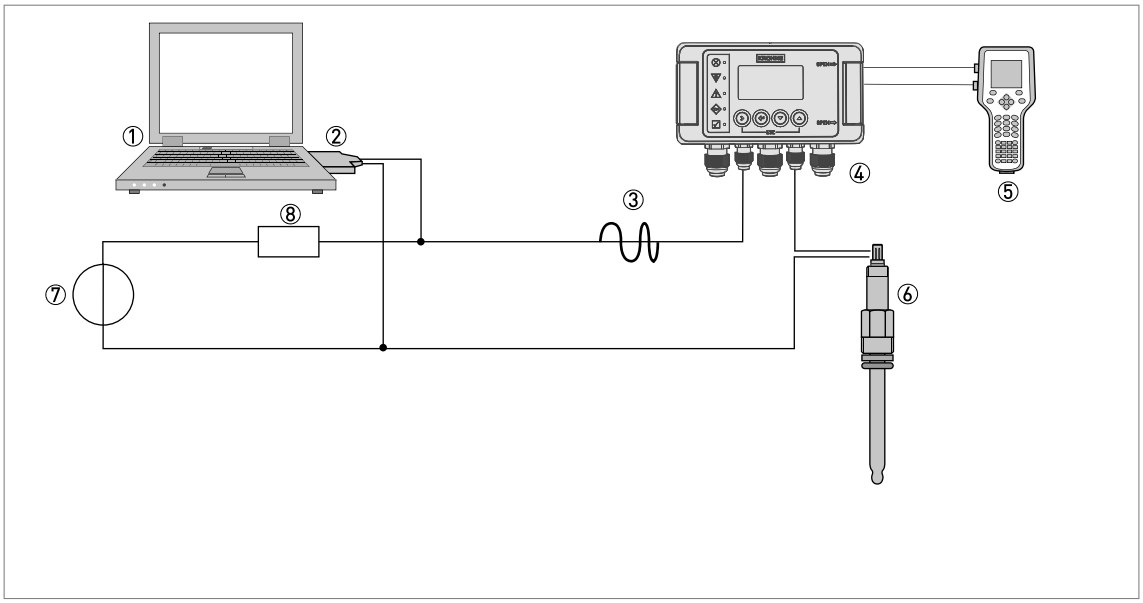


Figure 3-1: Overview point-to-point connection

① HART® master with e.g. PACTware™ FDT/DTM
② HART® modem
③ HART® signal
④ SMARTMAC 400
⑤ HART® master with HART® DD (for example field communicator)
⑥ SMARTPAT sensor
⑦ Power supply for devices (slaves) with passive current output
⑧ Load ≥ 250 Ω (Ohm) (only required if not used in SMARTMAC 400)

If using more than one HART® master please be aware of the correct configuration because only one Primary master and one Secondary master are allowed. Two Primary masters or two Secondary masters will cause communication errors.

Default master modes are

- SMARTMAC 400: Secondary
- HART® modem in PACTware: Primary
- HART® Field Communicator: Secondary (can't be changed in most devices)

These default master modes lead to the following use cases:

If you

- parameterise or calibrate your SMARTPAT sensor using PACTware with a HART® modem, the master mode of the SMARTMAC 400 should be "Secondary"
- parameterise or calibrate your SMARTPAT sensor with a HART® field communicator, the master mode of the SMARTMAC 400 should be "Primary"
- use PACTware with a HART® modem and a HART® field communicator at the same time, the HART® functionality of the SMARTMAC 400 must be deactivated
- use a HART® PLC, find out its master mode and adapt the master mode of the SMARTMAC 400 appropriate

3.4 Pre-installation requirements

CAUTION!
Always note the following items to ensure a proper and safe installation:

- *Make sure that there is adequate space to the sides.*
- *Protect the device from direct sunlight.*
- *The device installed in control cabinets require adequate cooling, e.g. by fan or heat exchanger.*
- *Do not expose the device to intense vibration.*
- *Use assembly materials and tools in compliance with the applicable occupational health and safety directives (assembly materials and tools are not part of the scope of delivery).*
- *Do not make any mechanical modifications to the device. This can result in the loss of proper functionality, as well as the rights under the device warranty.*
- *The device must not be heated by radiated heat (e.g. exposure to the sun) to a electronics housing surface temperature above the maximum permissible ambient temperature. If it is necessary to prevent damage from heat sources, a heat protection (e.g. sun shade) has to be installed.*

CAUTION!
The device must be suitable for the temperature specified (including chemical resistance).

INFORMATION!
Assembly materials and tools are not part of the delivery. Use the assembly materials and tools in compliance with the applicable occupational health and safety directives.

3.5 Opening the housing

INFORMATION!
Clean and grease all threads each time you open the housing. Use only resin-free and acid-free grease. Before closing the cover, ensure that the housing gasket is properly fitted, clean and undamaged.

All installation works on the electrical connections and mounting require to open the housing:

Opening the plastic housing

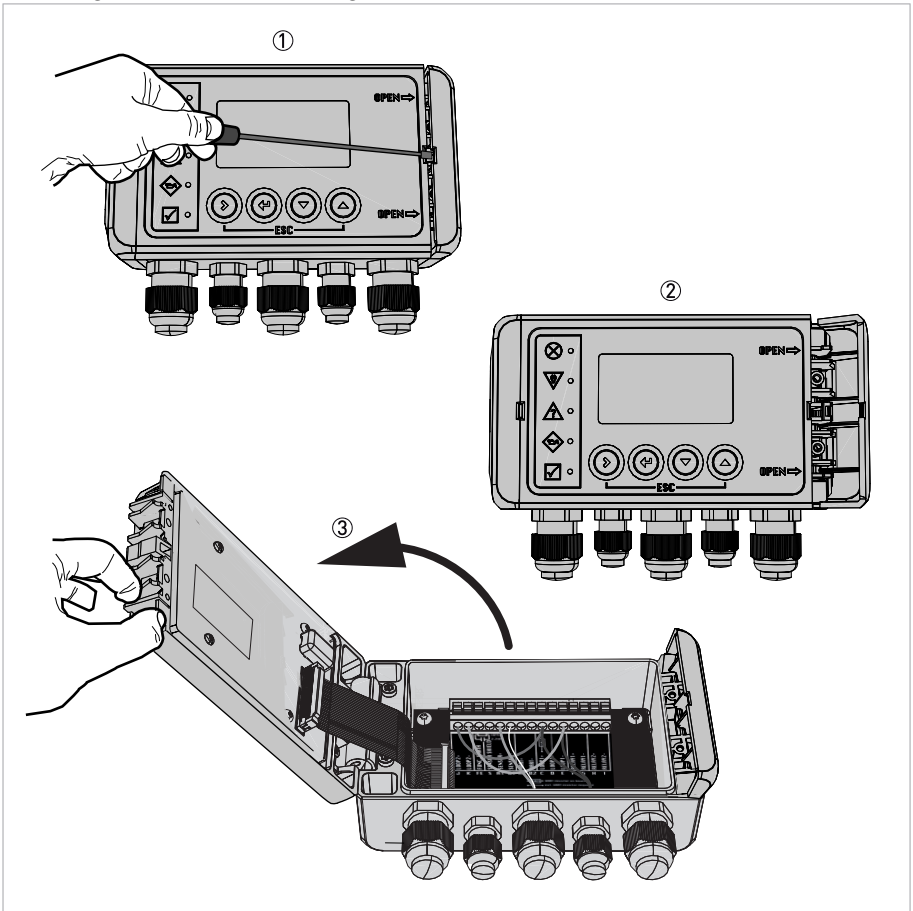


Figure 3-2: Opening the plastic housing

- Put a small flat tool (e.g. screwdriver) into the right hinge lock and open the device ①.
- Lift up the housing ②.

➲ Now you have access to the electronic compartment and the possibility to mount the device on a wall.

Opening the aluminium housing

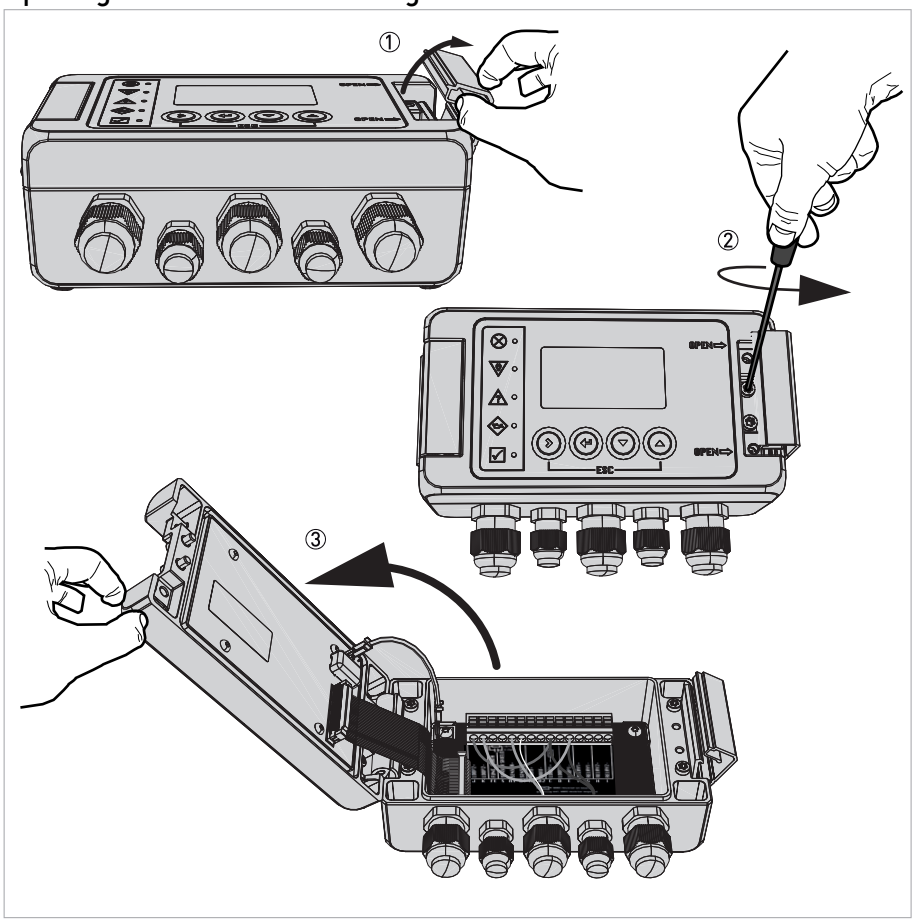


Figure 3-3: Opening the aluminium housing

- Pull only the right hinge lock the side ①.
- Loosen the 2 torx screws (TX20) with a torx screwdriver ②.
- Lift up the housing ③.

➲ Now you have access to the electronic compartment and the possibility to mount the device on a wall.

- For closing the housing again, use the 2 torx screws with a torque of 1,5 Nm.

3.6 Wall mounting

CAUTION!
Always note the following items to ensure a proper and safe installation:

- *Make sure that there is adequate space to the sides.*
- *The device must not be heated by radiated heat (e.g. exposure to the sun) to a electronics housing surface temperature above the maximum permissible ambient temperature. If it is necessary to prevent damage from heat sources, a heat protection (e.g. sun shade) has to be installed.*
- *Units installed in control cabinets require adequate cooling, e.g. by fan or heat exchanger.*
- *Do not expose the unit to intense vibration.*
- *Use assembly materials and tools in compliance with the applicable occupational health and safety directives (assembly materials and tools are not part of the scope of delivery).*

CAUTION!
Installation, assembly, start-up and maintenance may only be performed by appropriately trained personnel. The regional occupational health and safety directives must always be observed.

INFORMATION!
A mounting system with a minimum load force of 0.1 kN (for example FISCHER type UX10) suitable for the background has to be applied.

3.6.1 Plastic housing

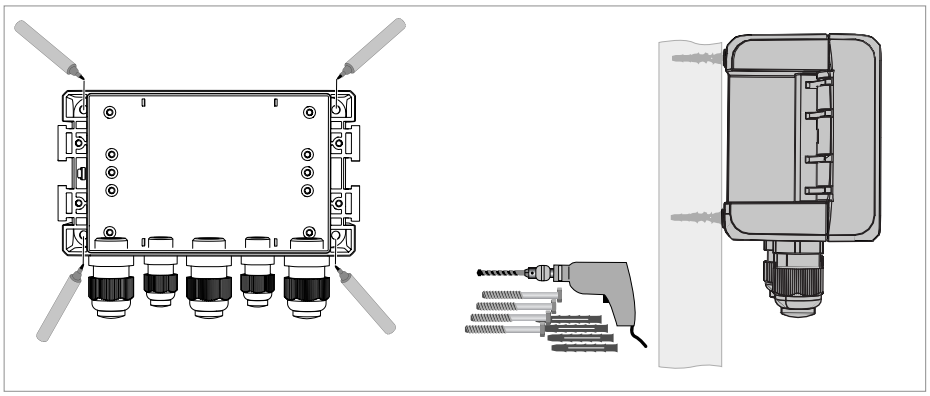


Figure 3-4: Wall mounting of the plastic housing

① Mark the holes with a suitable pen ①.
② Drill the 4 holes and fasten the device securely to the wall ②.

INFORMATION!
For outdoor mounting, we recommend the optional weather protection cover XGSH010000 for wall and pipe mounting. For more flexibility and convenient mounting, we recommend wall mounting brackets XGSH010020 for plastic housing.

3.6.2 Aluminium housing

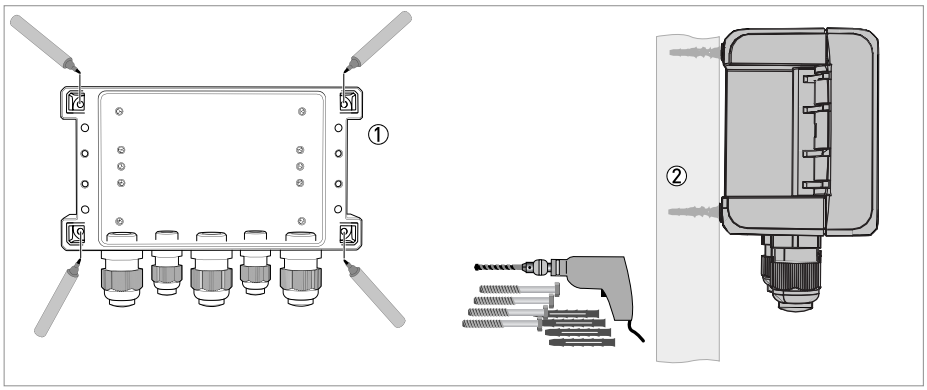


Figure 3-5: Wall mounting of the aluminium housing

① Mark the holes with a suitable pen ①.
② Drill the 4 holes and fasten the device securely to the wall ②.

INFORMATION!
For outdoor mounting, we recommend the optional weather protection cover XGSH010000 for wall and pipe mounting. For more flexibility and convenient mounting, we recommend wall mounting brackets XGSH010030 for aluminium housing.

4.1 Safety instructions

DANGER!
All work on the electrical connections may only be carried out with the power disconnected.
Take note of the voltage data on the nameplate!

DANGER!
Observe the national regulations for electrical installations!

DANGER!
For devices used in hazardous areas, additional safety notes apply; please refer to the Ex documentation.

WARNING!
Observe without fail the local occupational health and safety regulations.
Any work done on the electrical components of the measuring device may only be carried out by properly trained specialists.

INFORMATION!
Look at the device nameplate to ensure that the device is delivered according to your order.
Check for the correct supply voltage printed on the nameplate.

4.2 Important device-specific notes on electrical connection

INFORMATION!
The SMARTMAC 400 is a loop powered device and has no function if no SMARTPAT sensor is connected.

INFORMATION!
Use only shielded cables for connection with the control system (e.g. PLC).

4.3 Connection diagram overview

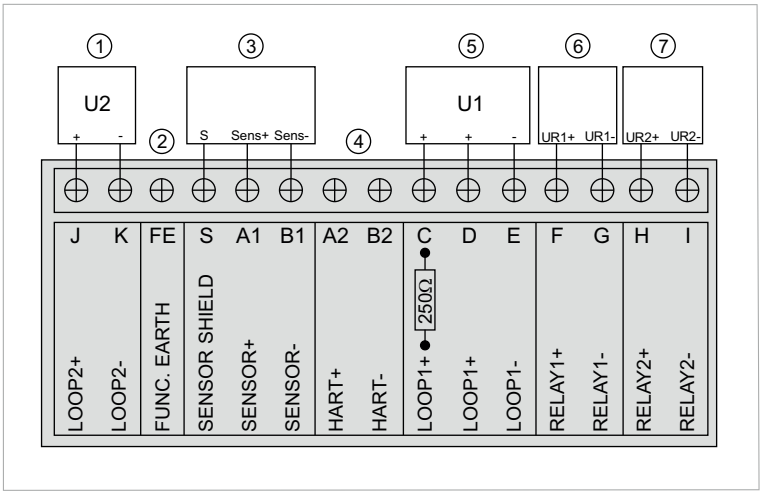


Figure 4-1: Connection diagram overview

① Terminals for loop 2
② Terminal for functional earth
③ Terminals for sensor connection
④ Terminals for external HART-Modem / external HART-adapter
⑤ Terminals for loop 1: Connect D and E when the power supply has an internal resistor or C and E to use the internal resistor of this device. You must not connect C and D at the same time!
⑥ Terminals for relay 1
⑦ Terminals for relay 2

INFORMATION!

The device is equipped with an internal HART® access for the NonEx-version (A2 and B2) that offers the opportunity to access the field device via HART® handheld or HART® modem.

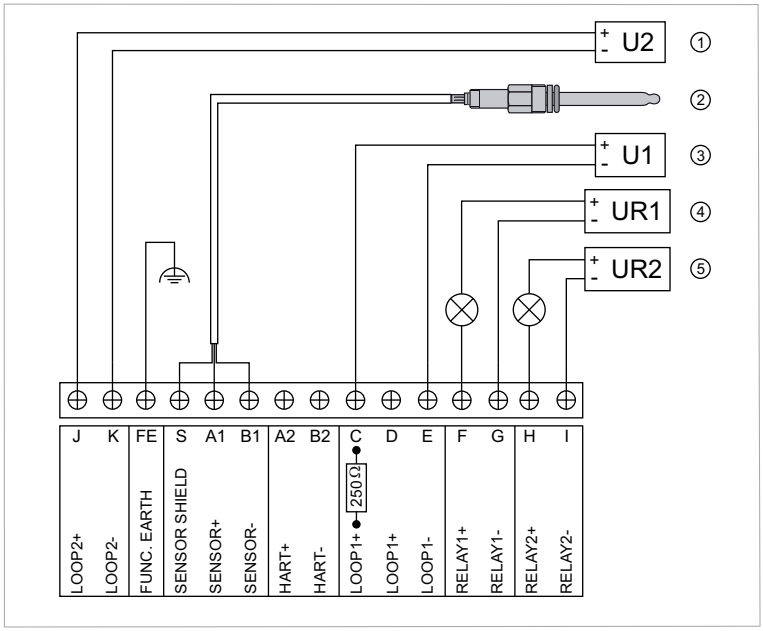


Figure 4-2: Connection example with a 2-wire field device

① Power supply for loop 2. Used for second 4...20 mA output and/or NE107 LEDs and backlight.
② Connected field device, e.g. SMARTPAT PH.
③ Power supply for loop 1. Main loop for operating the device, in this case with usage of internal resistor.
④ Power supply for relay 1
⑤ Power supply for relay 2

4.4 Connecting the field device cable

CAUTION!

When connecting the power supply, always note the safety regulations of the current state of the art. To avoid fatal injuries, destruction or damage of the device or measuring errors, also note the following items:

- *Cables may only be connected when the power is switched off.*
- *Always keep the housing of the device well closed if you do not perform any installation works. The function of the housing is to protect the electronic equipment from dust and moisture.*
- *Check the nameplate and assure that the power supply meets the voltage of the device. The device is loop powered and operates in the range of 20...30 VDC with a voltage drop < 4 V. If the power supply is below 20 VDC the device and field device will not work. If the power supply is above 30 VDC the device and field device sensor may be damaged/destroyed.*

CAUTION!

Do not use the integrated 250 Ohm HART® resistor of the device, when using an Ex isolation amplifier of third-party with integrated 250 Ohm HART® resistor.

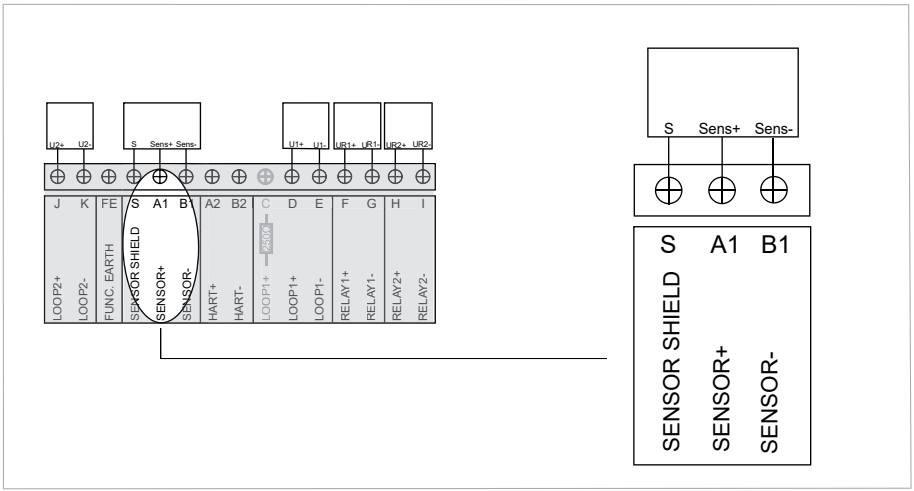


Figure 4-3: Connecting the field device cable

INFORMATION!

The cable glands installed by the manufacturer are designed for a cable diameter of 3...6,5 mm for M12 and 5...10 mm for M16. If you are using cables with a larger diameter than 3...6,5 mm for M12 and 5...10 mm for M16, you must replace the manufacturer's cable glands with suitable ones. The operator is responsible for the correct sealing of cable glands.

4.5 Connecting the second current output

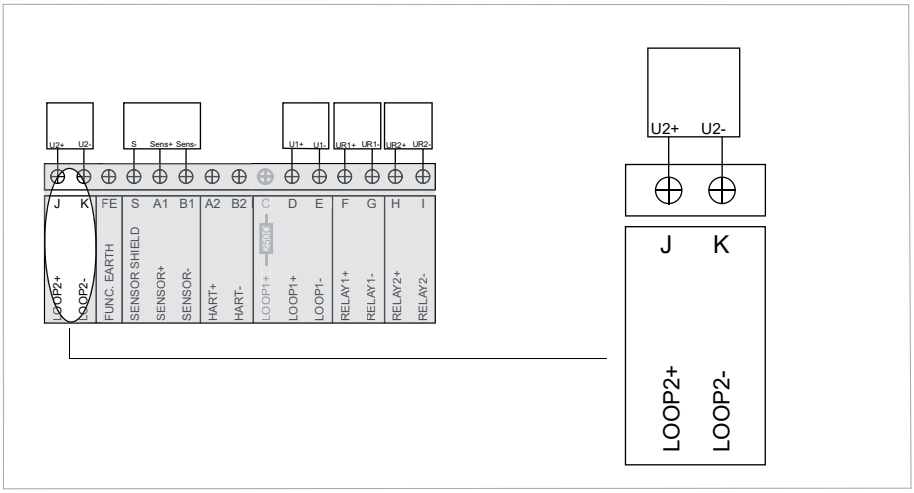


Figure 4-4: Connection of second current output

The second current output can be either used as current output for any measurand of a SMARTPAT sensor or as power supply for backlight and LEDs for NAMUR NE 107 signalisation.

4.6 Connecting the relay outputs

The device has two solid state relays that can work as status output, system alarm, cleaning control or limit switch:

- The relay contacts are electrically isolated from each other and from all other circuits.
- The output stages of the status outputs / limit switches behave like relay contacts.
- Possible conditions: NO (normally open) or NC (normally closed).

Connection values:

- Maximum Voltage = 30 V
- Maximum Load Current = 75 mA up to 55°C and 50 mA above 55°C
- Max On resistance = 10 Ohm

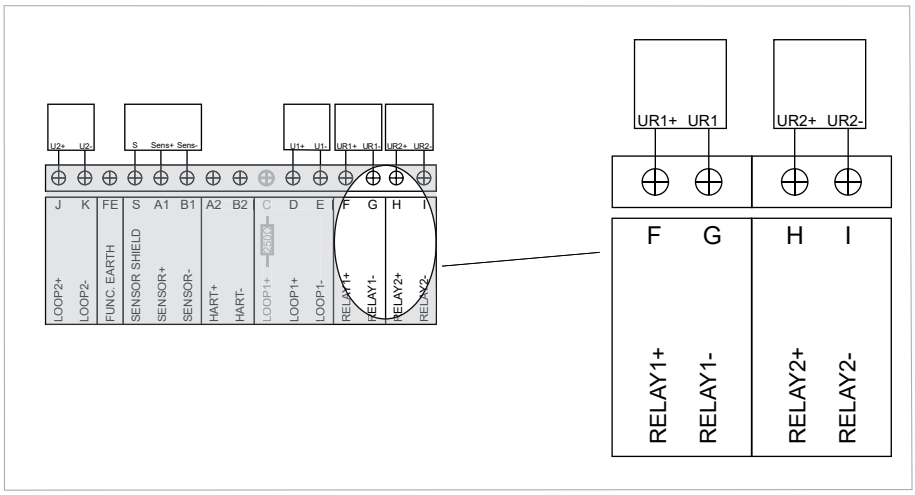


Figure 4-5: Connecting the relay outputs

4.7 Connecting the external HART adapter

With the SMARTMAC 400, you have direct access to all sensor functions. In case a sensor connection via PC or HART field communicator is nevertheless desired, the internal or optional external HART adapter can be used. By using the external HART adapter, it is not necessary to open the housing.

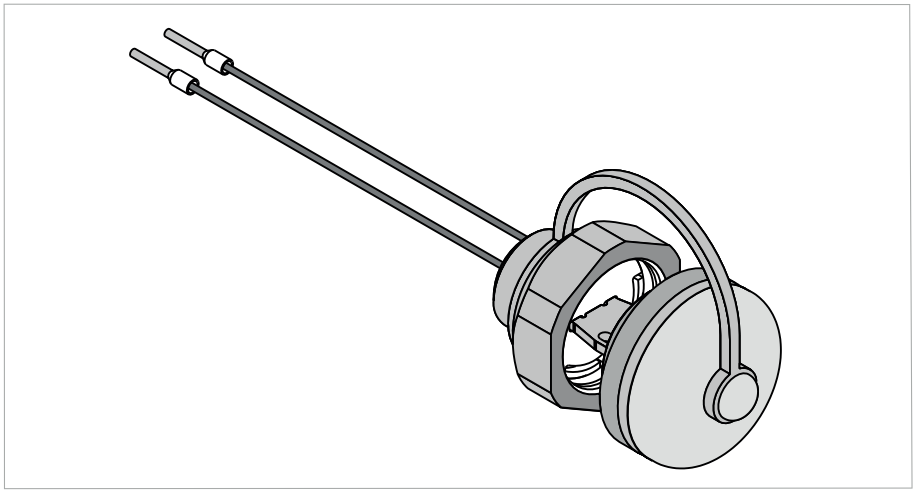


Figure 4-6: External HART adapter

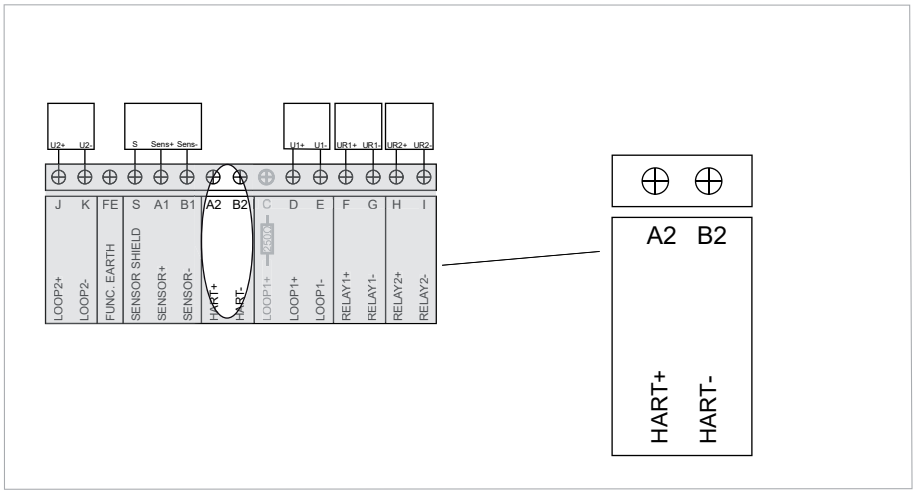


Figure 4-7: Connection of the external HART® adapter

① Open the housing.
② Remove the middle M16 cable gland and screw the HART® adapter.
③ Connect the HART® adapter to connections A2 and B2.

Consider that the cap needs to be closed for a protection of the electronics parts.

4.8 Power supply

DANGER!

To avoid fatal injuries as well as destruction or damage of the device assure a correct installation before switching on the power. This includes:

- *The device is mechanically safe, mounting and power connection comply with the regulations.*
- *The electrical terminal compartments must be secured, i.e. the housing has to be closed and the screws have to be tightened.*
- *The electrical operating data of the power supply comply with the requirements of the device.*

WARNING!

Observe without fail the local occupational health and safety regulations.
Any work done on the electrical components of the measuring device may only be carried out by properly trained specialists.

CAUTION!

When connecting the power supply, always note the safety regulations of the current state of the art. To avoid fatal injuries, destruction or damage of the device or measuring errors, also note the following items:

- *Cables may only be connected when the power is switched off.*
- *Always keep the housing of the device well closed if you do not perform any installation works. The function of the housing is to protect the electronic equipment from dust and moisture.*
- *Check the nameplate and assure that the power supply meets the voltage of the device. The device is loop powered and operates in the range of 20...30 VDC with a voltage drop < 4 V. If the power supply is below 20 VDC the device and field device will not work. If the power supply is above 30 VDC the device and field device sensor may be damaged/destroyed.*

CAUTION!

Do not use the integrated 250 Ohm HART® resistor of the device, when using an Ex isolation amplifier of third-party with integrated 250 Ohm HART® resistor.

The device and the SMARTPAT sensor require a minimum operating voltage of 20 VDC. The power supply is provided via the 2-wire interface (4...20 mA).

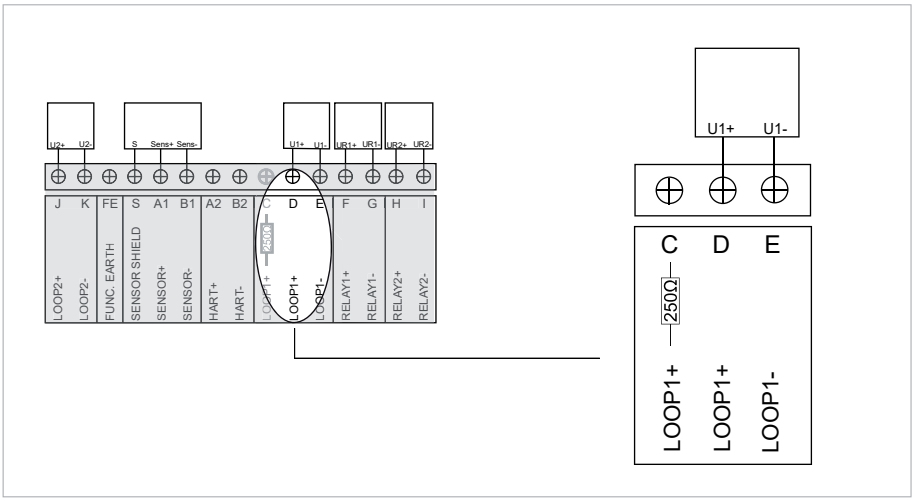


Figure 4-8: Connection of the power supply

5.1 Start-up

DANGER!
To avoid fatal injuries as well as destruction or damage of the device assure a correct installation before switching on the power. This includes:

- *The device is mechanically safe, mounting and power connection comply with the regulations.*
- *The electrical terminal compartments must be secured, i.e. the housing has to be closed and the screws have to be tightened.*
- *The electrical operating data of the power supply comply with the requirements of the device.*

CAUTION!
Do not use the integrated 250 Ohm HART® resistor of the device, when using an Ex isolation amplifiers of third-party with integrated 250 Ohm HART® resistor.

WARNING!
Observe without fail the local occupational health and safety regulations.
Any work done on the electrical components of the measuring device may only be carried out by properly trained specialists.

The device and the SMARTPAT sensor require a minimum operating voltage of 20 VDC. The power supply is provided via the 2-wire interface (4...20 mA).

- Switch on the power with the help of a disconnecting device (switch, circuit breaker).

➲ The device performs a self test; afterwards it begins to check immediately if a SMARTPAT sensor is connected and the display shows the current value(s).

During initialisation of the device and the SMARTPAT sensor the manufacturer logo appears. The logo disappears after a few seconds once the initialisation is completed.

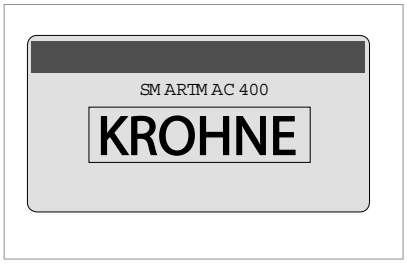


Figure 5-1: Start-up

Afterwards, the measured value appears.

During searching of a connected SMARTPAT sensor, the system shows the progress as progress bar, the current address number (e.g. "1 of 63" or "5 of 15") and the found SMARTPAT sensor.

During searching for SMARTPAT sensors, it is possible to navigate through the menu by pressing >. If a SMARTPAT sensor is connected and cannot be found, please increase the Polling address to 0...63 (see function table of A3.2) or set a user specific range (A.3.4).

When the search was successful, the display shows the KROHNE product name of the SMARTPAT sensor.

Figure 5-2:
Product name of the SMARTPAT sensor

6.1 Operating elements

The operation elements consist of the four operation keys:

Operating key	Symbol in text
	>
	↵
	↑
	↓

The function of a key depends on the mode of the device and on the menu level:

Key	Measuring mode	Menu mode		
		Menu mode	Sub-menu or function mode	Parameter and data level
>	Switch from measuring mode to menu mode.	Access to main menu	Access to sub-menu	For numerical values: move cursor one position to the right
↵	Reset of the display	Return to measuring mode (prompt appears whether the data should be saved)	Press 1 to 3 times, return to menu mode, data saved	Return to sub-menu or function, data saved
↑ or ↓	-	Select menu	Select sub-menu or function	Use highlighted cursor to change number, unit, property
Esc: > + ↑	-	-	Return to main menu, data not saved	Return to next sub-menu or function, data not saved

INFORMATION!

- *Always push the keys at right angles to the front. Touching them from the side can cause incorrect operation!*
- *Each time you press a key, an "□" flashes in the upper right corner of the display.*
- *After 5 minutes of inactivity, there is an automatic return to the measuring mode. In this case the device does not save previously changed data!*

6.2 Menu mode

The menu mode consists of four main menus with a couple of different sub-levels. Altogether there are the following levels:

- Main menu levels
- First and second submenu levels
- Parameter level

6.2.1 Menu mode structure

Mainmenu	Submenu	
A Setup	A1 Language	
	A3 HART settings	A3.1 HART Master
		A3.2 Polling address range
		A3.3 User specific address
		A3.4 User specific range
		A3.5 Manual hold
		A3.6 Field device scan
	A4 Display	A4.1 1.Measurement page
		A4.2 2.Measurement page
		A4.3 3.Measurement page
		A4.4 Trend graph
		A4.5 Number format
		A4.6 Illumination settings
		A4.8 Contrast
	A5 I/O	A5.2 Loop 1
		A5.3 Loop 2
		A5.4 Relay 1
		A5.5 Relay 2
	A6 Device	A6.1 Information
		A6.2 Security

Mainmenu	Submenu	
B PAT sensor	B1 Calibration COND	B1.1 Start calibration
		B1.2 Cell constant
	B2 Calibration PH	B2.1 Two point calibration
		B2.2 One point calibration
	B3 Calibration ORP	B3.2.2 All outputs on hold?
		B3.3.1 Set redox solution
		B3.4.1 ORP solution ready?
		B3.5.1 Save parameter
	B4 Logbooks	B4.1 Calib. logbook
		B4.2 Two pt. calib. logbook PH
		B4.3 One pt. calib. logbook PH
		B4.4 Error logbook
	B5 Setup	B5.1 Manual hold
		B5.2 Process input
		B5.3 TAG
		B5.4 I/O
		B5.5 I/O HART
		B5.6 Information
		B5.7 Commissioning
	B6 Service	B6.1 Trimming
		B6.2 Reset
		B6.3 Factory reset
		B6.4 Sensor lock
	B7 Replace sensor	B7.1 Load from sensor
		B7.2 Write to sensor
E Test	E 1 System	E1.1 PV
		E1.2 SV
		E1.3 TV
		E1.4 QV
	E2 Loop 2	E2.1 Current value
	E3 Relays	E3.1 Relay 1
		E3.2 Relay 2
F Service	This menu is password protected and contains functions to be used by service personnel only.	

Table 6-1: Menu mode structure

6.2.2 Status messages and diagnostic information

The diagnostic messages are displayed in accordance with NAMUR standard NE 107.

INFORMATION!
As status message always the name of the relevant status group and the status symbol is displayed.

Each status message (= status signal) has a specific symbol, determined by NAMUR, which is displayed with the message. The length of each message is limited to one line.

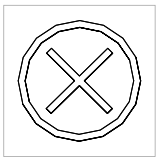
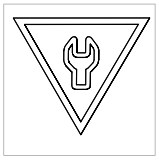
Symbol	Status signal	Description and consequence
	Failure	No measurement possible.
	Function check	A test function or the manual hold function is active; The displayed or transferred measured value does not correspond to the actual measured value.
	Out of specification	Device is being operated out of specification. Check device and/or process.
	Maintenance required	Measurements might not be accurate anymore. Maintenance is needed.
	Diagnosis OK	The device is working properly.

Table 6-2: NAMUR NE 107 signalisation

Error category according to NAMUR NE 107	Error group	Error message	Description	Action
Failure	Sensor	Device malfunction	The field device sensor reports device malfunction (2nd status byte)	Check field device sensor and replace it if necessary.
		Access restriced	The field device reports the command error: access restricted	Check field device configuration.
		Device Busy	The field device sensor is busy	Repeat your request.
		General command error	Report for all command error not explicitly handled	Check field device .
		HART communication failure	HART® communication failed	Check field device and cable connections and replace field device necessary.
		Loop 1 low alarm current	Alarm current on loop 1 (≤ 3.5 mA)	Check field device and replace it if necessary.
		Loop 1 high alarm current	Alarm current on loop 1 (≥ 20.5 mA)	Check field device and replace it if necessary.
		Current mon. deviation high	Current monitoring max. deviation time span reached	Check field device and replace it if necessary.
Failure	Configuration	USP<645>: Temp wrong unit	Process input for temperature has wrong unit code	Change configuration of tertiary variable.
		USP<645>: Cond wrong unit	Process input for conductivity has wrong unit code	Change configuration of primary variable.
	Process	USP<645>: Temp too high	Input temperature > 100°C	Decrease process temperature according to USP<645> specification.
		USP<645>: Temp too low	Input temperature < 0°C	Increase process temperature according to USP<645> specification.
		USP<645>: Cond too high	Input conductivity > 3.1 µS/cm	Decrease process conductivity according to USP<645> specification.
		USP<645>: Cond too low	Input conductivity < 0.6 µS/cm	Increase process conductivity according to USP<645> specification.
		USP<645>: Cond. out of tolerance	Water quality / cond. out of tolerance	Check process conditions.
Check function	Configuration	Loop current fixed	The HART® device reports loop current fixed (2nd status byte)	Remove manual hold function.

Error category according to NAMUR NE 107	Error group	Error message	Description	Action
Out of specification	Sensor	Device variable alert	This bit is set if any Device Variable is in an Alarm or Warning State.	Check field device configuration.
		pH > pH max	pH > pH Max.	Check SMARTPAT sensor.
		pH < pH min	pH < pH Min.	Check SMARTPAT sensor.
		Temp > Temp max	Temp. > Temp. Max.	Check SMARTPAT sensor.
		Temp < Temp min	Temp. < Temp. Min.	Check SMARTPAT sensor.
		ORP > ORP max	ORP > ORP Max.	Check SMARTPAT sensor.
		ORP < ORP min	ORP < ORP Min.	Check SMARTPAT sensor.
		Cond > Cond max	Conductivity > Max. conductivity	Check SMARTPAT sensor.
		Cond< Cond min	Conductivity < Min. conductivity	Check SMARTPAT sensor.
		Resist> Resist max	Resistance > Max. resistivity	Check SMARTPAT sensor.
		Resist< Resist min	Resistance < Min. resistivity	Check SMARTPAT sensor.
	Configuration	Loop current saturated	The HART® device reports loop current saturated (2nd status byte)	Check SMARTPAT sensor configuration of 4 and 20 mA values.
Out of specification	Process	L2 under-saturation	The measurement value is out of range. The current is limited by the lower limit of the current output.	Check SMARTMAC 400 Loop 2 configuration of 4 and 20 mA.
		L2 over-saturation	The measurement value is out of range. The current is limited by the upper limit of the current output.	Check SMARTMAC 400 Loop 2 configuration of 4 and 20 mA.
		Non Primary vars out of limits	The HART® device reports non PV out of limits (2nd status byte)	Check SMARTPAT sensor configuration.
		Primary vars out of limits	The HART® device reports pv out of limits (2nd status byte)	Check SMARTPAT sensor configuration.

Error category according to NAMUR NE 107	Error group	Error message	Description	Action
Maintenance required	Sensor	Slope <- 65mV/pH	Slope < -65mV/Ph	Calibrate field device. If slope is still<-65 mV, replace the field device.
		Slope >- 50mV/pH	Slope > -50mV/Ph	Calibrate field device. If slope is still>-50 mV, replace the field device.
		Offset <-99mV	Offset < -99mV	Calibrate field device. If offset is still <-99 mV, replace the field device.
		Offset >+99mV	Offset > +99mV	Calibrate field device. If offset is still >+99 mV, replace the field device.
		Maintenance interval exp.	Maintenance interval expired	Calibrate field device.
		Calib data range	Calibration data out of range	Repeat calibration. If error message appears again, replace the field device.
Information		L2 not powered	This info message indicated that the second loop L2 is enabled but not powered	Power Loop 2 or switch off Loop 2 (HART® 5.3.1 / 4...20 mA 5.3.2).
		HART com-disabled	HART communication disabled info	Check HART communication.
		Current monitoring active	Current monitoring activated	

Table 6-3: Status messages and diagnostic information

6.3 Function tables

A Setup

Menu level	Designation / function	Settings / descriptions
A1	Language	Language **Options:** • English • Deutsch • Francais • Espanol • Italiano
A3	HART® settings	Settings of HART® Master
A3.1	HART® master	Settings of HART® Master **Options:** • Primary • Secondary • Off
A3.2	Polling address range	Search range for finding of a HART® device **Options:** • 0...15 • 0...63 • User specific range • User specific address

Menu level	Designation / function	Settings / descriptions
A3.3	User specific address	User specific address for HART® devices (only displayed if "User specific address" is selected in A.3.2)
A3.3.1	User specific address	User specific address for HART® devices (only displayed if "User specific address" is selected in A.3.2) Range: 000...063
A3.4	User specific range	User specific search range for HART® devices (only displayed if "User specific range" is selected in A.3.2)
A3.4.1	First polling address	User specific search range for HART® devices (only displayed if "User specific range" is selected in A.3.2) Range: 000...063
A3.4.2	Last polling address	User specific search range for HART® devices (only displayed if "User specific range" is selected in A.3.2) Range: 000...063
A3.5	Manual hold	Manual hold of current outputs and / or relays to avoid an alarm
A3.5.2	Manual hold?	Activate manual hold to avoid an alarm Options: • Yes • No When message "FD (Field Device) in multidrop-mode" is displayed, set Polling address (B5.5.2) to zero!
A3.5.4.1	Hold second loop?	Activate manual hold for second loop (only displayed if second loop is activated in A5.3.1) Options: • Yes • No
A3.5.5.1	Hold relays?	Activate hold for relays (Only displayed if relays are activated in A5.4 or/and A5.5) Options: • Yes • No
A3.6	Field device scan	Restart search of HART® devices
A3.6.1	Start device scan?	Start search of HART® devices Options: • Yes • No
A4	Display	Configuration of measurement display
A4.1	1. Measurement page	Configuration of 1. measurement page
A4.1.1	Value	Setting of value Options: • PV • SV • TV • QV • 4...20 mA (L1) • 4...20 mA (L2)
A4.2	2. Measurement page	Configuration of 2. measurement page

Menu level	Designation / function	Settings / descriptions
A4.2.1	Main value	Setting of main value **Options:** • PV • SV • TV • QV • 4...20 mA (L1) • 4...20 mA (L2)
A4.2.2	Additional value	Setting of additional value **Options:** • PV • SV • TV • QV • 4...20 mA (L1) • 4...20 mA (L2)
A4.3	3. Measurement page	Configuration of 3. measurement page
A4.3.1	Displayed variables	Selection of number of displayed values **Options:** • One • Two • Three • Four
A4.3.2	Value line one	Selection of first displayed measuring value **Options:** • PV • SV • TV • QV • 4...20 mA (L1) • 4...20 mA (L2)
A4.3.3	Value line two	Selection of second displayed measuring value **Options:** • PV • SV • TV • QV • 4...20 mA (L1) • 4...20 mA (L2)
A4.3.4	Value line three	Selection of third measuring value **Options:** • PV • SV • TV • QV • 4...20 mA (L1) • 4...20 mA (L2)

Menu level	Designation / function	Settings / descriptions
A4.3.5	Value line four	Selection of fourth displayed measuring value **Options:** • PV • SV • TV • QV • 4...20 mA (L1) • 4...20 mA (L2)
A4.4	Trend graph	Configuration of Trend graph
A4.4.1	Value	Selection of displayed value **Options:** • PV • SV • TV • QV • 4...20 mA (L1) • 4...20 mA (L2)
A4.4.3	Select range	Adjustment of displayed measuring range **Options:** • Automatic • Manual
A4.4.5	Lower range value	Definition of lower range value (only displayed if Manual is selected in A4.4.3)
A4.4.7	Upper range value	Definition of upper range value (only displayed if Manual is selected in A4.4.3)
A4.4.9	Show lim. line relay 1	Display of limit line for relay 1 **Options:** • Yes • No
A4.4.11	Show lim. line relay 2	Display of limit line for relay 2 **Options:** • Yes • No
A4.4.15	Timespan	Timespan **Options:** • 15min • 30min • 60min • 2h • 12h • 24h • 2d • 7d
A4.5	Number format	Configuration of the number format of each measuring value
A4.5.1	Digits PV	Settings of digits for PV Range: 002...006

Menu level	Designation / function	Settings / descriptions
A4.5.2	Decimals PV	Settings of decimals for PV **Options:** • Automatic • #N.XXXX • #N.XXX • #N.XX • #N.X
A4.5.3	Digits SV	Settings of digits for SV Range: 002...006
A4.5.4	Decimals SV	Settings of decimals for SV **Options:** • Automatic • #N.XXXX • #N.XXX • #N.XX • #N.X
A4.5.5	Digits TV	Settings of digits for TV Range: 002...006
A4.5.6	Decimals TV	Settings of decimals for TV **Options:** • Automatic • #N.XXXX • #N.XXX • #N.XX • #N.X
A4.5.7	Digits QV	Settings of digits for QV Range: 002...006
A4.5.8	Decimals QV	Settings of decimals for QV **Options:** • Automatic • #N.XXXX • #N.XXX • #N.XX • #N.X
A4.5.9	Digits 4...20 mA L1	Settings of digits for 4...20 mA L1 Range: 002...006
A4.5.10	Decimals 4...20 mA L1	Settings of decimals for 4...20 mA L1 **Options:** • Automatic • #N.XXXX • #N.XXX • #N.XX • #N.X
A4.5.11	Digits 4...20 mA L2	Settings of digits for 4...20 mA L2 Range: 002...006

Menu level	Designation / function	Settings / descriptions
A4.5.12	Decimals 4...20 mA L2	Settings of decimals for 4...20 mA L2 **Options:** • Automatic • #N.XXXX • #N.XXX • #N.XX • #N.X
A4.6	Illumination settings	Illumination Settings (only displayed if Current output or Power supply is selected in A5.3.1).
A4.6.1	Backlight	Settings of backlight (only displayed if Current output or Power supply is selected in A5.3.1). **Options:** • On • Off • Timer
A4.6.2	Timer	Holding time of backlight without key activation (only displayed if Current output or Power supply is selected in A5.3.1 and Timer is selected in A4.6.1). Range: 00...60 seconds
A4.6.3	Status LEDs	Status LEDs for NAMUR NE 107 (only displayed if Current output or Power supply is selected in A5.3.1). **Options:** • On • Off
A4.8	Contrast	Contrast of display. Range: -10...+10
A5	I/O	Settings of Loops and Relays
A5.2	Loop 1	Settings for Loop 1
A5.2.1	Loop current settings	Configuration of the field device's 4...20 mA Signal by HART®
A5.2.1.2	Lower range value	Configuration of the field device's 4 mA Signal by HART® Range: 10.000^{-3}...500.00 µS/cm
A5.2.1.3	Upper range value	Configuration of the field device's 20 mA Signal by HART® Range: 10.000^{-3}...500.00 µS/cm
A5.2.2	Loop monitoring	Comparative measurement between measured current and current transmitted by HART®
A5.2.2.1	Activate monitoring	Activation of monitoring **Options:** • Yes • No
A5.2.2.2	Max. deviation	Maximal permitted deviation (only displayed if monitoring is activated in A5.2.2.1) Range: 100.00^{-3}...1.0000 mA
A5.2.2.3	Reaction time	Time of deviation, till error message displays (only displayed if monitoring is activated in A5.2.2.1) 5.0000...3600.0 seconds
A5.3	Loop 2	Setting for Loop 2

Menu level	Designation / function	Settings / descriptions
A5.3.1	Mode	Operating mode of 2. current output **Options:** • Off • Power Supply • Current Output
A5.3.3	Variable selection	Selection of displayed value (only displayed if Current Output is selected in A5.3.1) **Options:** • PV • SV • TV • QV • 4...20 mA (L1)
A5.3.4	Lower range value	Definition of the lower range value (only displayed if Current Output is selected in A5.3.1) -Min...Max µS/cm
A5.3.5	Upper range value	Definition of the upper range value (only displayed if Current Output is selected in A5.3.1) -Min...Max µS/cm
A5.3.6	Lower ext. range	Definition of the lower ext. range (only displayed if Current Output is selected in A5.3.1) Range: 3.8000...20.500 mA
A5.3.7	Upper ext. range	Definition of the upper ext. range (only displayed if Current Output is selected in A5.3.1) Range: 3.8000...20.500 mA
A5.3.8	Error function	This function describes, if a lower (3.5 mA) or an upper (21.5 mA) error value is displayed (only displayed if Current Output is selected in A5.3.1) **Options:** • Hold value • High error current • Low error current
A5.3.9	Low error current	Low error current (only displayed if Current Output is selected in A5.3.1 and Low error current is selected in A5.3.8) Range: 3.5000...3.6000 mA
A5.3.10	High error current	High error current (only displayed if Current Output is selected in A5.3.1 and High error current is selected in A5.3.8) Range: 2.1000...21.500 mA
A5.3.11	Trimming 4 mA	Trimming 4 mA (only displayed if Current Output is selected in A5.3.1)
A5.3.11.2	4 mA Trimming	4 mA Trimming (only displayed if Current Output is selected in A5.3.1) Range: 0.0000...25.000 mA
A5.3.12	Trimming 20 mA	Trimming 20 mA (only displayed if Current Output is selected in A5.3.1)
A5.3.12.2	20 mA Trimming	20 mA Trimming (only displayed if Current Output is selected in A5.3.1) Range: 0.0000...25.000 mA
A5.4	Relay 1	Settings for Relay 1

Menu level	Designation / function	Settings / descriptions
A5.4.1	Mode	Operating mode of the relays Options: • Off • Limit switch (band) • Limit switch (thres.) • Field device status • USP<645> • Loop 1 error current • System alarm • Cleaning mode
A5.4.3	Invert	Invertion of the relay (only displayed if not Off is selected in A4.5.1) Options: • Yes • No
A5.4.5	Set variable	Settings of the variable that is relating to the relay (only displayed if Limit switch (band) or Limit switch (thres.) is selected in A5.4.1) Options: • PV • SV • TV • QV • 4...20 mA (L1) • 4...20 mA (L2)
A5.4.7	Set low alarm	Settings of the lower switching threshold (only displayed if Limit switch (band) is selected in A5.4.1) Range: 0.0000...Max mA
A5.4.9	Set Low Alarm Hyst.	Settings of the lower hysteresis value (only displayed if Limit switch (band) is selected in A5.4.1) Range: 0.0000...Max mA
A5.4.11	Set High Alarm	Settings of the upper switching threshold (only displayed if Limit switch (band) is selected in A5.4.1) Range: 0.0000...Max mA
A5.4.13	Set high alarm hyst.	Settings of the upper hysteresis value (only displayed if Limit switch (band) is selected in A5.4.1) Range: 0.0000...Max mA
A5.4.15	Set threshold	Settings of the switching threshold (only displayed if Limit switch (thres.) is selected in A5.4.1) Range: 0.0000...Max mA
A5.4.17	Set hysteresis	Settings of the hysteresis value (only displayed if Limit switch (thres.) is selected in A5.4.1) Range: 0.0000...Max mA
A5.4.19	Set characteristic	Settings of the direction of excess, on which the relay should switch (only displayed if Limit switch (thres.) is selected in A5.4.2) Options: • Overrun • Underrun

Menu level	Designation / function	Settings / descriptions
A5.4.21	Field device status	Selection of the NAMUR-status of the SMARTPAT sensor, at which the relay switches (only displayed if Field device status is selected in A5.4.1) Options: • Maintenance req. • Out of specification • Check function • Failure
A5.4.23	Set factor USP<645>	Settings for the factor for USP<645> (only displayed if USP<645> is selected in A5.4.1.) Range: 0.0000...100.00
A5.4.24	Loop 1 error current	Settings of the Loop 1 error current, at which the relay switches (only displayed if Loop 1 error current is selected in A5.4.1) Options: • High • Low • Both
A5.4.26	Cleaning int. unit	Settings of the unit for the cleaning interval (only displayed if Cleaning mode is selected in A5.4.1) Options: • Seconds • Minutes • Hours • Days
A5.4.27	Cleaning interval	Setting for the cleaning interval (only displayed if Cleaning mode is selected in A5.4.1) Range: 0.0000...10000 seconds
A5.4.28	Cleaning lead time	Setting of the delay time before cleaning starts, current outputs and second relay are held (only displayed if Cleaning mode is selected in A5.4.1) Range: 0.0000...10000 seconds
A5.4.29	Cleaning duration	Setting for the cleaning duration (only displayed if Cleaning mode is selected in A5.4.1) Range: 0.0000...10000 seconds
A5.4.30	Cleaning recov. time	Setting of the delay time after cleaning cycle before measurement starts, current outputs and second relay are held (only displayed if Cleaning mode is selected in A5.4.1) Range: 0.0000...10000 seconds
A5.4.31	Hold outp. when act.	All outputs (current outputs and second relay) are held when selecting "Yes" (only displayed if Cleaning mode is selected in A5.4.1) Options: • Yes • No
A5.4.32	Next cleaning cycle	Time remaining until next cleaning cycle in days, hours, minutes and seconds (only displayed if Cleaning Mode is selected in A5.4.1) _d _h _m _s
A5.4.33	Manual cleaning	Start manual cleaning? (only displayed if Cleaning Mode is selected in A5.4.1 Options: • Yes • No

Menu level	Designation / function	Settings / descriptions
A5.4.34	Stop cleaning	Stop cleaning? (only displayed if Cleaning Mode is selected in A5.4.1 **Options:** • Yes • No
A5.5	Relay 2	Settings for Relay 2
A5.5.1	Mode	Operating mode of the relays **Options:** • Off • Limit switch (band) • Limit switch (thres.) • Field device status • USP<645> • Loop 1 error current • System alarm
A5.5.3	Invert	Invertion of the relay (only displayed if not Off is selected in A4.5.1)
A5.5.5	Set Variable	Settings of the variable that is relating to the relay (only displayed if Limit switch (band) or Limit switch (thres.) is selected in A5.5.1) **Options:** • PV • SV • TV • QV • 4...20 mA L1 • 4...20 mA L2
A5.5.7	Set low alarm	Settings of the lower switching threshold (only displayed if Limit switch (band) is selected in A5.5.1) -Min...Max
A5.5.9	Set low alarm hyst.	Settings of the lower hysteresis value (only displayed if Limit switch (band) is selected in A5.5.1) -Min...Max
A5.5.11	Set high alarm	Settings of the upper switching threshold (only displayed if Limit switch (band) is selected in A5.5.1) -Min...Max
A5.5.13	Set high alarm hyst.	Settings of the upper hysteresis value (only displayed if Limit switch (band) is selected in A5.5.1) -Min...Max
A5.5.15	Set threshold	Settings of the switching threshold (only displayed if Limit switch (thres.) is selected in A5.5.1) -Min...Max
A5.5.17	Set hysteresis	Settings of the hysteresis value (only displayed if Limit switch (thres.) is selected in A5.5.1) -Min...Max
A5.5.19	Set characteristic	Settings of the direction of excess, on which the relay should switch (only displayed if Limit switch (thres.) is selected in A5.5.1) **Options:** • Overrun • Underrun

Menu level	Designation / function	Settings / descriptions
A5.5.21	Field device status	Selection of the NAMUR-Status of the SMARTPAT sensor, at which the relay switches (Only displayed if Field device status is selected in A5.5.1) Options: • Maintenance req. • Out of specification • Check function • Failure
A5.5.23	Set factor USP<645>	Settings for the factor for USP<645> (only displayed if USP<645> is selected in A5.5.1.) Range: 0.0000...100.00
A5.5.24	Loop 1 error current	Settings of the Loop 1 error current, at which the relay switches (only displayed if Loop 1 error current is selected in A5.5.1) Options: • High • Low • Both
A6	Device	Information about device, attached SMARTPAT sensor and security settings
A6.1	Information	Information about device
A6.1.1	Display	Information about display
A6.1.1.1	Sys. serial number	System serial number
A6.1.1.2	V number	Order code of the device
A6.1.1.3	CG number	Number of CG
A6.1.1.4	Device name	Device name
A6.1.1.5	Electronic revision	Electronic Revision
A6.1.1.6	Software version	Software version
A6.1.1.7	Display brd. serialnum.	Display board serial number
A6.1.1.8	Basic brd. serialnum.	Basic board serial number
A6.1.1.9	Electronic serialnum.	Electronic serial number
A6.1.1.10	Production date	Production date
A6.1.1.11	Calibration date	Calibration date
A6.1.2	Field device	Information of the SMARTPAT sensor
A6.1.2.1	TAG	TAG
A6.1.2.2	HART ID	HART ID
A6.1.2.3	Device Type Code	Device Type Code
A6.1.2.4	Manufacturer	Manufacturer
A6.1.2.5	HART Revision	HART Revision
A6.1.2.6	Polling address	Polling Address
A6.1.2.7	4 mA Setting	4 mA Setting
A6.1.2.8	20 mA Setting	20 mA Setting
A6.2.	Security	Security settings for access on the device
A6.2.1.	Login	Login in the system as designated user
A6.2.2.	Change password	Change of password
A6.2.3.	Reset password	Reset of password
B	PAT sensor	PAT sensor menu

Menu level	Designation / function	Settings / descriptions
B1	Calibration	Calibration of SMARTPAT COND sensor (only displayed if SMARTPAT COND sensor is connected)
B1.1	Start calibration	Start of SMARTPAT COND sensor calibration (only displayed if SMARTPAT COND sensor is connected)
B1.1.2.1	Calibration method	Setting of calibration method (only displayed if SMARTPAT COND sensor is connected) **Options:** • Product calibration • Calibration solution • Input cell constant
B1.1.3.2	All outputs on hold?	Setting all outputs on hold? (only displayed if SMARTPAT COND sensor is connected) **Options:** • Yes • No When message "FD (Field Device) in multidrop-mode" is displayed, set Polling address (B5.5.2) to zero!
B1.1.4.1	Value stable?	Is displayed value stable? (only displayed if SMARTPAT COND sensor is connected and if Product calibration is selected in **B1.1.2.1**) Confirm stable value with ↵
B1.1.4.3	Calibration value	Calibration value is displayed (only displayed if SMARTPAT COND sensor is connected and if Product calibration is selected in **B1.1.2.1**)
B1.1.4.4	Save value?	Do you want to save the calibration value? (only displayed if SMARTPAT COND sensor is connected and if Product calibration is selected in **B1.1.2.1**) **Options:** • Yes • No
B1.1.4.5	All outputs on hold?	Primary value is displayed (only displayed if SMARTPAT COND sensor is connected, if Product calibration is selected in **B1.1.2.1** and No is selected in **B1.1.4.4**) Do you want to set all outputs on hold? **Options:** • Yes • No
B1.1.4.6	Set unit of ref. val.	Set unit of reference value (only displayed if SMARTPAT COND sensor is connected, if Product calibration is selected in **B1.1.2.1** and Yes is selected in **B1.1.4.4**) **Options:** • mS/cm (only displayed if Conductivity is selected in B5.4.1.2) • µS/cm (only displayed if Conductivity is selected in B5.4.1.2) • kOhm*cm (only displayed if Resistivity is selected in B5.4.1.2) • MOhm*cm (only displayed if Resistivity is selected in B5.4.1.2)
B1.1.4.7	Set reference value	Setting of the reference value (only displayed if SMARTPAT COND sensor is connected, if Product calibration is selected in **B1.1.2.1** and Yes is selected in **B1.1.4.4**) Range: 0.0000...Max.

Menu level	Designation / function	Settings / descriptions
B1.1.5.2	Set unit of calib. sol.	Set unit of calibration solution (only displayed if SMARTPAT COND sensor is connected and if Calibration solution is selected in **B1.1.2.1**) **Options:** • mS/cm (only displayed if Conductivity is selected in B5.4.1.2) • µS/cm (only displayed if Conductivity is selected in B5.4.1.2) • kOhm*cm (only displayed if Resistivity is selected in B5.4.1.2) • MOhm*cm (only displayed if Resistivity is selected in B5.4.1.2)
B1.1.5.3	Set calib. solution	Set calibration solution (only displayed if SMARTPAT COND sensor is connected and if Calibration solution is selected in **B1.1.2.1**) Range: 0.0000...Max.
B1.1.5.6	Calibration value	Calibration value is displayed (only displayed if SMARTPAT COND sensor is connected and if Calibration solution is selected in **B1.1.2.1**)
B1.1.6.1	Set new cell constant	Setting of new cell constant (only displayed if SMARTPAT COND sensor is connected and if Input cell constant is selected in **B1.1.2.1**) Range: 0.0000...Max.
B1.1.7	Calibration parameter	Calibration parameters are displayed (only displayed if SMARTPAT COND sensor is connected) Old cell constant: New cell constant: Message
B1.1.8.1	Save parameter?	Do you want to save the calibration parameter? (only displayed if SMARTPAT COND sensor is connected) **Options:** • Yes • No
B1.1.8.2	Set calibration date	Settting of the calibration date (only displayed if SMARTPAT COND sensor is connected and if Yes is selected in **B1.1.8.1**) YYYY-MM-DD
B1.1.9	All outputs on hold?	Primary value is displayed (only displayed if SMARTPAT COND sensor is connected) All outputs on hold? **Options:** • Yes • No
B1.2	Cell constant	Cell constant is displayed (only displayed if SMARTPAT COND sensor is connected)
B2	Calibration	Calibration of the SMARTPAT PH sensor (only displayed if SMARTPAT PH sensor is connected)
B2.1	Two point calibration	Two point calibration (only displayed if SMARTPAT PH sensor is connected)
B2.1.2.2	All outputs on hold	Do you want to set all outputs on hold? (only displayed if SMARTPAT PH sensor is connected) **Options:** • Yes • No When message "FD (Field Device) in multidrop-mode" is displayed, set Polling address (B5.5.2) to zero!

Menu level	Designation / function	Settings / descriptions
B2.1.3.1	Temperature comp.	Setting temperature compensation (only displayed if SMARTPAT PH sensor is connected) **Options:** • Automatic • Manual
B2.1.3.2	Set temp. comp.	Setting the compensation temperature (only displayed if SMARTPAT PH sensor is connected and Manual is selected in **B2.1.3.1**) 000.00...050.00
B2.1.4.1	Buffer solution 1	Measure buffer solution 1 (only displayed if SMARTPAT PH sensor is connected)
B2.1.4.3	Set buffer solution 1	Setting of buffer solution 1 (only displayed if SMARTPAT PH sensor is connected) 00.00...14.00
B2.1.5.1	Buffer solution 2	Measure buffer solution 2 (only displayed if SMARTPAT PH sensor is connected)
B2.1.5.3	Set buffer solution 2	Setting of buffer solution 2 (only displayed if SMARTPAT PH sensor is connected) 00.00...14.00
B2.1.6.2	Calibration parameter	Calibration parameters are displayed (only displayed if SMARTPAT PH sensor is connected) Slope: Offset: Message
B2.1.7.1	Save parameter?	Do you want to save parameters? (only displayed if SMARTPAT PH sensor is connected) **Options:** • Yes • No
B2.1.7.2	Set calibration date	Setting of the calibration date (only displayed if SMARTPAT PH sensor is connected and Yes is selected in **B2.1.7.1**) YYYY-MM-DD
B2.1.8	All outputs on hold?	Primary value is displayed (only displayed if SMARTPAT PH sensor is connected) Do you want to set all outputs on hold? **Options:** • Yes • No
B2.2	One point calibration	One point calibration, will be implemented soon (only displayed if SMARTPAT PH sensor is connected)
B3	Calibration	Calibration of the SMARTPAT ORP sensor (only displayed if SMARTPAT ORP sensor is connected)
B3.2.2	All outputs on hold?	Do you want to set all outputs on hold? (only displayed if SMARTPAT ORP sensor is connected) **Options:** • Yes • No When message "FD (Field Device) in multidrop-mode" is displayed, set Polling address (B5.5.2) to zero!

Menu level	Designation / function	Settings / descriptions
B3.3.1	Set redox solution	Setting the redox solution (only displayed if SMARTPAT ORP sensor is connected) -Min...Ma
B3.4.1	ORP solution ready?	Is ORP solution ready? (only displayed if SMARTPAT ORP sensor is connected)
B3.4.3	Calibration parameter	Calibration parameters are displayed (only displayed if SMARTPAT ORP sensor is connected) ORP solution: Offset: Message
B3.5.1	Save parameter?	Do you want to save parameters? (only displayed if SMARTPAT ORP sensor is connected) **Options:** • Yes • No
B3.5.2	Set calibration date	Set calibration date (only displayed if SMARTPAT ORP sensor is connected and Yes is selected in 3.5.1) YYYY-MM-DD
B3.6	All outputs on hold?	Primary value is displayed (only displayed if SMARTPAT ORP sensor is connected) Do you want to set all outputs on hold? **Options:** • Yes • No
B4	Logbooks	Logbooks
B4.1	Calib. logbook	Calibration logbook (only displayed if SMARTPAT ORP sensor is connected)
B4.1.2	Calib. logbook	Calibration logbook pages with entries are displayed (only displayed if SMARTPAT ORP sensor is connected) ORP solution: Offset: Date YYYY-MM-DD
B4.2	Two pt. calib. logbook	Two point calibration logbook (only displayed if SMARTPAT PH sensor is connected)
B4.2.2	Two pt. calib. logbook	Two point calibration logbook pages with entries are displayed (only displayed if SMARTPAT PH sensor is connected) Slope: Offset: Date YYYY-MM-DD
B4.3	One pt. calib. logbook	One point calibration logbook will be implemented soon (only displayed if SMARTPAT PH sensor is connected)
B4.4	Error logbook	Error logbook
B4.4.2	Error logbook	Error logbook pages with error messages are displayed
B5	Setup	Setup for PAT sensors
B5.1	Manual hold	Manual hold of current outputs and / or relays to avoid an alarm When message "FD (Field Device) in multidrop-mode" is displayed, set Polling address (B5.5.2) to zero!

Menu level	Designation / function	Settings / descriptions
B5.1.2	Manual hold?	Activate manual hold to avoid an alarm **Options:** • Yes • No
B5.1.4.1	Hold second loop?	Activate manual hold for second loop (only displayed if second loop is activated in A5.3.1) **Options:** • Yes • No
B5.1.5.1	Hold relays?	Activate manual hold for relays (Only displayed if relays are activated in A5.4 or/and A5.5) **Options:** • Yes • No
B5.2	Process input	Process input settings
B5.2.1	Temperature unit	Temperature unit settings
B5.2.1.2	Set temperature unit	Setting of temperature unit **Options:** • °C • °F
B5.2.2	Temperature offset	Setting temperature offset
B5.2.2.2	Set temp. offset	Set temperature offset Range: -200.00...+200.00
B5.2.2.3	Set date	Set date YYYY-MM_DD
B5.2.3	Temperature comp.	Temperature compensation (only displayed if SMARTPAT PH sensor is connected)
B5.2.3.2	Set temp. comp.	Setting for temperature compensation (only displayed if SMARTPAT PH sensor is connected) **Options:** • Automatic • Manual
B5.2.3.3	Manual temp. comp.	Setting of manual compensation temperature (only displayed if SMARTPAT PH sensor is connected and Manual is selected in **B5.2.3.2**) Range: 000.00...050.00
B5.2.4	Manual temperature	Manual temperature value is displayed (only displayed if SMARTPAT PH sensor is connected and Manual is selected in **B5.2.3.2**)
B5.2.5	Temp. comp. mode	Temperature compensation mode (only displayed if SMARTPAT COND sensor is connected) Selection from **B5.2.6** is displayed
B5.2.6	Set temp. comp. mode	Set temperature compensation mode (only displayed if SMARTPAT COND sensor is connected)

Menu level	Designation / function	Settings / descriptions
B5.2.6.2	Set mode	Settings for temperature compensation mode (only displayed if SMARTPAT COND sensor is connected) **Options:** • Off • Linear • Natural water • Ultrapure water (will be implemented soon)
B5.2.7	Temp. coeff.	Temperature coefficient is displayed (only displayed if SMARTPAT COND sensor is connected and linear is selected in B5.2.6.2)
B5.2.8	Set temp. coeff.	Setting for temperature coefficient (only displayed if SMARTPAT COND sensor is connected and linear is selected in B5.2.6.2)
B5.2.8.2	Temp. coeff.	Set temperature coefficient (only displayed if SMARTPAT COND sensor is connected and linear is selected in B5.2.6.2) Range: -Min...Max
B5.2.9	Reference temp.	Reference temperature is displayed (only displayed if SMARTPAT COND sensor is connected and linear is selected in B5.2.6.2)
B5.2.10	Set ref. temp.	Setting of the reference temperature (only displayed if SMARTPAT COND sensor is connected and linear is selected inB5.2.6.2)
B5.2.10.2	Reference temp.	Set reference temperature (only displayed if SMARTPAT COND sensor is connected and linear is selected in B5.2.6.2) Range: -005.00...+140.00
B5.2.11	Maintenance int.	Setting of maintenance interval: When the interval is expired, the sensor will output an information via HART. When activating the LEDs, the blue LED will light up.
B5.2.11.2	Set maintenance int.	Set maintenance interval Range: 000...999 d
B5.2.12	Remaining time	Remaining time is displayed
B5.2.13	Reset mainten. Int.	Reset of the maintenance interval
B5.2.13.2	Reset maintenance?	Do you want to reset the maintenance interval? **Options:** • Yes • No
B5.2.14	Autoclaving counter	Settings for autoclaving counter (only displayed if SMARTPAT PH sensor is connected)
B5.2.14.2	Autoclaving count	Number of autoclaving operations is displayed (only displayed if SMARTPAT PH sensor is connected)
B5.2.14.3	Incl. autocl. count.?	Do you want to increase the autoclaving counter? (only displayed if SMARTPAT PH sensor is connected) **Options:** • Yes • No
B5.3	TAG	TAG settings
B5.3.1	TAG	Device TAG
B5.3.1.2	Set device TAG	Setting of the device TAG
B5.3.2	Long TAG	Long TAG setting
B5.3.2.2	Set long TAG	Setting of long TAG
B5.4	I/O	I/O settings

Menu level	Designation / function	Settings / descriptions
B5.4.1	Measurand	Measurand settings (only displayed if SMARTPAT COND sensor is connected)
B5.4.1.2	Set measurand	Setting of the measurand (only displayed if SMARTPAT COND sensor is connected) **Options:** • Conductivity • Resistivity
B5.4.2	Meas. range	Measuring range settings
B5.4.2.2	Lower range value	Set lower range value Range: 0.0000...14.000 pH (only displayed if SMARTPAT PH sensor is connected) Range: 100.000^{-3}...20.000 µS/cm (only displayed if SMARTPAT COND sensor is connected) Range: -1500.0...+1500.0 mV (only displayed if SMARTPAT ORP sensor is connected)
B5.4.2.3	Upper range value	Set upper range value Range: 0.0000...14.000 pH (only displayed if SMARTPAT PH sensor is connected) Range: 100.000^{-3}...20.000 µS/cm (only displayed if SMARTPAT COND sensor is connected) Range: -1500.0...+1500.0 mV (only displayed if SMARTPAT ORP sensor is connected)
B5.4.3	Time constant	Time constant settings
B5.4.3.2	Set time constant	Set time constant Range: 01...60 seconds
B5.5	I/O HART	I/O HART settings
B5.5.1	Message	Message setting
B5.5.1.2	Set message	Set message (max. 32 digits)
B5.5.2	Polling address	Polling address setting
B5.5.2.2	Set polling address	Set polling address Range: 00...63
B5.5.3	Loop curent mode	Loop curent mode setting
B5.5.3.2	Enable current out.?	Do you want to enable the current output? **Options:** • Yes • No
B5.5.4	Device variables	Device variables are displayed (only displayed if SMARTPAT PH sensor is connected)
B5.5.4.1	pH value	pH value is displayed (only displayed if SMARTPAT PH sensor is connected) -Min...Max
B5.5.4.2	Max. pH	Max. pH value is displayed (only displayed if PH sensor is connected)
B5.5.4.3	Min. pH	Min. pH value is displayed (only displayed if SMARTPAT PH sensor is connected)
B5.5.4.4	Electrode voltage	Electrode voltage is displayed (only displayed if SMARTPAT PH sensor is connected) -Min...Max

Menu level	Designation / function	Settings / descriptions
B5.5.4.5	Temperature	Temperature is displayed (only displayed if SMARTPAT PH sensor is connected) -Min...Max
B5.5.4.6	Max. temperature	Max. temperature is displayed (only displayed if SMARTPAT PH sensor is connected)
B5.5.4.7	Min. temperature	Min. temperature is displayed (only displayed if SMARTPAT PH sensor is connected)
B5.5.5	Device variables	Device variables are displayed (only displayed if SMARTPAT ORP sensor is connected)
B5.5.5.1	ORP value	ORP value is displayed (only displayed if SMARTPAT ORP sensor is connected) -Min...Max
B5.5.5.2	Max. ORP	Max. ORP value is displayed (only displayed if SMARTPAT ORP sensor is connected
B5.5.5.3	Min. ORP	Min. ORP value is displayed (only displayed if SMARTPAT ORP sensor is connected
B5.5.5.4	Electrode voltage	Electrode voltage is displayed (only displayed if SMARTPAT ORP sensor is connected -Min...Max
B5.5.5.5	Temperature	Temperature is displayed (only displayed if SMARTPAT ORP sensor is connected -Min...Max
B5.5.5.6	Max. temperature	Max. temperature is displayed (only displayed if SMARTPAT ORP sensor is connected
B5.5.5.7	Min. temperature	Min. temperature is displayed (only displayed if ORP sensor is connected
B5.5.6	Device variables	Setting and display of device variables (only displayed if SMARTPAT COND sensor is connected)
B5.5.6.1	PV [cond. / resist.]	Set PV [cond. / resist.] (only displayed if SMARTPAT COND sensor is connected) -Min...Max
B5.5.6.2	Max. PV	Max. PV is displayed (only displayed if SMARTPAT COND sensor is connected)
B5.5.6.3	Min. PV	Min. PV is displayed (only displayed if SMARTPAT COND sensor is connected)
B5.5.6.4	SV [cond. / resist.]	Set SV [cond. / resist.] (only displayed if SMARTPAT COND sensor is connected) -Min...Max
B5.5.6.5	Max. SV	Max. SV is displayed (only displayed if SMARTPAT COND sensor is connected)
B5.5.6.6	Min. SV	Min. SV is displayed (only displayed if SMARTPAT COND sensor is connected)
B5.5.6.7	Temperature	Temperature is displayed (only displayed if SMARTPAT COND sensor is connected) -Min...Max
B5.5.6.8	Max. Temperature	Max. temperature is displayed (only displayed if SMARTPAT COND sensor is connected)
B5.5.6.9	Min. temperature	Min. temperature is displayed (only displayed if SMARTPAT COND sensor is connected)
B5.6	Information	Information about the sensor
B5.6.1	Sensor information	Sensor data are displayed

Menu level	Designation / function	Settings / descriptions
B5.6.1.1	Order code	Order code is displayed
B5.6.1.2	Device name	Device name is displayed
B5.6.1.3	Serial number	Serial number is displayed
B5.6.1.4	HART ID	HART ID is displayed
B5.6.1.5	Polling address	Polling address is displayed
B5.6.1.6	Manufacturer	Manufacturer is displayed
B5.6.1.7	Date of manufact.	Date of manufacturing is displayed
B5.6.1.8	SW revision	Software revision is displayed
B5.6.1.9	HW revision	Hardware revision is displayed
B5.6.2	Calib. information	Calibration information is displayed
B5.6.2.1	Measurand	Measurand selected in B5.4.1.2 is displayed (only displayed if SMARTPAT COND sensor is connected)
B5.6.2.2	Slope	Slope is displayed (only displayed if SMARTPAT PH sensor is connected)
B5.6.2.3	Offset	Offset is displayed (only displayed if SMARTPAT PH sensor is connected)
B5.6.2.4	Offset	Offset is displayed (only displayed if SMARTPAT ORP sensor is connected)
B5.6.2.5	ORP solution	ORP solution value is displayed (only displayed if SMARTPAT ORP sensor is connected)
B5.6.2.6	Process offset	Process offset for one point calibration (when implemented) is displayed (only displayed if SMARTPAT PH sensor is connected)
B5.6.2.7	Inner buffer	pH value of inner buffer is displayed (only displayed if SMARTPAT PH sensor is connected)
B5.6.2.8	Buffer solution 1	pH value of buffer solution 1 is displayed (only displayed if SMARTPAT PH sensor is connected)
B5.6.2.9	Buffer solution 2	pH value of buffer solution 2 is displayed (only displayed if SMARTPAT PH sensor is connected)
B5.6.2.10	Calibration method	Calibration method selected in B1.1.2.1 is displayed (only displayed if SMARTPAT COND sensor is connected)
B5.6.2.11	Cell constant	Cell constant is displayed (only displayed if SMARTPAT COND sensor is connected)
B5.6.2.12	Calibration solution	Calibration solution is displayed (only displayed if SMARTPAT COND sensor is connected and Calibration solution is executed in B1.1.2.1)
B5.6.2.13	Reference value	Reference value is displayed (only displayed if SMARTPAT COND sensor is connected and Product calibration is executed in B1.1.2.1
B5.6.2.14	Num. of calibrations	Number of calibrations is displayed
B5.6.2.15	Autoclaving counter	Autoclaving counter is displayed (only displayed if SMARTPAT PH sensor is connected)
B5.6.3	Operating parameters	Operating parameters are displayed (only displayed if SMARTPAT PH sensor is connected)
B5.6.3.1	Commissioning date	Commissioning date is displayed (only displayed if SMARTPAT PH sensor is connected)
B5.6.3.2	Operating hours	Operating hours are displayed (only displayed if SMARTPAT PH sensor is connected)
B5.6.3.3	Time > 80°C / 176°F	Operating time > 80°C / 176°F is displayed (only displayed if SMARTPAT PH sensor is connected)
B5.6.3.4	Time > 110°C / 230°F	Operating time > 110°C / 230°F is displayed (only displayed if SMARTPAT PH sensor is connected)
B5.6.3.5	Time < -300mV	Operating time < -300mV is displayed (only displayed if SMARTPAT PH sensor is connected)
B5.6.3.6	Time > 300mV	Operating time > 300mV is displayed (only displayed if SMARTPAT PH sensor is connected)

Menu level	Designation / function	Settings / descriptions
B5.6.3.7	Max. temperature	Max. operating temperature is displayed (only displayed if SMARTPAT PH sensor is connected)
B5.6.3.8	Temperature comp.	Temperature compensation selected in B5.2.3.2 is displayed (only displayed if SMARTPAT PH sensor is connected)
B5.6.3.9	Temp. Manual	Manual compensation temperature set in B5.2.3.3 is displayed (only displayed if SMARTPAT PH sensor is connected and Manual is selected in B5.2.3.2)
B5.6.4	Operating parameters	Operating parameters are displayed (only displayed if SMARTPAT ORP sensor is connected)
B5.6.4.1	Commissioning date	Commissioning date is displayed (only displayed if SMARTPAT ORP sensor is connected) YYYY-MM-DD
B5.6.4.2	Operating hours	Operating hours are displayed (only displayed if SMARTPAT ORP sensor is connected)
B5.6.4.3	Time > 80°C / 176°F	Operating time > 80°C / 176°F is displayed (only displayed if SMARTPAT ORP sensor is connected)
B5.6.4.4	Time > 110°C / 230°F	Operating time > 110°C / 230°F is displayed (only displayed if SMARTPAT ORP sensor is connected)
B5.6.4.5	Max. temperature	Max. operating temperature is displayed (only displayed if SMARTPAT ORP sensor is connected)
B5.6.5	Operating parameters	Operating parameters are displayed (only displayed if SMARTPAT COND sensor is connected)
B5.6.5.1	Commissioning date	Commissioning date is displayed (only displayed if SMARTPAT COND sensor is connected) YYYY-MM-DD
B5.6.5.2	Operating hours	Operating hours are displayed (only displayed if SMARTPAT COND sensor is connected)
B5.6.5.3	Op. t. > max. OP temp.	Operating time > max. operating temperature is displayed (only displayed if SMARTPAT COND sensor is connected).
B5.6.5.4	Max. OP temperature	Max. operating temperature is displayed (only displayed if SMARTPAT COND sensor is connected)
B5.6.5.5	Max. temperature	Max. operating temperature is displayed (only displayed if SMARTPAT COND sensor is connected)
B5.6.5.6	Temperature comp.	Temperature compensation selected in B5.2.6.2 is displayed (only displayed if SMARTPAT COND sensor is connected)
B5.6.5.7	Temperature coeff.	Temperature coefficient set in B5.2.8.2 is displayed (only displayed if SMARTPAT COND sensor is connected)
B5.6.5.8	Reference temp.	Reference temperature set in B5.2.10.2 is displayed (only displayed if SMARTPAT COND sensor is connected)
B5.7	Commissioning	Commissioning setting
B5.7.1	Set comm. date	Set commissioning date
B5.7.1.2	Set commisioning	Set commissioning date YYYY-MM-DD
B6	Service	Service settings SMARTPAT COND
B6.1	Trimming	Trimming settings
B6.1.1	4mA trimming	4mA trimming setting
B6.1.1.2	4mA trimming	4mA trimming Use △ and ▽ to trim.
B6.1.2	20mA trimming	20mA trimming setting

Menu level	Designation / function	Settings / descriptions
B6.1.2.2	20mA trimming	20mA trimming Use △ and ▽ to trim.
B6.2	Reset	Reset execution
B6.2.2	Reset?	Do you want to execute a reset? **Options:** • Yes • No
B6.3	Factory reset	Factory reset execution
B6.3.2	Factory reset	Do you want to execute a factory reset? **Options:** • Yes • No
B6.4	Sensor lock	Sensor lock execution
B6.4.2	Lock sensor?	Do you want to lock the sensor irreversibly? **Options:** • Yes • No
B6.4.3	Confirm lock sensor?	Do you confirm irreversible lock of the sensor? **Options:** • Yes (Warning! If you select and confirm "Yes", the sensor is locked and the HART communication is not possible anymore. The setting is not reversible anymore!) • No
B7	Replace sensor	Sensor replacement support
B7.1	Load from sensor	Load settings from sensor
B7.2	Write to sensor	Write settings to new sensor
E	Test	Device tests
E1	System	Execute system tests
E1.1	PV	Set PV Range: -Min...Max
E1.1	Start simulation?	Start simulation? **Options:** • Yes • No
E1.2	SV	Set SV Range: -Min...Max
E1.2	Start simulation?	Start simulation? **Options:** • Yes • No
E1.3	TV	Set TV Range: -Min...Max

Menu level	Designation / function	Settings / descriptions
E1.3	Start simulation?	Start simulation? **Options:** • Yes • No
E1.4	QV	Set QV Range: -Min...Max
E1.4	Start simulation?	Start simulation? **Options:** • Yes • No
E2	Loop 2	Test of Loop 2 (only displayed if Loop 2 is activated in A5.3.1)
E2.1	Current value	Set current value Range: 0.0000...Max
E2.1	Start simulation?	Start simulation? **Options:** • Yes • No
E3	Relays	Test relays
E3.1	Relay 1	Set relay 1 Range: -1.0000...+1.0000
E3.1	Start simulation?	Start simulation? **Options:** • Yes • No
E3.2	Relays 2	Test relay 2 Range: -1.0000...+1.0000
E3.2	Start simulation?	Start simulation? **Options:** • Yes • No

6.4 Setup

Equipment Start-Up

When the power is switched on, the device starts searching a SMARTPAT sensor.

6.4.1 Configuration of measurement page

The device offers the opportunity to choose between five measurement pages. You can configure them after connecting the field device and switch by pressing ▼ or ▲.

1. Measurement page

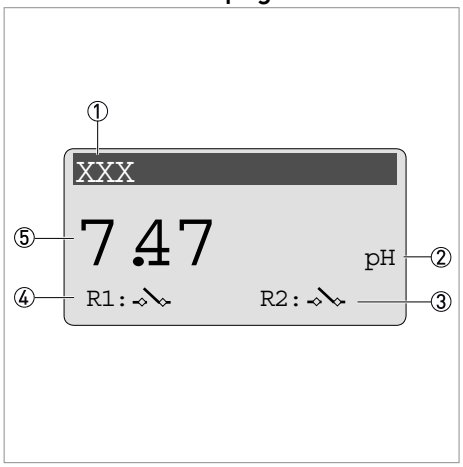


Figure 6-1: 1. Measurement page

① TAG
② Measuring unit
③ Relay 2 status
④ Relay 1 status
⑤ Measuring value

The 1. Measurement page shows one large value with the corresponding unit.

In menu option A4.1, you can choose if the PV, SV, TV, QV, 4...20 mA (L1) or 4...20 mA (L2) value is displayed. For the definition of the HART® dynamic variables, please look into the manual of the connected field device.

2. Measurement page

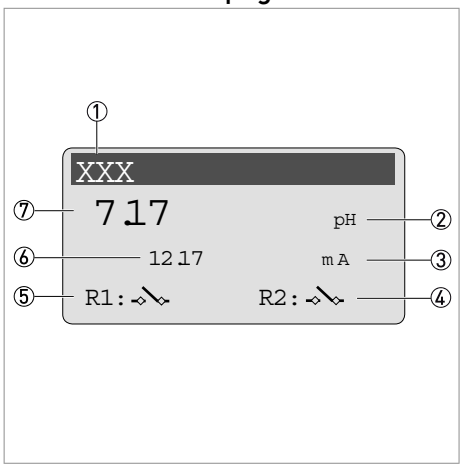


Figure 6-2: 2. Measurement page

① TAG
② Measuring unit first value
③ Measuring unit second value
④ Relay 2 status
⑤ Relay 1 status
⑥ 2. Measuring value
⑦ 1. Measuring value

This 2. measurement page shows two values with the corresponding unit.

For the displayed values you can chose between PV, SV, TV, QV, 4...20 mA (L1) in menu option **A4.2**. Those options are for both variables.

3. Measurement page

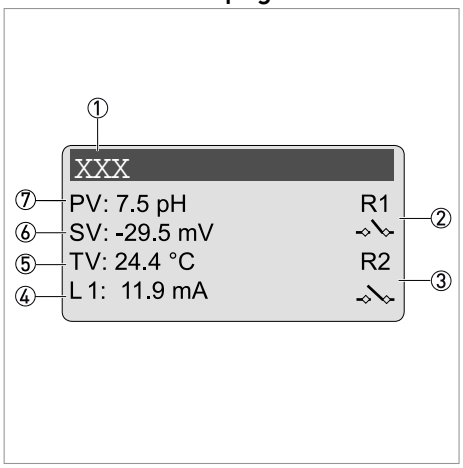


Figure 6-3: 3. Measurement page

① TAG
② Relay 1 status
③ Relay 2 status
④ 4. Measuring value
⑤ 3. Measuring value
⑥ 2. Measuring value
⑦ 1. Measuring value

This 3. Measurement page shows up to four values with the corresponding unit.

The number of values is freely configurable. The status of the relays is displayed on the right side in this case.

Go to menu option **A4.3** to choose between the parameters PV, SV, TV, QV, 4...20 mA (L1) and 4...20 mA (L2) for each value.

Trend graph

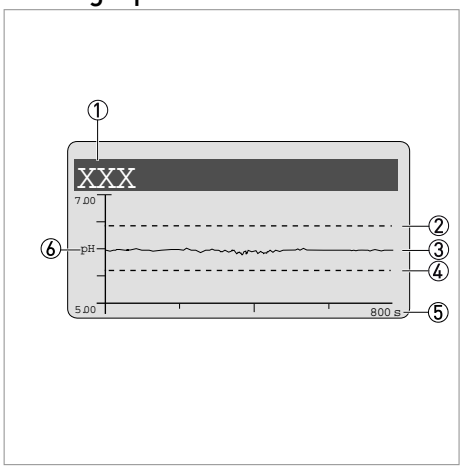


Figure 6-4: Trend graph

① TAG
② Limit line (for example relay 1)
③ Trend graph
④ Limit line (for example relay 2)
⑤ Span
⑥ Measuring unit

The trend graph shows a graph of the measured values (y-axis) for a predefined time period (x-axis).

Go to menu option **A4.4** to set the variable which should be displayed. You can choose between the variables PV, SV, TV, QV, 4...20 mA (L1) and 4....20 mA (L2). Set the range where you can decide between manual and automatic. In manual mode, you can define the lower range and the upper range value. Decide, wether the limit lines of relay 1 and relay 2 should be displayed.

Graph summary

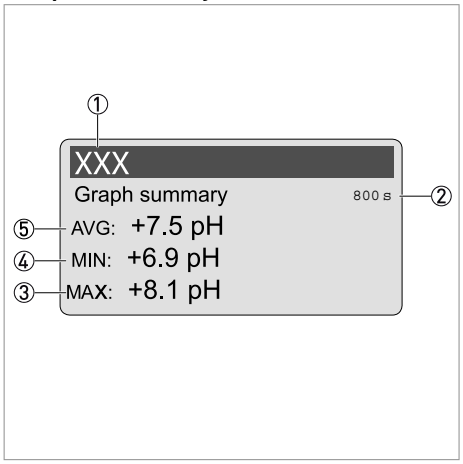


Figure 6-5: Graph summary

① TAG
② Span
③ Max. measured value
④ Min. measured value
⑤ Average measured value

On the Graph summary, the measured values for the configured parameters are evaluated for the defined span.

Status page

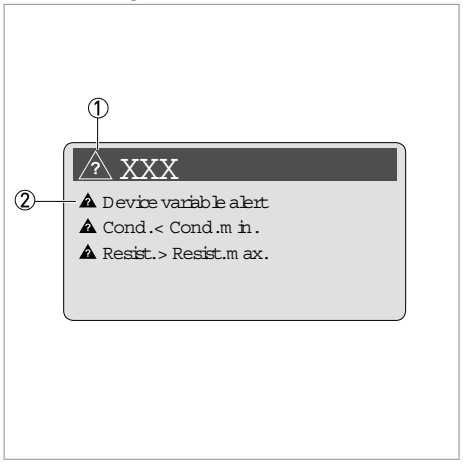


Figure 6-6: Status page

① TAG
② Error message

The status page shows the status of the field device. In front of each message there is a letter indicating the category of a status message. Furthermore, there is a status message explaining the error category in front of each group of messages. Press > to get detailed information about the displayed error and leave that page by pressing ↵. Press ▼ or ▲ to leave the status page to the measurement pages for entering the menu.

6.4.2 Number format

The function "Number format" in menu **A4.5** allows to define the number format of each measuring value. You can configure the number of digits and the decimals of PV, SV, TV, QV, 4...20 mA L1 and 4...20 mA L2.

6.4.3 Configuration of loop 1

Press > to enter the main menu
Press ↓ or ↑ until the submenu **Setup** is highlighted and press > to enter the submenu.
Press ↓ or ↑ until the submenu **I/O** is highlighted and press > to enter the submenu.
Press ↓ or ↑ until the submenu **Loop 1** is highlighted and press > to enter the submenu.
Press ↓ or ↑ until the submenu **Loop current settings** is highlighted and press > to enter the submenu. Define the **Lower range value** and press ↵. Define the **upper range value** and press ↵ to get back in the higher level.
Press ↓ or ↑ until the submenu **Loop monitoring** is highlighted and press > to enter the submenu. Activate the Monitoring for a comparative measurement between the measurend current and the current transmitted by HART® If required, set the **Max. deviation** and the **Reaction time**. Press ↵ several times to save the configuration and to return to the measuring mode.

6.4.4 Configuration of loop 2

Press > to enter the main menu.
Press ↓ or ↑ until the submenu **Setup** is highlighted and press > to enter the submenu.
Press ↓ or ↑ until the submenu **I/O** is highlighted and press > to enter the submenu.
Press ↓ or ↑ until the submenu **Loop 2** is highlighted and press > to enter the submenu.
Press ↓ or ↑ until the submenu **Mode** is highlighted and press > to enter the submenu. Press ↓ or ↑ to choose between **Current output**, **Power supply**, **Off**. Press ↵ to get back in the higher level.
If **Power supply** is selected, you can use Loop 2 for backlight and LEDs for NAMUR NE 107 signalisation.
If **Current output** is selected, the following possibilities are available for selection.
Press ↓ or ↑ until the submenu **Variable selection** is highlighted and press > to enter the submenu. Choose a variable and press ↵.
Press ↓ or ↑ until the submenu **Lower range value** is highlighted and press > to enter the submenu. Define the lowest value and press ↵.
Press ↓ or ↑ until the submenu **Upper range value** is highlighted and press > to enter the submenu. Define the highest value and press ↵.
Press ↓ or ↑ until the submenu **Lower ext. range** is highlighted and press > to enter the submenu. Define the lowest value and press ↵.
Press ↓ or ↑ until the submenu **Upper Ext. range** is highlighted and press > to enter the submenu. Define the highest value and press ↵.
Press ↓ or ↑ until the submenu **Error function** is highlighted and press > to enter the submenu. Define the error function. If the measurement is defective or the HART® communication is interrupted, the value can be hold or a high or low error current can be sent.
Press ↓ or ↑ until the submenu **Trimming 4mA** is highlighted and press > to enter the submenu. Define the **4mA Trimming** and press ↵. Press ↵ to get back in the higher level.
Press ↓ or ↑ until the submenu **Trimming 20mA** is highlighted and press > to enter the submenu. Define the **20mA Trimming** and press ↵. Press ↵ several times to save the configuration and to return to the measuring mode.

6.4.5 Function of relay 1 + 2

To configure relay 1 and 2, go to menu **A5.4** respectively **A5.5**.

Limit switch (band)

In Limit switch (band) mode, you define a permitted measuring range (band). When the measuring value exceeds or falls below this range, the relay switches.

You can choose if the relay opens (not inverted) or closes (inverted) when the value exceeds or falls below the band.

In addition, two hysteresis are configurable. For the upper limit you define an upper hysteresis and for the lower limit a lower hysteresis.

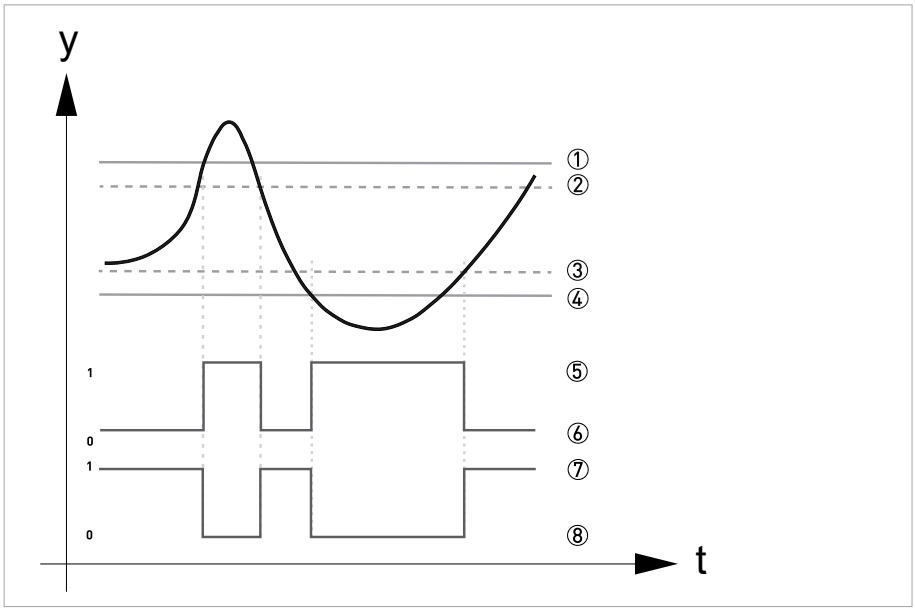


Figure 6-7: Limit switch (band)

① High alarm
② High hysteresis
③ Low hysteresis
④ Low alarm
⑤ Relay closed (not inverted)
⑥ Relay open (not inverted)
⑦ Relay closed (inverted)
⑧ Relay open (inverted)

Limit switch (threshold)

In Limit Switch (Threshold) mode, you define a threshold. When the measuring value exceeds or falls below this threshold, the relay switches.

Decide wether the relay opens (inverted) or closes (not inverted) when the value exceeds or falls below the threshold.

The hysteresis is freely configurable. Define an upper hysteresis if you have an upper threshold and a lower hysteresis if you have a lower threshold.

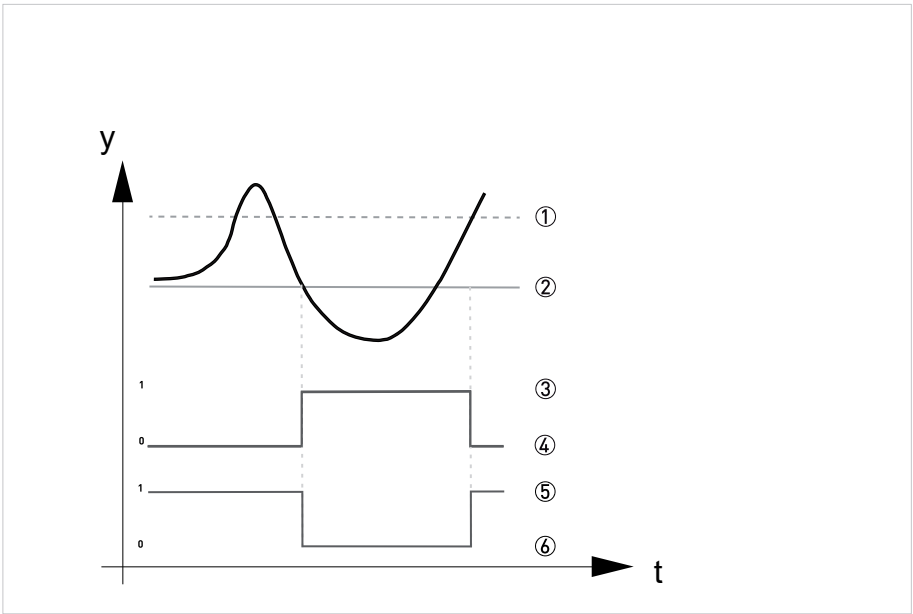


Figure 6-8: Limit switch (threshold) underrun direction

① Hysteresis
② Threshold
③ Relay closed (not inverted)
④ Relay open (not inverted)
⑤ Relay closed (inverted)
⑥ Relay open (inverted)

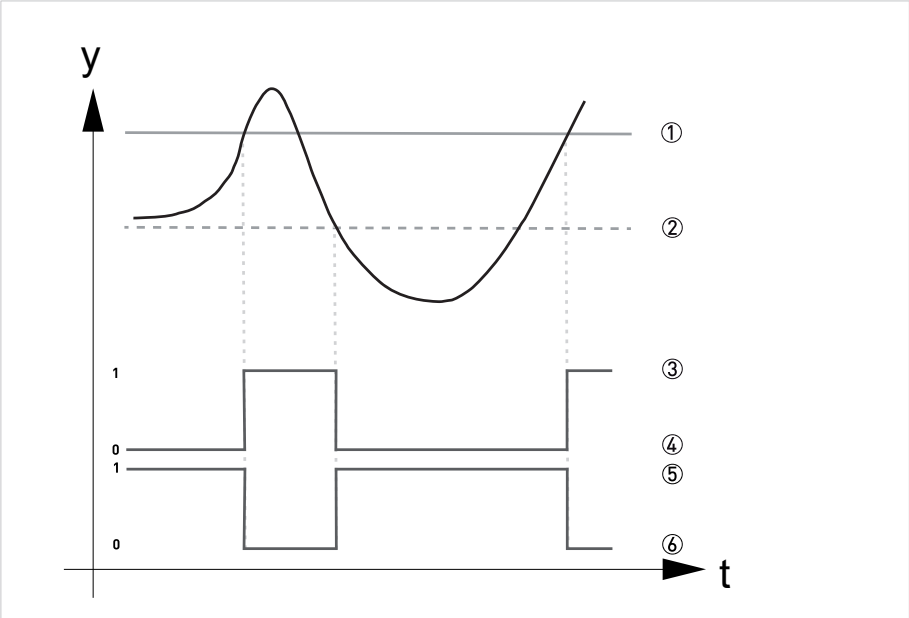


Figure 6-9: Limit switch (threshold) overrun direction

① Threshold
② Hysteresis
③ Relay closed (not inverted)
④ Relay open (not inverted)
⑤ Relay closed (inverted)
⑥ Relay open (inverted)

6.4.6 Configuration of relay 1+2

You can choose between Limit switch (threshold), Limit switch (band), Off, cleaning mode, System alarm, Loop 1 error current, USP<645> and Field device status.

Limit switch (threshold)

In Limit Switch (Threshold) mode, you define a threshold. When the measuring value exceeds or falls below this threshold, the relay switches.

Press > to enter the main menu.
Press ↓ or ↑ until the submenu **Setup** is highlighted and press > to enter the submenu.
Press ↓ or ↑ until the submenu **I/O** is highlighted and press > to enter the submenu.
Press ↓ or ↑ until the submenu **Relay 1** is highlighted and press > to enter the submenu.
Press ↓ or ↑ until the submenu **Mode** is highlighted and press > to enter the submenu. Press ↓ or ↑ until the submenu **Limit switch (thresh.)** is highlighted and press ↵.
Press ↓ or ↑ until the submenu **Invert** is highlighted and press > to enter the submenu. Choose between **Yes** and **No** when an inversion is required or not and press ↵.
Press ↓ or ↑ until the submenu **Set variable** is highlighted and press > to enter the submenu. Choose between **4...20 mA [L1]**, **QV**, **TV**, **SV**, **PV**, **4...20 mA [L2]** to set the variable and press ↵.
Press ↓ or ↑ until the submenu **Set threshold** is highlighted and press > to enter the submenu. Define the value and press ↵.
Press ↓ or ↑ until the submenu **Set hysteresis** is highlighted and press > to enter the submenu. Define the value and press ↵.
Press ↓ or ↑ until the submenu **Set characteristic** is highlighted and press > to enter the submenu. Choose between **Overrun** and **Underrun** and press ↵.
Press ↵ several times to save the configuration and to return to the measuring mode.

Limit switch (band)

In Limit switch (band) mode, you define a permitted measuring range (band). When the measuring value exceeds or falls below this range, the relay switches.

Press > to enter the main menu.
Press ↓ or ↑ until the submenu **Setup** is highlighted and press > to enter the submenu.
Press ↓ or ↑ until the submenu **I/O** is highlighted and press > to enter the submenu.
Press ↓ or ↑ until the submenu **Relay 1** is highlighted and press > to enter the submenu.
Press ↓ or ↑ until the submenu **Mode** is highlighted and press > to enter the submenu Press ↓ or ↑ until the submenu **Limit switch (band)** is highlighted and press ↵.
Press ↓ or ↑ until the submenu **Invert** is highlighted and press > to enter the submenu. Choose between **Yes** and **No** when an inversion is required or not and press ↵.
Press ↓ or ↑ until the submenu **Set variable** is highlighted and press > to enter the submenu. Choose between **4...20mA** and **User** and press ↵.
Press ↓ or ↑ until the submenu **Set low alarm** is highlighted and press > to enter the submenu. Define the value and press ↵.
Press ↓ or ↑ until the submenu **Set low alarm hysteresis** is highlighted and press > to enter the submenu. Define the value and press ↵.
Press ↓ or ↑ until the submenu **Set high alarm** is highlighted and press > to enter the submenu. Define the value and press ↵.
Press ↓ or ↑ until the submenu **Set high alarm hysteresis** is highlighted and press > to enter the submenu. Define the value and press ↵.
Press ↵ several times to save the configuration and to return to the measuring mode.

System alarm

Use of the relays for system alarm

Press > to enter the main menu.
Press ↓ or ↑ until the submenu **Setup** is highlighted and press > to enter the submenu.
Press ↓ or ↑ until the submenu **I/O** is highlighted and press > to enter the submenu.
Press ↓ or ↑ until the submenu **Relay 1** is highlighted and press > to enter the submenu.
Press ↓ or ↑ until the submenu **Mode** is highlighted and press > to enter the submenu. Press ↓ or ↑ until the submenu **System alarm** is highlighted and press ↵.
Press ↓ or ↑ until the submenu **Invert** is highlighted and press > to enter the submenu. Choose between **Yes** and **No** when an inversion is required or not and press ↵.
Press ↵ several times to save the configuration and to return to the measuring mode.

Loop1 error current

Use of the relays for error current

Press > to enter the main menu.
Press ↓ or ↑ until the submenu **Setup** is highlighted and press > to enter the submenu.
Press ↓ or ↑ until the submenu **I/O** is highlighted and press > to enter the submenu.
Press ↓ or ↑ until the submenu **Relay 1** is highlighted and press > to enter the submenu.
Press ↓ or ↑ until the submenu **Mode** is highlighted and press > to enter the submenu. Press ↓ or ↑ until the submenu **Loop 1 error current** is highlighted and press ↵.
Press ↓ or ↑ until the submenu **Invert** is highlighted and press > to enter the submenu. Choose between **Yes** and **No** when an inversion is required or not and press ↵.
Press ↓ or ↑ until the submenu **Loop 1 error current** is highlighted and press > to enter the submenu. Choose between **Both**, **Low** and **High** to configure the switching point of the relay and press ↵.
Press ↵ several times to save the configuration and to return to the measuring mode.

USP<645>

Use of the relays to control the conductivity according to USP<645> of ultrapure water

Press > to enter the main menu.
Press ↓ or ↑ until the submenu **Setup** is highlighted and press > to enter the submenu.
Press ↓ or ↑ until the submenu **I/O** is highlighted and press > to enter the submenu.
Press ↓ or ↑ until the submenu **Relay 1** is highlighted and press > to enter the submenu.
Press ↓ or ↑ until the submenu **Mode** is highlighted and press > to enter the submenu. Press ↓ or ↑ until the submenu **USP<645>** is highlighted and press ↵.
Press ↓ or ↑ until the submenu **Invert** is highlighted and press > to enter the submenu. Choose between **Yes** and **No** when an inversion is required or not and press ↵.
Press ↓ or ↑ until the submenu **Set factor for USP<645>** is highlighted and press > to enter the submenu. Define the value and press ↵.
Press ↵ several times to save the configuration and to return to the measuring mode.

Field device status

Use of the relays for a SMARTPAT sensor status

Press > to enter the main menu.
Press ↓ or ↑ until the submenu **Setup** is highlighted and press > to enter the submenu.
Press ↓ or ↑ until the submenu **I/O** is highlighted and press > to enter the submenu.
Press ↓ or ↑ until the submenu **Relay 1** is highlighted and press > to enter the submenu.
Press ↓ or ↑ until the submenu **Mode** is highlighted and press > to enter the submenu. Press ↓ or ↑ until the submenu **Field device status** is highlighted and press ↵.
Press ↓ or ↑ until the submenu **Invert** is highlighted and press > to enter the submenu. Choose between **Yes** and **No** when an inversion is required or not and press ↵.
Press ↓ or ↑ until the submenu **Field device status** is highlighted and press > to enter the submenu. Choose between **Maintenance requir.**, **Failure**, **Check function**, **Out of specification**. The relay switches when the field device transmits the selected error category and press ↵.
Press ↵ several times to save the configuration and to return to the measuring mode.

Cleaning mode

Use of relay 1 for sensor cleaning control

Press > to enter the main menu.
Press ↓ or ↑ until the submenu **Setup** is highlighted and press > to enter the submenu.
Press ↓ or ↑ until the submenu **I/O** is highlighted and press > to enter the submenu.
Press ↓ or ↑ until the submenu **Relay 1** is highlighted and press > to enter the submenu.
Press ↓ or ↑ until the submenu **Mode** is highlighted and press > to enter the submenu. Press ↓ or ↑ until the submenu **Cleaning mode** is highlighted and press ↵.
Press ↓ or ↑ until the submenu **Invert** is highlighted and press > to enter the submenu. Choose between **Yes** and **No** when an inversion is required or not and press ↵.
Press ↓ or ↑ until the submenu **Cleaning int. unit** is highlighted and press > to enter the submenu. Choose the time unit for the cleaning interval and press ↵.
Press ↓ or ↑ until the submenu **Cleaning interval** is highlighted and press > to enter the submenu. Set time span between cleaning cycles with > (selecting position) and ↓ or ↑ (selecting number). Press ↵ for confirmation of adjusted value.
Press ↓ or ↑ until the submenu **Cleaning lead time** is highlighted and press > to enter the submenu. Set cleaning lead time for delayed cleaning start with > (selecting position) and ↓ or ↑ (selecting number). Press ↵ for confirmation of adjusted value.
Press ↓ or ↑ until the submenu **Cleaning duration** is highlighted and press > to enter the submenu. Set cleaning duration with > (selecting position) and ↓ or ↑ (selecting number). Press ↵ for confirmation of adjusted value.
Press ↓ or ↑ until the submenu **Cleaning recov. time** is highlighted and press > to enter the submenu. Set sensor recovery time after cleaning with > (selecting position) and ↓ or ↑ (selecting number). Press ↵ for confirmation of adjusted value.
Press ↓ or ↑ until the submenu **Hold outp. when act.** is highlighted and press > to enter the submenu. Choose between **Yes** and **No** when output should be hold or not during cleaning cycle and press ↵.
Press ↓ or ↑ until the submenu **Next cleaning cycle** is highlighted and press > to enter the submenu.
Press ↓ or ↑ until the submenu **Manual cleaning** is highlighted and press > to enter the submenu. Choose between **Yes** and **No** to start cleaning manually or not and press ↵.
Press ↓ or ↑ until the submenu **Stop cleaning** is highlighted and press > to enter the submenu. Choose between **Yes** and **No** to stop cleaning manually or not and press ↵.
Press ↵ several times to save the configuration and to return to the measuring mode.

6.4.7 Illumination setting

Press > to enter the main menu.
Press ↓ or ↑ until the submenu **Setup** is highlighted and press > to enter the submenu.
Press ↓ or ↑ until the submenu **Display** is highlighted and press > to enter the submenu.
Press ↓ or ↑ until the submenu **Illumination setting** is highlighted and press > to enter the submenu.
Press ↓ or ↑ until the submenu **Backlight** is highlighted and press > to enter the submenu Choose between **On**, **Off** and **Timer** when a backlight is required and press ↵. If **Timer** was chosen, press ↓ or ↑ until the submenu **Timer** is highlighted and press > to enter the submenu. Define the holding time of backlight without key activation and press ↵.
Press ↓ or ↑ until the submenu **Status LEDs** is highlighted and press > to enter the submenu. Choose between **Yes** and **No** when the LEDs are required or not and press ↵.
Press ↵ several times to save the configuration and to return to the measuring mode.

6.4.8 Overflow sign and exponential format

If there is not enough space available for the complete measured value, the display either shows the overflow sign or uses the exponential format (depending on the settings in functions).

Overflow sign
The user can define that a particular display line should consist of a fixed number of digits in menu A4.5. For this purpose the corresponding function must not have the setting "automatic". If the measuring result in this line exceeds this number, the display shows the overflow sign right beside the plus/minus sign. It appears as a triangle pointing to the left as shown in the following drawings:

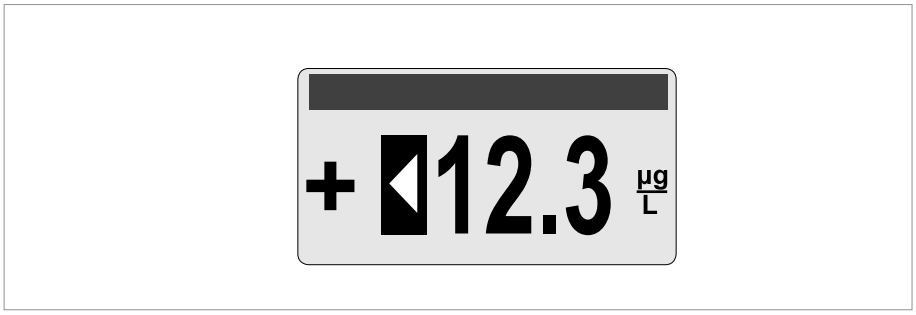


Figure 6-10: Overflow sign

Exponential format

If the format of the related display line is set to "automatic" in menu A4.5 long measuring results appear in an exponential format:

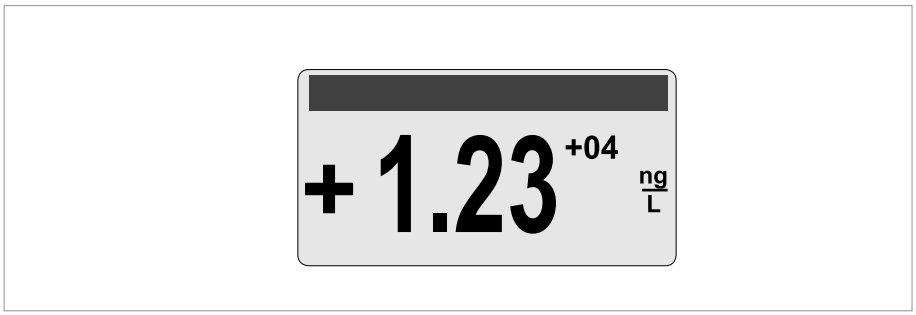


Figure 6-11: Exponential format

6.5 SMARTPAT sensor calibration

INFORMATION!
For sensor handling during calibration please consider the standard documentation of the sensor!

To start a sensor calibration proceed as follows:

Press > to enter the main menu.
Press ↓ or ↑ until the submenu **PAT sensor** is highlighted and press > to enter the submenu.
Press > to enter the submenu **Calibration**.

The further procedure is described sensor-specifically in the following chapters.

6.5.1 SMARTPAT COND sensor calibration

Three calibration methods are available:
"Product calibration" to calibrate the sensor with the help of a reference sensor
"Calib. solution" to calibrate the sensor with the help of a reference solution
"Input cell constant" to enter the calibrated cell constant of a sensor

Product calibration

Press > to enter the submenu **Start calibration**.
Choose calibration method **Product calibration** and press ↵.
Choose between **Yes** and **No** to set all outputs on hold or not and press ↵.
Press ↵ when measured value is stable.
Press ↵ to confirm displayed calibration value.
Choose **Yes** to save value and press ↵ to go on with the calibration or choose **No** to abort calibration.
Choose unit of reference value between **µS/cm** and **mS/cm** for measurand (B5.4.1.2) conductivity or**MOhm*cm** and **kOhm*cm** for measurand (B5.4.1.2) resistivity and press ↵.
Set reference value with > (selecting position) and ↓ or ↑ (selecting number). Press ↵ for confirmation of adjusted value.
Press ↵ to confirm displayed calibration parameter.
Choose **Yes** to save parameter and press ↵ to go on with the calibration or choose **No** to abort calibration.
Set calibration date with > (selecting position) and ↓ or ↑ (selecting number). Press ↵ for confirmation of adjusted date.
Choose between **Yes** and **No** to set all outputs on hold or not and press ↵.

Calibration solution

Press > to enter the submenu **Start calibration**.			
	Choose calibration method **Calibration solution** and press ↵.		
		Choose between **Yes** and **No** to set all outputs on hold or not and press ↵.	
			Choose unit of calibration solution between **µS/cm** and **mS/cm** for measurand (B5.4.1.2) conductivity or**MOhm*cm** and **kOhm*cm** for measurand (B5.4.1.2) resistivity and press ↵.
			Set calibration solution value with > (selecting position) and ↓ or ↑ (selecting number). Press ↵ for confirmation of adjusted value.
			Press ↵ to confirm displayed calibration value.
			Press ↵ to confirm displayed calibration parameter.
			Choose **Yes** to save parameter and press ↵ to go on with the calibration or choose **No** to abort calibration.
			Set calibration date with > (selecting position) and ↓ or ↑ (selecting number). Press ↵ for confirmation of adjusted date.
			Choose between **Yes** and **No** to set all outputs on hold or not and press ↵.

Input cell constant

Press > to enter the submenu **Start calibration**.			
	Choose calibration method **Input cell constant** and press ↵.		
		Choose between **Yes** and **No** to set all outputs on hold or not and press ↵.	
			Set new cell constant with > (selecting position) and ↓ or ↑ (selecting number). Press ↵ for confirmation of adjusted constant.
			Press ↵ to confirm displayed calibration parameter.
			Choose **Yes** to save parameter and press ↵ to go on with the calibration or choose **No** to abort calibration.
			Set calibration date with > (selecting position) and ↓ or ↑ (selecting number). Press ↵ for confirmation of adjusted date.
			Choose between **Yes** and **No** to set all outputs on hold or not and press ↵.

6.5.2 SMARTPAT ORP sensor calibration

Before proceeding with the calibration process put SMARTPAT ORP sensor in the appropriate ORP test solution.

	Choose between **Yes** and **No** to set all outputs on hold or not and press ↵.	
		Set redox solution value of ORP test solution with > (selecting position) and ↓ or ↑ (selecting number). Press ↵ for confirmation of adjusted value.
		Press ↵ to confirm readyness of ORP solution and displayed calibration value.
		Press ↵ to confirm displayed calibration parameter.
		Choose **Yes** to save parameter and press ↵ to go on with the calibration or choose **No** to abort calibration.
		Set calibration date with > (selecting position) and ↓ or ↑ (selecting number). Press ↵ for confirmation of adjusted date.
		Choose between **Yes** and **No** to set all outputs on hold or not and press ↵.

6.5.3 SMARTPAT PH sensor calibration

Two calibration methods are possible:
"One point calibration" with a reference sensor (will be implemented in SMARTPAT PH sensors soon)
"Two point calibration" with two buffer solutions

Two point calibration

	Choose **Two point calibration** and press ↵.	
		Choose between **Yes** and **No** to set all outputs on hold or not and press ↵.
		Choose temperature compensation between **Manual** and **Automatic** and press ↵.
		For manual temperature compensation set temperature compensation value with > (selecting position) and ↓ or ↑ (selecting number). Press ↵ for confirmation of adjusted value.
		Put SMARTPAT PH sensor into buffer solution 1 and press ↵ to confirm stable value.
		Set value of buffer solution 1 with > (selecting position) and ↓ or ↑ (selecting number). Press ↵ for confirmation of adjusted value.
		Put SMARTPAT PH sensor into buffer solution 2 and press ↵ to confirm stable value.
		Set value of buffer solution 2 with > (selecting position) and ↓ or ↑ (selecting number). Press ↵ for confirmation of adjusted value.
		Press ↵ to confirm displayed calibration parameter.
		Choose **Yes** to save parameter and press ↵ to go on with the calibration or choose **No** to abort calibration.
		Choose between **Yes** and **No** to set all outputs on hold or not and press ↵.

6.6 Sensor exchange function

With the sensor exchange function, settings from a SMARTPAT sensor can be copied to another when replacing an old sensor with a new one.

Load settings from old sensor

Press > to enter the main menu
Press ↓ or ↑ until the submenu **PAT sensor** is highlighted and press > to enter the submenu.
Press ↓ or ↑ until the submenu **Replace sensor** is highlighted and press > to enter the submenu.
Press ↓ or ↑ until the submenu **Load from sensor** is highlighted and press > to enter the submenu. After loading the settings the message: **Sensor backup complete** is displayed.

- After the backup is completed exchange the sensor.

Write settings to the new sensor

Press > to enter the main menu
Press ↓ or ↑ until the submenu **PAT sensor** is highlighted and press > to enter the submenu.
Press ↓ or ↑ until the submenu **Replace sensor** is highlighted and press > to enter the submenu.
Press ↓ or ↑ until the submenu **Write to sensor** is highlighted and press > to enter the submenu. After writing the settings to the new sensor the message: **Sensor restore complete** is displayed.

INFORMATION!
*When **Write to sensor** is started without having made a backup or a different sensor type is connected (e.g. PH sensor instead of COND sensor) the message **No valid data found** is displayed.*

Backup data

COND	PH	ORP
TAG	TAG	TAG
Long TAG	Long TAG	Long TAG
4..20mA range upper value	4..20mA range upper value	4..20mA range upper value
4..20mA range lower value	4..20mA range lower value	4..20mA range lower value
Maintenance interval	Maintenance interval	Maintenance interval
Time constant (4..20mA)	Time constant (4..20mA)	Time constant (4..20mA)
HART message	HART message	HART message
Polling address	Polling address	Polling address
Loop mode (fixed, active)	Loop mode (fixed, active)	Loop mode (fixed, active)
Temperature compensation mode	Temperature compensation mode	
Temperature coefficient (alpha)	Manual temperature	
Reference temperature		
Measurand : PV / SV configuration (PV / SV can be swapped)		

7.1 Maintenance and repair

The device is maintenance free. Also note the following admonition concerning malfunctions:

DANGER!
In case of a malfunction only the technical service is allowed to repair the device. Never try to repair the device on your own, otherwise it may come to fatal injuries, destruction or damage of the device or measuring errors.

7.2 Spare parts availability

The manufacturer adheres to the basic principle that functionally adequate spare parts for each device or each important accessory part will be kept available for a period of 3 years after delivery of the last production run for the device.

This regulation only applies to spare parts which are subject to wear and tear under normal operating conditions.

7.3 Availability of services

The manufacturer offers a range of services to support the customer after expiration of the warranty. These include repair, maintenance, technical support and training.

INFORMATION!
For more precise information, please contact your local sales office.

7.4 Returning the device to the manufacturer

7.4.1 General information

This device has been carefully manufactured and tested. If installed and operated in accordance with these operating instructions, it will rarely present any problems.

WARNING!
Should you nevertheless need to return a device for inspection or repair, please pay strict attention to the following points:

- *Due to statutory regulations on environmental protection and safeguarding the health and safety of the personnel, the manufacturer may only handle, test and repair returned devices that have been in contact with products without risk to personnel and environment.*
- *This means that the manufacturer can only service this device if it is accompanied by the following certificate (see next section) confirming that the device is safe to handle.*

WARNING!
If the device has been operated with toxic, caustic, radioactive, flammable or water-endangering products, you are kindly requested:

- *to check and ensure, if necessary by rinsing or neutralising, that all cavities are free from such dangerous substances,*
- *to enclose a certificate with the device confirming that it is safe to handle and stating the product used.*

7.4.2 Form (for copying) to accompany a returned device

CAUTION!
To avoid any risk for our service personnel, this form has to be accessible from outside of the packaging with the returned device.

Company:		Address:
Department:		Name:
Telephone number: Fax number:		Email address:
Manufacturer order number or serial number:		
The device has been operated with the following medium:		
This medium is:		radioactive
		water-hazardous
		toxic
		caustic
		flammable
		We checked that all cavities in the device are free from such substances.
		We have flushed out and neutralized all cavities in the device.
We hereby confirm that there is no risk to persons or the environment caused by any residual media contained in this device when it is returned.		
Date:		Signature:
Stamp:		

7.5 Disposal

LEGAL NOTICE!
Disposal must be carried out in accordance with legislation applicable in your country.

Separate collection of WEEE (Waste Electrical and Electronic Equipment):

According to the directive 2012/19/EU or UK Regulation 2013 No. 3113, the monitoring and control instruments marked with the WEEE symbol and reaching their end-of-life **must not be disposed of with other waste**.
The user must dispose of the WEEE to a designated collection point for the recycling of WEEE or send them back to our local organisation or authorised representative.

7.5.1 Disassembly and recycling

This section briefly describes the instructions of handling and disassembling the device when it has reached the end of its useful life (EOL) or is disposed of after usage. The information given is sufficient to gather the most important parts of the device (by the end-user) which can be used for recycling.

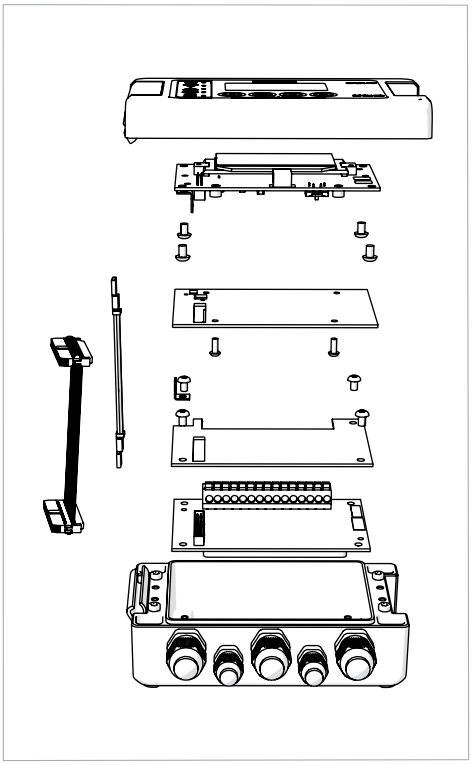


Figure 7-1: Overview disassembly - aluminium housing

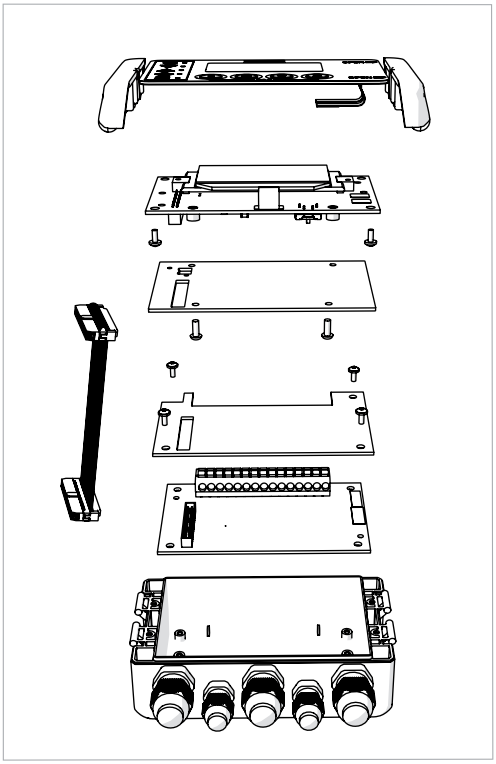


Figure 7-2: Overview disassembly- plastic housing

Component		Plastic version		Aluminium version	
		Material	Weight [g/lb]	Material	Weight [g/lb]
1	Housing	PC	197 / 0.43	Aluminium	645 / 1.42
2	Cable glands	PA6 V-2, CR / NBR	31 / 0.07	PA6 V-2, CR / NBR	31 / 0.07
3	LCD screen, size<23 cm^2	diverse	11 / 0.02	diverse	11 / 0.02
4	Cable	PVC, Copper	11 / 0.02	PVC, Copper	14 / 0.03
5	PCB display, size<76 cm^2	FR4	57 / 0.13	FR4	57 / 0.13
6	PCB display cover, size: 77 cm^2	FR4	23 / 0.05	FR4	25 / 0.05
7	PCB basic, size<82 cm^2	FR4	52 / 0.12	FR4	52 / 0.12
8	PCB basic cover, size<81 cm^2	FR4	20 / 0.04	FR4	20 / 0.04

Table 7-1: Disassembly and recycling

No battery and no capacitors >25 mm included

INFORMATION!
The percentage of hazardous substances present in the components complies with RoHS.

INFORMATION!
The product does not contain harmful gases or substances. There are no special guidance or actions necessary to disassemble the device.

CAUTION!
Before disassembling the device, make sure you have the proper tools needed.
- *For the plastic version: Flat tool*
- *For the aluminium version: Torx screwdriver T20*

INFORMATION!
- *Wear personal protective equipment.*
- *Make sure you use a steady workplace/bench to do the disassembly actions.*

DANGER!
*The device **MUST** be disconnected from mains power before disassembling.*

Remove connection and/or other cable(s)

Connection cable materials consist of (several) metal conductor (usually copper), surrounded with a flexible plastic insulation.

Disassembling the device

- Open the housing with a flat tool(plastic version) or with a torx screwdriver T20 (aluminium version)
- Disconnect all cables
- Remove the circuit boards

All main parts are now disassembled and can be shipped separately for reuse and/or recycling.

8.1 Technical data

INFORMATION!

- *The following data is provided for general applications. If you require data that is more relevant to your specific application, please contact us or your local sales office.*
- *Additional information (certificates, special tools, software,...) and complete product documentation can be downloaded free of charge from the website (Downloadcenter).*

Measuring system

Measuring principle	The measuring principle depends on the used SMARTPAT sensor(s), for further information refer to the SMARTPAT sensor manual(s).
Measuring range	The measuring range depends on the used SMARTPAT sensor(s), for further information refer to the SMARTPAT sensor manual(s).

Design

Construction	A typical measuring system consists of: • SMARTMAC 400 • SMARTPAT sensor • SMARTPAT VP-cable
Communication protocol	≥ HART® 5

Display and user interface

Graphic display	LC display 256 x 128 pixel
Operating elements	4 push buttons for operator control of the unit without opening the housing.
Operating menu	The operation menu consists of: Measuring mode: 6 pages (5 measurement pages and 1 status page) Menu mode: variety of main and submenus that allows to customise the device according to the demands of the measuring point.
Operating and display languages	English, German, French, Italian, Spanish, simplified Chinese
Units	SMARTPAT HART units

Operating conditions

Temperature	
Ambient	-20...+70°C / -4...+158°F
	Note: the manufacturer strongly recommends to protect the unit from external heat sources such as direct sunlight as higher temperatures reduce the life cycle of all electronic components!
Storage	-30...+70°C / -22...+158°F
Altitude	≤ 2000 m / 6561.68 f

Other conditions

Humidity	RH4...100% rH (IEC 60721-3-4:1995 Class 4K4)
Ingress protection acc. to IEC 60529:	IP66/ IP67

Installation conditions

Weight	Approx. 413 g / 0.91 lb for plastic housing Approx. 855 g / 1.89 lb for aluminium housing
Installation	Wall mounting; assure a vertical mounting orientation Wall or pipe mounting with weather protection cover

Materials

Housing	Aluminium Plastic (Polycarbonate)
Cable glands	3xM16x1.5 2xM12x1.5 Material: Polyamid

Electrical connections

Power supply	20...30 VDC, loop powered from 4...20 mA signal input; Voltage drop max. 4V at 4 mA and 2V at 20 mA
System requirements	250 Ω loop resistance for HART® communication. Note: In most Ex isolation amplifiers the 250 Ohm resistor is already integrated.
Current output	12...30 VDC; 4...20 mA signal output (passive)
Relays	**Two solid state relays working as status output, limit switch, system alarm, cleaning control, error current or alert functionality acc. to USP<645>** • The relay contacts are electrically isolated from each other and from all other circuits • The output stages of the status outputs/limit switches behave like relay contacts • Possible conditions: NO (normally open) or NC (normally closed) **Connection values:** • Maximum voltage = 30 V • Maximum load current = 75 mA up to 55°C and 50 mA above 55°C • Max on resistance = 10 Ohm

Approvals and certifications

CE	
The device meets the essential requirements of the EU directives. The CE marking indicates the conformity of the product with the union legislation applying to the product and providing for CE marking.	
For full information of the EU directives and standards and the approved certifications, please refer to the EU declaration on the website of the manufacturer.	
Hazardous areas	
ATEX	ATEX II 2 G Ex ia IIC T4 Gb
IECEX	IECEx ia IIC T4 Gb
QPS	QPS Ex ia IIC T4 Gb / Class I, Zone 1 AEx ia IIC T4 Gb
UKEX	UKEX II 2 G Ex ia IIC T4 Gb
Other approvals and standards	
NAMUR recommendation	NE 6, NE 21, NE 43, NE 53, NE 107
Shock resistance	IEC 60721-3-4 class 4M4
Vibration resistance	IEC 60721-3-4 class 4M4
	IEC 61298-3 low vibration control room

8.2 Dimensions

Plastic housing

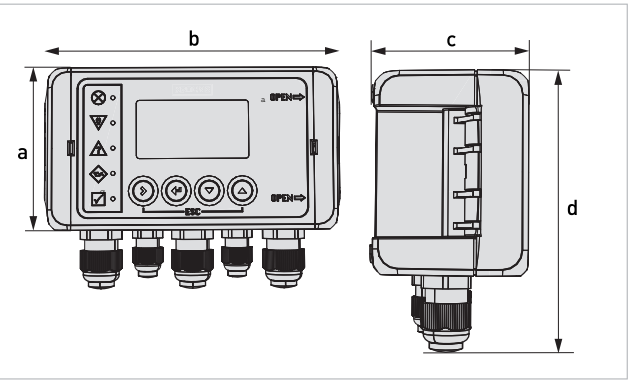


Figure 8-1: Dimensions plastic housing

	Dimensions [mm]				Weight [g]
	a	b	c	d	
Wall mounted	80	151	60	105	413

Table 8-1: Dimensions plastic housing in mm

	Dimensions [inch]				Weight [pound]
	a	b	c	d	
Wall mounted	3.15	5.94	2.36	4.13	0.91

Table 8-2: Dimensions plastic housing in inch

Aluminium housing

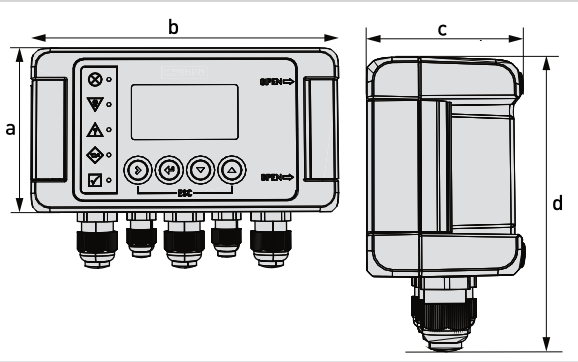


Figure 8-2: Dimensions aluminium housing

	Dimensions [mm]				Weight [g]
	a	b	c	d	
Wall mounted	86	159	60	111	855

Table 8-3: Dimensions aluminium housing in mm

	Dimensions [inch]				Weight [pound]
	a	b	c	d	
Wall mounted	3.39	6.26	2.36	4.37	1.89

Table 8-4: Dimensions aluminium housing in inch

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