



OPTISENS MAC 100 Handbook

Multiparameter signal converter

Electronic Revision: ER 1.1.6

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

All rights reserved. It is prohibited to reproduce this documentation, or any part thereof, without the prior written authorisation of KROHNE Messtechnik GmbH.

Subject to change without notice.

Copyright 2016 by
KROHNE Messtechnik GmbH - Ludwig-Krohne-Str. 5 - 47058 Duisburg (Germany)

1	Safety instructions	6
1.1	Software history	6
1.2	Intended use	7
1.3	Certifications	7
1.4	Safety instructions from the manufacturer	8
1.4.1	Copyright and data protection	8
1.4.2	Disclaimer	8
1.4.3	Product liability and warranty	9
1.4.4	Information concerning the documentation	9
1.4.5	Warnings and symbols used	10
1.5	Safety instructions for the operator	10
2	Device description	11
2.1	Scope of delivery	11
2.2	Device description	12
2.3	Sensor input combinations	14
2.4	Nameplate	15
3	Installation	16
3.1	General notes on installation	16
3.2	Storage and transport	16
3.3	Wall mounting	16
4	Electrical connections	20
4.1	Safety instructions	20
4.2	Used abbreviations	20
4.3	Important device-specific notes on electrical connection	21
4.4	Opening and closing the converter housing	22
4.4.1	Die-cast aluminium housing	22
4.4.2	Stainless steel converter housing	22
4.5	Overview of the terminal compartment	23
4.6	Connecting the signal cables	24
4.7	Connecting the power supply	24
4.8	Description and properties of the outputs and the input	26
4.8.1	Current output	26
4.8.2	Relay outputs	26
4.8.3	Control input (passive)	27
4.9	Connection diagrams of the outputs and the input	28
4.9.1	Important notes	28
4.9.2	Description of electrical symbols	28
4.9.3	Block diagram	29
4.9.4	Current output (active)	29
4.9.5	Relay outputs	30
4.9.6	Control input	30
4.10	Electrical connection of the outputs and the input	31
4.10.1	Connecting the current outputs	31

4.10.2 Connecting the relay outputs.....	32
5 Start-up.....	35
5.1 Switching on the power	35
6 Operation.....	37
6.1 Operating elements.....	37
6.2 Measuring mode.....	38
6.2.1 First measuring page.....	38
6.2.2 Second measuring page	40
6.2.3 Status page	41
6.2.4 Trend diagram.....	42
6.3 Menu mode	42
6.3.1 Navigating through the menus	43
6.3.2 Menu "quick setup".....	47
6.4 Menu mode structure.....	48
6.5 Function tables	51
6.5.1 Menu A, quick setup.....	51
6.5.2 Menu B, test	53
6.5.3 Menu C, setup	55
6.5.4 Menu D, service.....	60
6.6 Functions in detail	61
6.6.1 Manual hold.....	61
6.6.2 Simulation of measured values.....	61
6.6.3 Status log and calibration log.....	62
6.6.4 Error current of current output.....	63
6.6.5 Overflow sign and exponential format.....	64
6.6.6 Save settings	66
6.6.7 Load settings.....	66
6.6.8 Passwords.....	67
6.7 Status messages and diagnostic information.....	67
6.7.1 Error category "Device failure" (bold "F")	69
6.7.2 Error category "Application error" ("F", not bold)	70
6.7.3 Error category "Out of specification" (S)	70
6.7.4 Error category "Check request" or "Run check" (C)	71
6.7.5 Error category "Information" (I)	71
6.8 Timeout function.....	72
7 Service.....	73
7.1 Maintenance and repair	73
7.2 Spare parts availability.....	73
7.3 Availability of services	73
7.4 Returning the device to the manufacturer.....	73
7.4.1 General information.....	73
7.4.2 Form (for copying) to accompany a returned device.....	74
7.5 Disposal	74

8 Technical data	75
8.1 Measuring principle.....	75
8.2 Technical data table	75
8.3 Dimensions and weight	79
8.3.1 Housing die-cast aluminium.....	79
8.3.2 Housing stainless steel.....	80
8.3.3 Mounting plate die-cast aluminium	81
8.3.4 Mounting plate stainless steel.....	82
9 Notes	83

1.1 Software history

The "Electronic Revision" (ER) is consulted to document the revision status of electronic equipment according to NE 53 for all GDC devices. It is easy to see from the ER whether troubleshooting or larger changes in the electronic equipment have taken place and how that has affected the compatibility.



INFORMATION!

In the table below, "x" 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
2007-12-11	1.0.0	-	MA MAC 100 R01
2011-08-18	1.1.0_	5	MA MAC 100 R01
2013-04-11	1.1.1_	1	MA MAC 100 R01
2013-11-05	1.1.2_	1	MA MAC 100 R01
2015-03-31	1.1.4	1	MA MAC 100 R01
2015-11-09	1.1.6	1	MA MAC 100 R02

1.2 Intended use

***DANGER!***

Never install or operate the device in potentially explosive areas, it might cause an explosion that can result in fatal injuries.

***INFORMATION!***

This device is a Group 1, Class A device as specified within CISPR11:2009. 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.

***WARNING!***

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

In combination with the different sensors of the OPTISENS series the OPTISENS MAC 100 measures analytical parameters in water and waste water applications.

1.3 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 website of the manufacturer.

Other approvals and standards

- NAMUR recommendation NE 21 and NE 43

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 can not 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: Standard scope of delivery

- ① Signal converter
- ② Product documentation

2.2 Device description

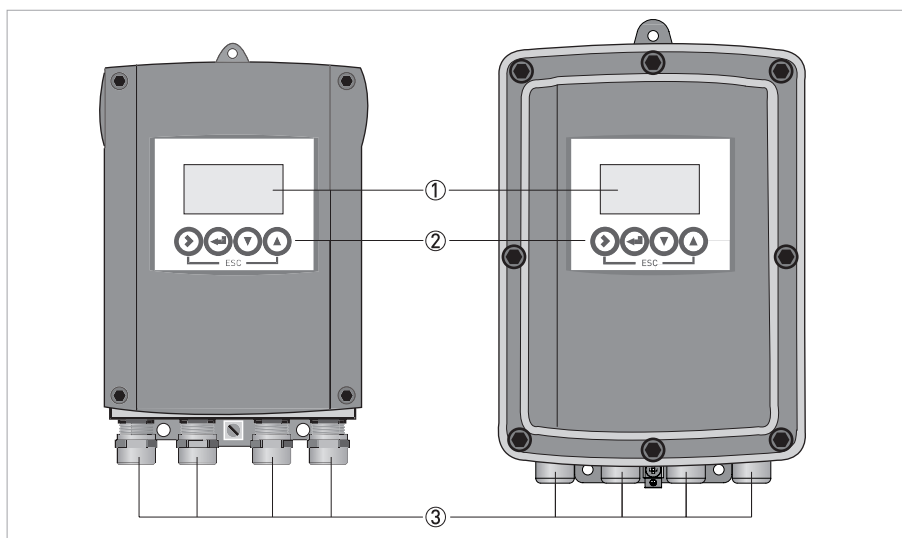


Figure 2-2: Device description (left - die-cast aluminium / right - stainless steel)

- ① Display
- ② Operation keys
- ③ Cable glands

The signal converter is able to measure different parameters in liquids and fluids which are common in the water and waste water as well as in food & beverage and the chemical industry. It has three freely programmable current outputs, one control input and optionally three mechanical relays which can be configured as alarm or status relays or limit switches. The manufacturer offers the device as a one channel version and a version with two channels. The last one possesses two sensor inputs for using sensors with different measuring principles as they are:

- Amperometric measurements (free chlorine / ozone / chlorine dioxide / dissolved oxygen)
- Potentiometric measurements (pH / ORP)
- Conductivity measurements (conductive / inductive)
- Optical measurements (turbidity / dissolved oxygen)

When ordering the one channel version, only the interface "Pos.A" is populated. In the version with two channels the interfaces "Pos.A" and "Pos.B" are populated (for further information refer to *Overview of the terminal compartment* on page 23).



INFORMATION!

- *The configuration of the signal converter (i.e. the number and type of sensor inputs) has to be set in the factory and cannot be changed later.*
- *The number and type of sensor inputs is specified via the order code and visible on the nameplate.*

The manufacturer offers the signal converter as a wall mount version only. Each device has a passive control input that can trigger an external "out of specification error" (e.g. that there is no flow). Additionally the control input can help to set the analogue outputs (current outputs and limit switches) to "zero" or to "manual hold" (e.g. for maintenance). For further details about the control input please refer to *Control input (passive)* on page 27.

The type and design of the cable glands depend on the version of the converter. For each device 4 cable glands are designated. The material can be selected between plastic or stainless steel. To connect the conduit systems use a NPT adapter made of brass.

Example for assignment of cable glands

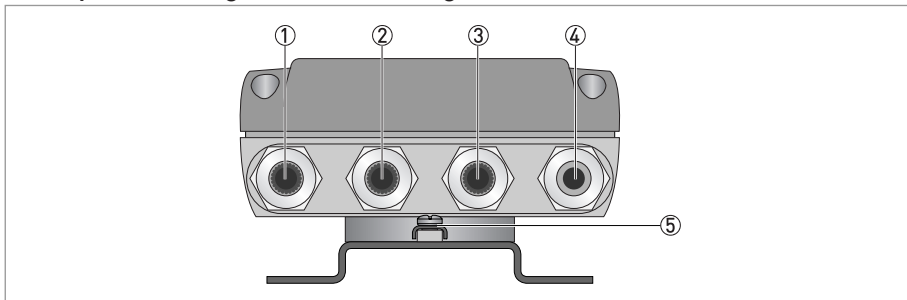


Figure 2-3: Cable glands

- ① Power
- ② Current output or relay output
- ③ Current outputs or temperature sensor
- ④ Sensor input
- ⑤ Possibility to connect a functional earth (only relevant for version with 24 V)

2.3 Sensor input combinations

The following combinations of the OPTISENS sensor inputs are possible:

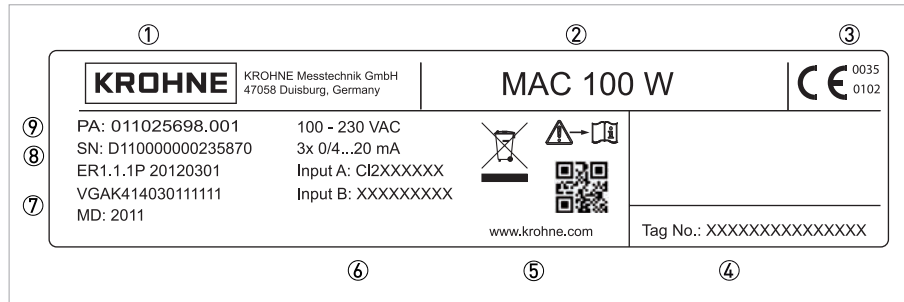
Possible combinations	Sensor input A	Sensor input B
Single channel version	pH / ORP	-
	Cl ₂ / ClO ₂ / O ₃	-
	conductive conductivity	-
	inductive conductivity	-
	optical dissolved oxygen	-
	amperometric dissolved oxygen	-
	turbidity	-
Dual channel version	pH / ORP	pH / ORP
	pH / ORP	conductive conductivity
	pH / ORP	inductive conductivity
	Cl ₂ / ClO ₂ / O ₃	pH / ORP
	conductive conductivity	conductive conductivity
	inductive conductivity	inductive conductivity

2.4 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.



- ① Manufacturer
- ② Device name
- ③ CE marking
- ④ TAG number
- ⑤ Electronic/electric device waste marking
Observe the operation and installation instruction
Internet address of manufacturer
Data Matrix code (serial number)
- ⑥ Power supply data
Number of current outputs
Parameter of measuring unit
- ⑦ Order code
Manufacturing date
- ⑧ Serial number
Electronic revision
- 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.*
- *Avoid continuous direct sunlight*
- *Store and transport the device in an environment with a temperature between -40...+70° C / -40...+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 Wall mounting

**DANGER!**

Never install or operate the device in potentially explosive areas, it might cause an explosion that can result in fatal injuries.

**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 signal converter from direct sunlight and install a sun shade if necessary.*
- *Signal converters installed in control cabinets require adequate cooling, e.g. by fan or heat exchanger.*
- *Do not expose the signal converter 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.

The mounting plate is fixed at the back side of the device in the delivery condition. The following drawings illustrate the proper mounting:

**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.

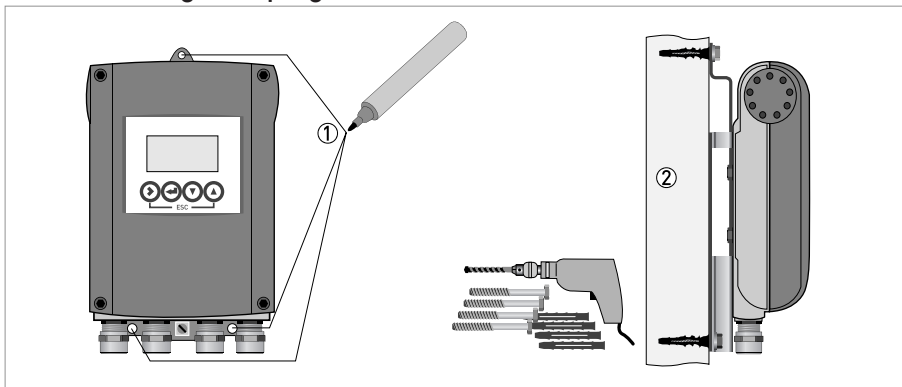
Wall mounting with plugs

Figure 3-1: Mounting procedure to walls



- Note the drawing above and mark all drill holes with the help of a pen, e.g. a felt pen ①.
- Fasten the device securely to the wall with the help of drilling machine, plugs, screws and the mounting plate ②.

Wall mounting of multiple devices (Die-cast aluminium)

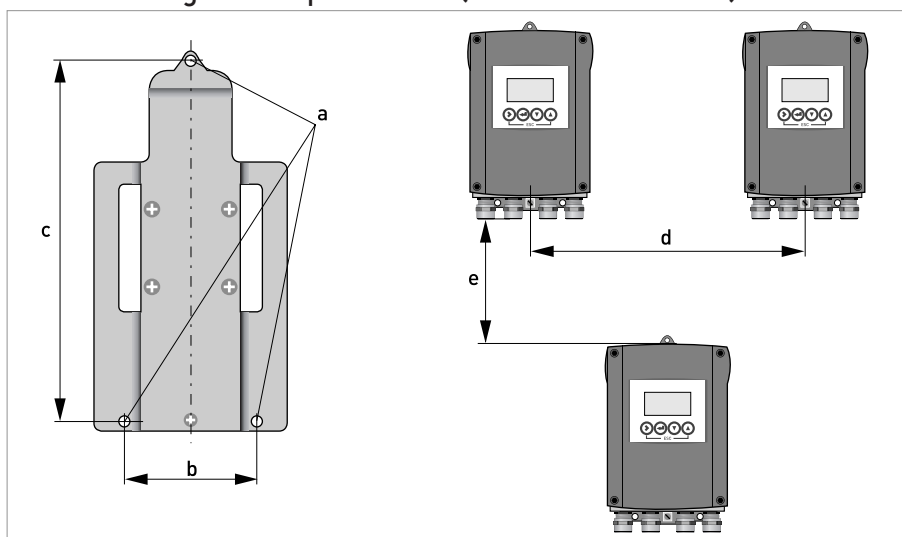


Figure 3-2: Dimensions and distances

	[mm]	["]
a	Ø6.5	Ø0.26
b	87.2	3.4
c	241	9.5
d	310	12.2
e	257	10.1

Wall mounting of multiple devices (Stainless steel)

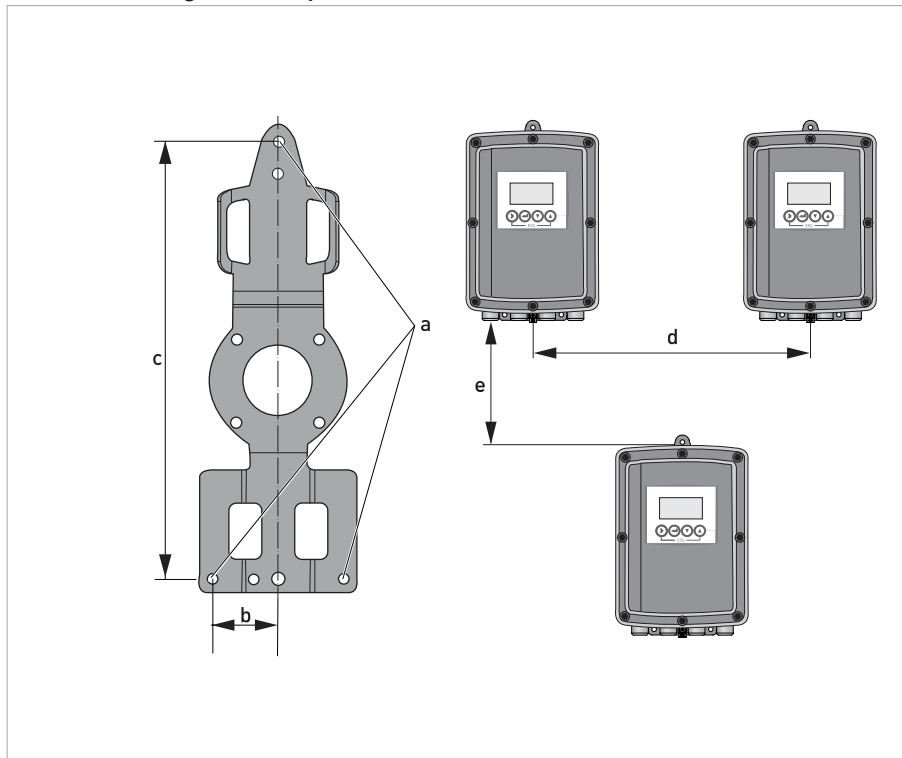


Figure 3-3: Dimensions and distances

	[mm]	[inch]
a	Ø6.5	Ø0.26
b	40	1.6
c	268	10.5
d	336	13.2
e	257	10.1

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!


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 Used abbreviations

Abbreviation	Description
C_p	Control input passive
I_a	Current output active
I_{max}	Maximum current
I_{nom}	Nominal current
R_L	Load resistance
R plus number (e.g. R1)	Relay contact
P	Power
U_{ext}	External voltage source
$U_{ext, max}$	Maximum voltage of the external voltage source
$U_{int, nom}$	Nominal internal voltage
U_{on}	Voltage for triggering the control input (on)
U_{off}	Voltage for triggering the control input (off)

4.3 Important device-specific notes on electrical connection

**DANGER!**

Never install or operate the device in potentially explosive areas, it might cause an explosion that can result in fatal injuries!

**DANGER!**

The device must be grounded in accordance with regulations in order to protect personnel against electric shocks.

**DANGER!**

When installing and wiring the device, note the safety regulations of the current state of the art. Also note the following items to avoid fatal injuries, destruction or damage of the device or measuring errors:

- *De-energise the cables of the power supply before you start any installation works.*
- *Always install input and control cables divided from each other and from high voltage current cables.*
- *Assure that all cables of the inputs and current outputs are shielded. Connect the shieldings only to one side, e.g. to the device.*
- *When using relays, note that with inductive loads the interference must be suppressed.*
- *Assure that all electrical connection works are compliant with the VDE 0100 directive "Regulations for electrical power installations with line voltages up to 1000 V" or equivalent national regulations.*
- *Use suitable cable glands for the various electrical cables and suitable connecting cables for the field of application. The outer diameter of the connecting cables has to fit to the cable glands.*
- *The nominal voltage of the connecting cable has to fit to the operating voltage of the device.*

**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.

4.4 Opening and closing the converter 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.

4.4.1 Die-cast aluminium housing

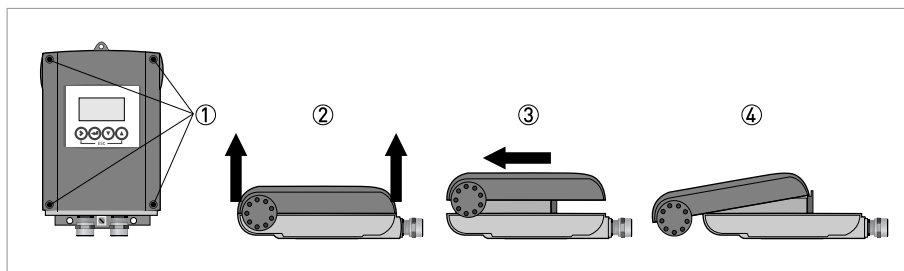


Figure 4-1: Opening the converter housing



- Loose the 4 screws ① with a crosstip screwdriver.
- Lift the housing at the top and bottom at the same time ②.
- Slide the housing cover backward ③.
- ➡ The housing cover is guided and held by the inside hinge; you have access to the terminal compartment now ④.

After completion of work close the converter housing.

4.4.2 Stainless steel converter housing

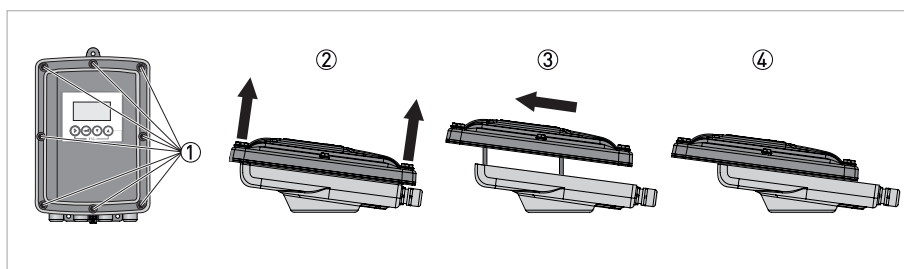


Figure 4-2: Opening the converter housing



- Loose the 8 hexagon screws ① with a 10 mm spanner socket.
- Lift the housing at the top and bottom at the same time ②.
- Slide the housing cover backward ③.
- ➡ The housing cover is guided and held by the inside hinge; you have access to the terminal compartment now ④.

After completion of work close the converter housing. To achieve a proper sealing of the device please tighten the screws in the following order with a torque of 5 Nm.

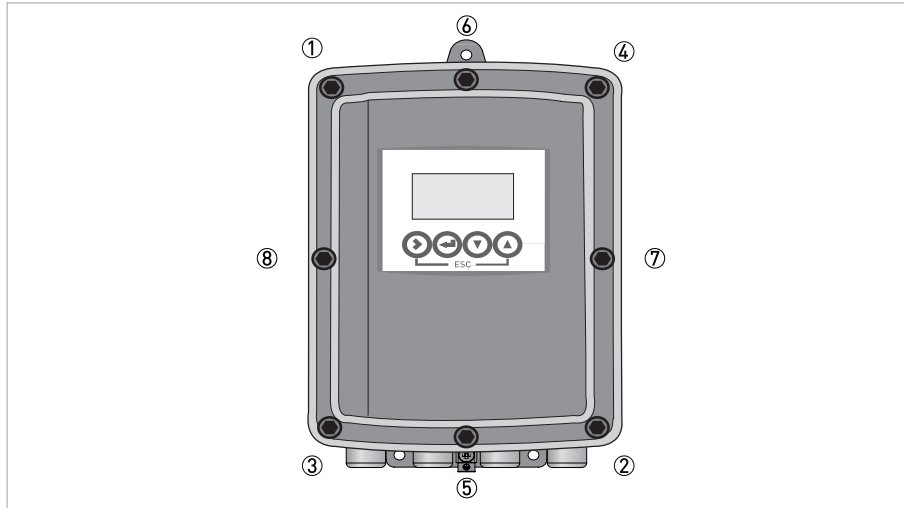
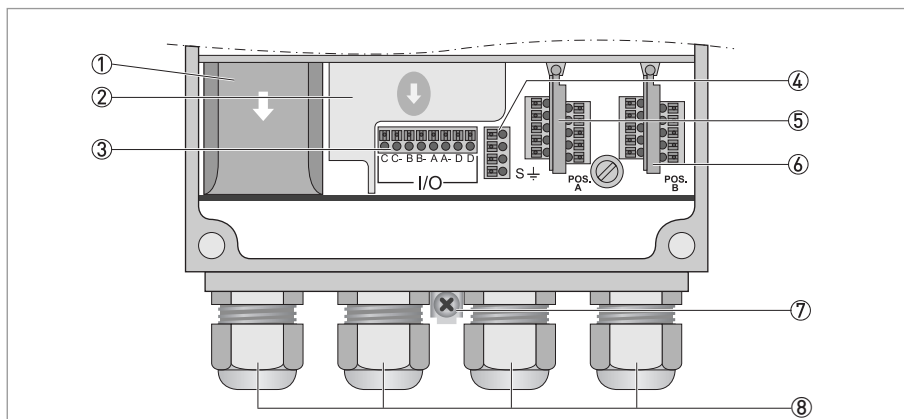


Figure 4-3: Tighten the screws

4.5 Overview of the terminal compartment



- ① Cover of power supply terminal
- ② Cover of relay outputs terminal
- ③ Current output terminal
- ④ Shield terminals
- ⑤ Terminals for sensor input A
- ⑥ Terminals for sensor input B
- ⑦ Possibility to connect a functional earth (only relevant for 24 V version)
- ⑧ Cable glands

4.6 Connecting the signal cables

**INFORMATION!**

The cable glands installed by the manufacturer are designed for a cable diameter of 8 to 13 mm. If you are using cables with a larger diameter, you must replace the manufacturer's cable glands with suitable ones.

For all information concerning the signal cables of the used sensor(s) and their connection refer to the relevant sensor handbook(s).

4.7 Connecting the power supply

**DANGER!**

The device must be grounded in accordance with regulations in order to protect personnel against electric shocks.

**DANGER!**

Never install or operate the device in potentially explosive areas, it might cause an explosion that can result in fatal injuries!

**CAUTION!**

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

- *De-energise the cables of the power supply before you start any installation works!*
- *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.*
- *Assure that there is a fuse protection for the infeed power circuit ($I_{nom} \leq 16\text{ A}$) and a disconnecting device (switch, circuit breaker) to isolate the signal converter.*
- *Check the nameplate and assure that the power supply meets the voltage and frequency of the device. You can operate the device in the range of 100...230 VAC with a tolerance of -15%/+10% while 240 VAC +5% is included in the tolerance range. The 24 VAC/DC version can be operated 24 VDC with a tolerance of -25/+30% or with 24 VAC with a tolerance of +15%/-10%. A power supply outside these specifications may destroy the device!*
- *Assure for 100...230 VAC version that the protective earth conductor (PE) is longer than the L- and N-conductor.*

**INFORMATION!**

The manufacturer has designed all creepage distances and clearances according to VDE 0110 and IEC 60664 for pollution degree 2. The power supply circuits fulfil the overvoltage category III and the output circuits fulfil the overvoltage category II.

Before you start to connect the power supply cables, note the following drawing with the function of the terminals:

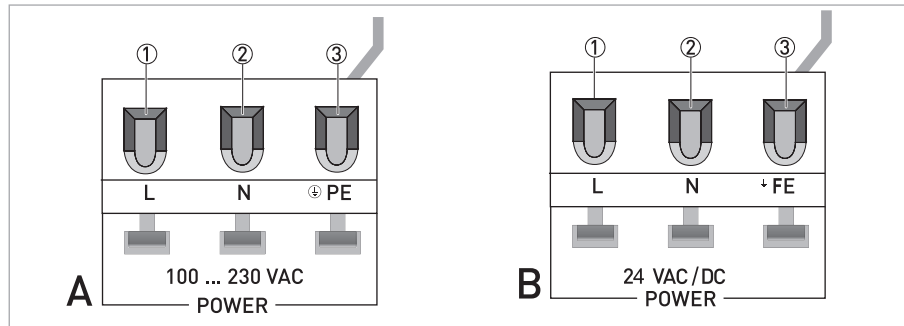


Figure 4-4: **A** - 100...230 VAC / **B**- 24 VAC/DC

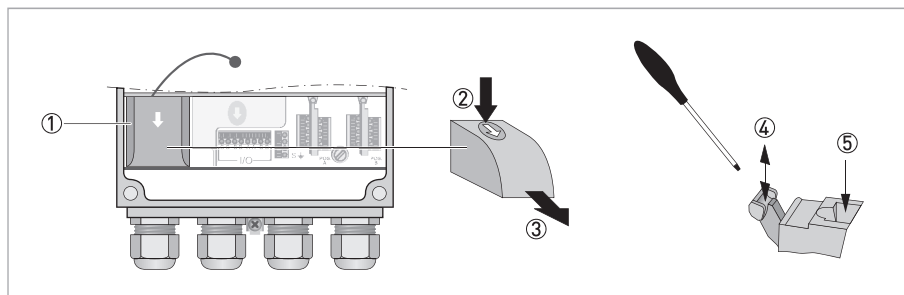
- ① Live (L)
- ② Neutral (N)
- ③ Protective Earth (PE) or Functional Earth (FE)

Afterwards connect the power supply cables accordingly:



CAUTION!

The manufacturer strongly recommends to use a slotted screwdriver with a tip of 3.5 x 0.5 mm / 0.14 x 0.02" to push down the lever! Otherwise you could damage the lever.



- De-energise the power supply cables with the help of a disconnecting device (switch, circuit breaker)!
- Open the converter housing (refer to *Opening and closing the converter housing* on page 22).
- Remove the cover of the power supply terminal ① by pressing it down and pulling forwards at the same time ② and ③, be careful and do not disrupt the retaining band (it prevents the cover from getting lost)!
- Use a slotted screwdriver with a tip of 3.5 x 0.5 mm / 0.14 x 0.02" to push down the lever, connect the wires to the terminals and pull up the levers again ④ and ⑤.
- Refasten the cover of the power supply terminal, close the converter housing and tighten all screws of the housing.

4.8 Description and properties of the outputs and the input

4.8.1 Current output



DANGER!

Never install or operate the device in potentially explosive areas, it might cause an explosion that can result in fatal injuries.



INFORMATION!

For further information refer to the connection diagrams and the technical data table.

- All outputs are electrically isolated from each other and from all other circuits.
- All operating data and functions can be adjusted.
- Output data: measuring results of the sensor inputs A and B inclusive one temperature value.
- Active mode: output range 0(4)...20 mA, load resistance $R_L \leq 550 \Omega$ at $I_{\max} \leq 22 \text{ mA}$, $U_{\text{int, nom}} = 15 \text{ VDC}$.
- Self-monitoring: interruption or load resistance too high in the current output loop.
- Error signalling possible via alarm relays, error indication on LC display.
- Current value error detection can be adjusted.

4.8.2 Relay outputs



DANGER!

Never install or operate the device in potentially explosive areas, it might cause an explosion that can result in fatal injuries.



INFORMATION!

For further information refer to the diagrams on page 29 and on page 30 as well as the technical data table on page 75.

The device has three electro-mechanical relays that can work as alarm relays or limit switches:

- 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).
- Contact ratings:
 - Relays for low voltages: $U \leq 30 \text{ VDC}$, $I \leq 1 \text{ A}$, resistive load (PELV / SELV) or $U \leq 50 \text{ VAC}$, $I \leq 4 \text{ A}$, resistive load (PELV / SELV)
 - Relays for high voltages: $U = 100...230 \text{ VAC}$, $I \leq 4 \text{ A}$, max. 1000 VA resistive load
- The contact circuits have to be either PELV / SELV circuits or hazardous voltage circuits.

4.8.3 Control input (passive)

**CAUTION!**

Pay attention to the maximum voltage and current values which can be applied to the control input! Applying power outside the allowed range can destroy or damage the device!

**INFORMATION!**

The factory default is a disabled control input!

The passive control input can trigger different events in the converter from outside. It is engaged via applying a voltage of $U_{on} > 8$ VDC and disengaged via applying a voltage of $U_{off} < 2.5$ VDC. The properties in detail are the following:

- Passive, not polarity sensitive
- Condition "off": $U_{off} \leq 2.5$ VDC with $I_{nom} = 0.4$ mA
- Condition "on": $U_{on} \geq 8$ VDC with $I_{nom} = 2.8$ mA
- $U_{ext, max} \leq 32$ VDC
- $I_{nom} = 6.5$ mA with $U_{ext} = 24$ VDC
- $I_{nom} = 8.2$ mA with $U_{ext} = 32$ VDC

For instance the control input can work together with a flow monitor that monitors the sample flow and gives a signal if the flow drops below a certain threshold. If in this case the control input has the setting "flow control", it triggers an "F application error" (this error indicates that the application-dependent fault, but device is okay). For more information refer to *Error category "Application error"* ("F", not bold) on page 70.

There are other purposes for the usage of the control input. For detailed information refer to the function C3.5 and especially C3.5.1 in the corresponding function table.

4.9 Connection diagrams of the outputs and the input

4.9.1 Important notes



DANGER!

Never install or operate the device in potentially explosive areas, it might cause an explosion that can result in fatal injuries.



INFORMATION!

- All groups are electrically isolated from each other and from all other input and output circuits.
- Active operating mode: the signal converter supplies the power for operation (activation) of the subsequent devices, observe max. operating data.
- Terminals that are not used must not have any conductive connection to other electrically conductive parts.

4.9.2 Description of electrical symbols

Symbol	Description
	mA meter, 0...20 mA or 4...20 mA and other, R_L is the internal resistance of the measuring point including the cable resistance
	DC voltage source (U_{ext}), external power supply, any connection polarity
	DC voltage source (U_{ext}), observe connection polarity according to connection diagrams
	Internal DC voltage source
	Controlled internal power source in the device
	Button, NO contact or similar

4.9.3 Block diagram

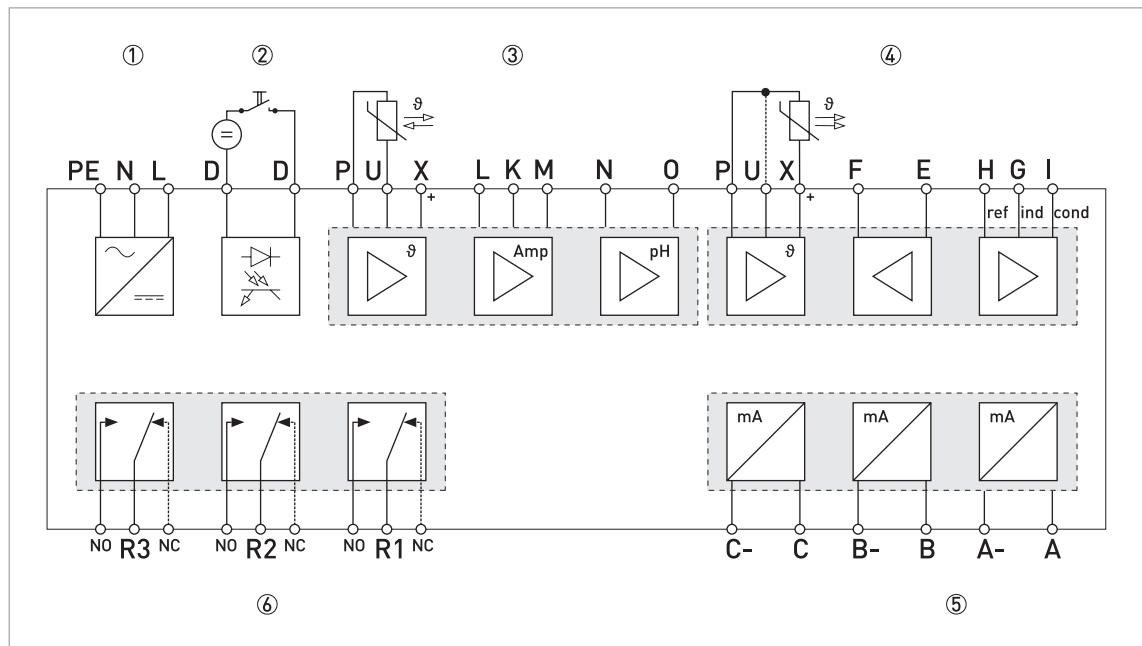


Figure 4-5: Block diagram

- ① Power supply (100...230 VAC or 24 VAC/DC)
- ② Control input (non-polarised), 8...32 VDC
- ③ Sensor input B, refer to sensor handbook (the terminals P, U and X show an example with a NTC resistor)
- ④ Sensor input A, refer to sensor handbook (the terminals P, U and X show an example with a Pt100/1000 resistor)
- ⑤ Current outputs A, B and C
- ⑥ Relay outputs R1, R2 and R3

4.9.4 Current output (active)



CAUTION!

To avoid damage or destruction of the device always note the following items:

- Observe the connection polarity!
- Note the properties of the current output. For further information refer to *Current output* on page 26.

Connection diagram of current output (active)

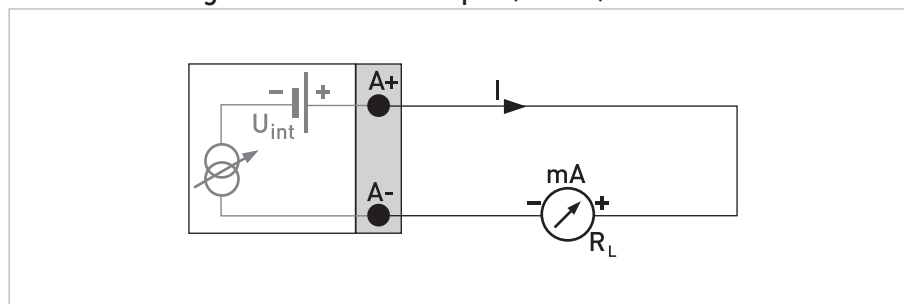


Figure 4-6: Current output (active)

4.9.5 Relay outputs

**CAUTION!**

To avoid damage or destruction of the device always note the properties of the relay outputs, further information on page 26.

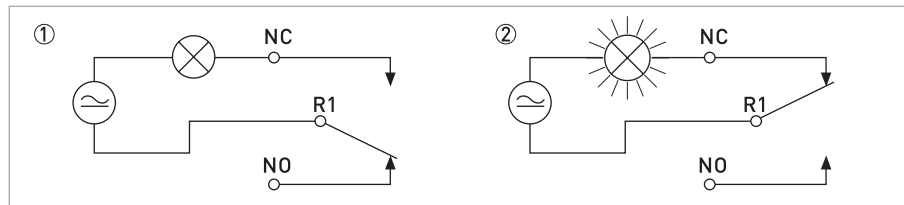


Figure 4-7: Example: different conditions of a relay output

- ① Normal operation: device in operation and no current error message, indicator lamp off, relay contact open.
- ② Alarm condition: error message occurs, indicator lamp on, device de-energised or with malfunction, relay contact closed.

4.9.6 Control input

**CAUTION!**

To avoid damage or destruction of the device always note the properties of the control input, further information on page 27.

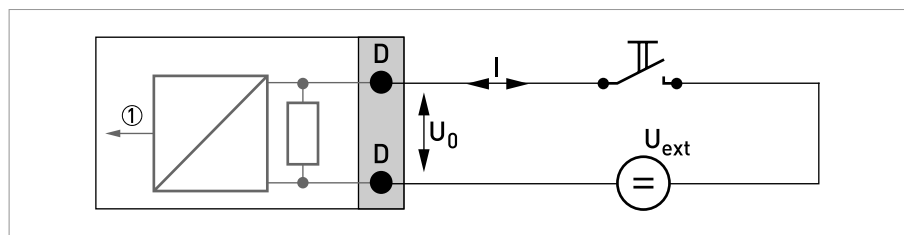


Figure 4-8: Control input

- ① Signal

4.10 Electrical connection of the outputs and the input



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!



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.



- Open the housing cover (refer to *Opening and closing the converter housing* on page 22).
- Push the prepared cables through the cable entries and connect the necessary conductors.
- Connect the shield.
- Tighten the screw connection of the cable entry securely.
- Seal all cable entries that are not needed with a plug.
- Close the housing cover (refer to *Opening and closing the converter housing* on page 22).



INFORMATION!

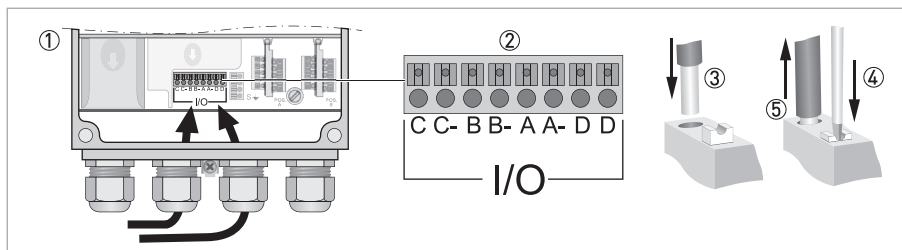
Ensure that the housing gasket is properly fitted, clean and undamaged.

4.10.1 Connecting the current outputs



CAUTION!

Use the correct cable gland. For further information refer to *Device description* on page 12.



- Conduct the cables with prefabricated shielding through the correct cable glands ① and ②.
- Insert the cable into the terminal ③.
- To remove the cable push the lever down with a suitable tool ④ and pull the cable out of the terminal ⑤.

4.10.2 Connecting the relay outputs

**DANGER!**

To avoid dangerous voltages, the switching voltage for the relay contacts must fulfill one of the following conditions: it must either originate from the same network as the signal converter power supply including pre-fuse and separator (see Section 4.6) or come from a SELV or PELV network. When installing, always comply with the prevailing national and international regulations and standards.

**CAUTION!**

If you want to switch inductive loads (even relays or protection coils), you always have to dejam them! Otherwise there may occur interferences with the measuring signal. Also note the following items:

- If you use DC voltage, dejam the relay coil with a free-wheeling diode; refer to the following table and the following drawing "Interference suppression"!
- If dejamming is not possible, you have to assure that the relay contact is protected by a RC protection circuit! Also refer to the following table.
- If you use potential-free relay outputs, assure that a suitable shut-off device and a pre-fuse is installed in the feed line on site.
- When switching inductive loads, the manufacturer recommends a protective circuit to avoid unnecessarily high contact burn on the relay contact!

**INFORMATION!**

In delivery condition, the relay contacts are also suitable for low signal currents (from approx. 1 mA). Please note that the gold plating burns off during the switching operation when larger currents are used (from approx. 100 mA). Afterwards, the relays can no longer reliably switch small currents!

AC voltage: required capacitors and resistances for dejamming

Current up to	Capacitor	Resistor
60 mA	10 nF / 260 V	390 Ω / 2 W
70 mA	47 nF / 260 V	22 Ω / 2 W
150 mA	100 nF / 260 V	47 Ω / 2 W
1.0 A	220 nF / 260 V	47 Ω / 2 W

Interference suppression (A = AC, B = DC)

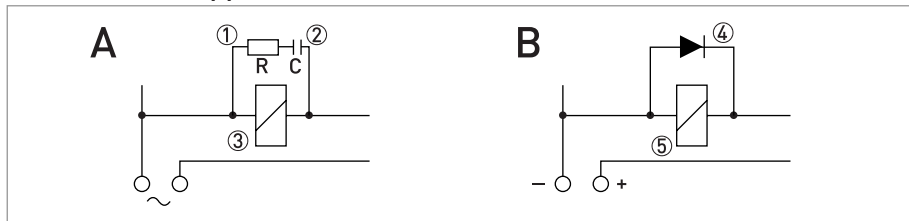


Figure 4-9: Interference suppression

- ① Resistor, $R = 47 \dots 390 \, \Omega$, see table before
- ② Capacitor, $C = 10 \dots 220 \, \text{nF}$, see table before (e.g. Siemens MKC B 81 921)
- ③ Relay coil
- ④ Free-wheeling diode
- ⑤ Relay coil

Required cable properties

- Maximum wire cross section: $1.5 \, \text{mm}^2 / 0.06 \, \text{square inch}$
- Minimum stripping length for wires: $8 \, \text{mm} / 0.31 \, \text{inch}$

Note the following procedure, remove the cover and connect the cables accordingly:

Step 1: removing the cover

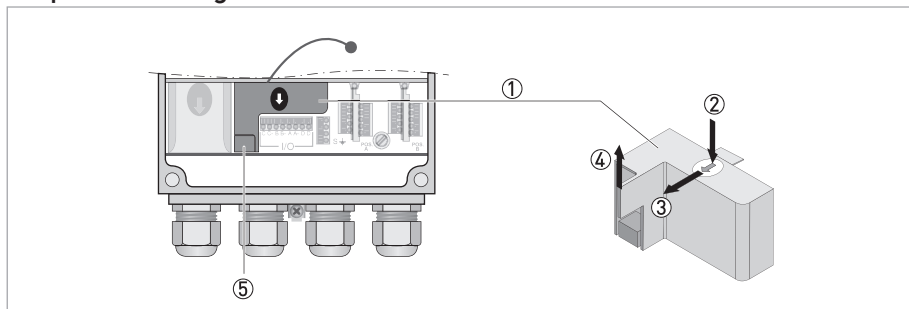


Figure 4-10: Removing the cover

**CAUTION!**

The screw under the cover ⑤ is not to be used as a cable connection. Do not loosen or remove the cover or the screw!



- Start to remove the cover of the relay outputs ① by pressing it down ②.
- Pull the cover forward ③, then upward out of the clip and remove it ② and ④.
- Remove the cover of the earth terminal by pulling it upward ⑤.



You see the 10-pin terminal block which is fitted with a connected bridge.

Step 2: connecting the cables

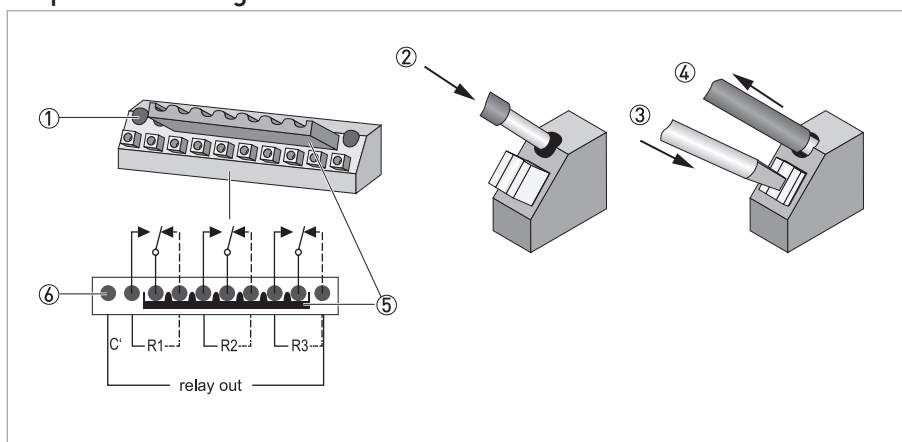


Figure 4-11: Connecting the cables



- Connect the cables to the single relay terminals ① as described in the previous drawing ②, note the required cable properties!
- If you want to release a cable from the relay terminals, first unlock the locking device ③ with a suitable tool and pull out the cable ④.

**INFORMATION!**

If a switching voltage is applied to connection "C" ⑥ in the previous drawing, relay contacts R1, R2 and R3 are supplied in parallel with the help of the link plug ⑤. This allows the voltage switched from the relays to be passed on. You can remove the bridge if this supply is not needed.



- After you have connected all cables, refasten the cover of the relay outputs.
- Close the converter housing and tighten all screws of the housing. (For further information refer to *Opening and closing the converter housing* on page 22).

5.1 Switching on the power

**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!**

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!**

The manufacturer delivers the device preconfigured and ready for operation with the sensor specified in the customer's order. Though due to the physics of the measurement, the operator has to perform an onsite calibration or an adjustment to the relevant sensor and to the environmental conditions at the initial start-up. For more details refer to the manual of the relevant sensor!



- Switch on the power with the help of a disconnecting device (switch, circuit breaker).
- The device performs a self test; afterwards it begins to measure immediately if a sensor is connected and the display shows the current value(s).

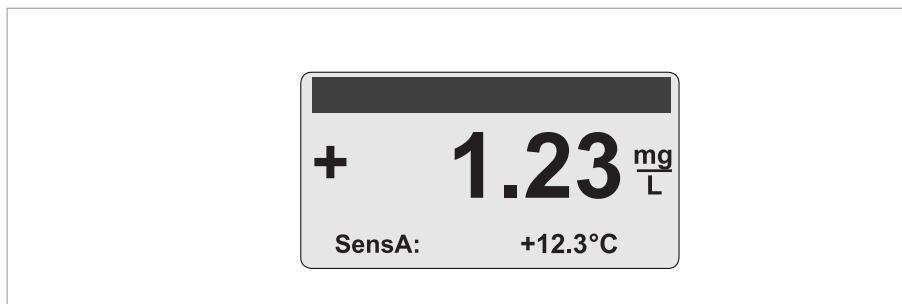


Figure 5-1: Example: current value (1 channel device)

The previous drawing shows the measured value of sensor input A in the upper line and the temperature reading in the lower line.

**INFORMATION!**

Note that the display can only show a temperature reading if a temperature sensor is attached! If this is not the case, the maximum or minimum range of the measuring range appears in the last line.

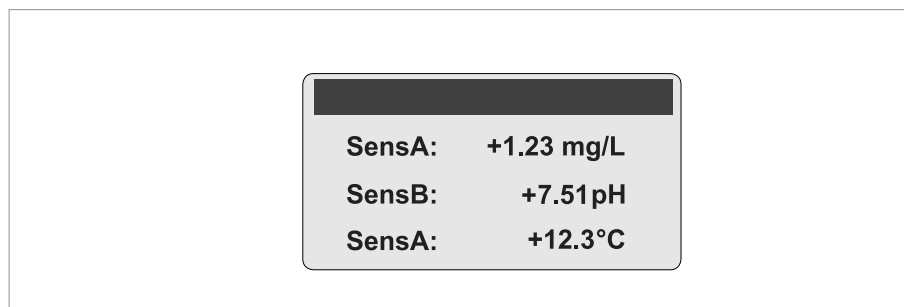


Figure 5-2: Example: current value (2 channel device)

6.1 Operating elements

The operation elements consist of the four operation keys below the display. In the texts of this documentation each operation key has a specific symbol:

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		
		Main menu level	Sub-menu or function level	Parameter and data level
➤	Switch from measuring mode to menu mode; press key for 2.5 seconds (display shows "keep key pressed" and countdown) and release it after further 2.5 seconds (display shows "release key now" and countdown)	Access to displayed menu, then 1st submenu is displayed	Access to displayed sub-menu or function	Numerical values: move cursor one position to the right
➤	Reset of the display controller ①	Return to measuring mode (prompt appears whether the data should be saved)	Return to next higher level or sublevel, data are saved	Return to sub-menu or function, data are saved
↑ or ↓	Switch between measuring pages	Select menu, moving up or down	Select sub-menu or function, moving up or down	Change parameter/data marked by the cursor, move the decimal point
Esc: ➤ + ↑	No function	No function	Return to main menu level, data not saved	Return to next higher level, data not saved

① This function allows checks with respect to custody transfer; it can be used in few situations, e.g. if the display is disturbed.

**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! For calibration of oxygen this function is disabled.

6.2 Measuring mode

The measuring mode consists of four different measuring pages. You can scroll through them and choose the desired one by pressing the keys ↑ or ↓.

**INFORMATION!**

- The following sections show the measuring pages in the default status. You can change their appearance in the menu mode.
- After starting-up the device always shows the first measuring page. If you choose another measuring page with the help of ↑ or ↓, the display shows this page continuously. All measuring page can be configured individually in the menu C5.3 and C5.4.
- The converter is not able to detect the exhaustion of the connected electrodes!

6.2.1 First measuring page

After switching on the power, the display always shows the first measuring page. In the default status there is no difference between the first measuring page of the one channel version and the two channel version. Right beside all measuring results you see the corresponding unit at the end of the line. Only if there is no unit available it is left out (this is only the case with the diagnosis values).

**INFORMATION!**

Diagnosis values are all values which do not belong to the measured values of the sensor inputs A and B (e.g. error messages). Also note the following items:

- If there is enough space and the type of measuring result is not clear when looking at the figure(s) and unit, there is also a short description (in the following named "label") at the beginning of the lines.
- The labels can appear on the first measuring page as well on the second measuring page.

Possible labels

Label	Description
Sens A:	Measured value of process input A
Sens B:	Measured value of process input B
off	Indicating that a value is currently not available

The following drawing shows an example of the first measuring page in the default setting:

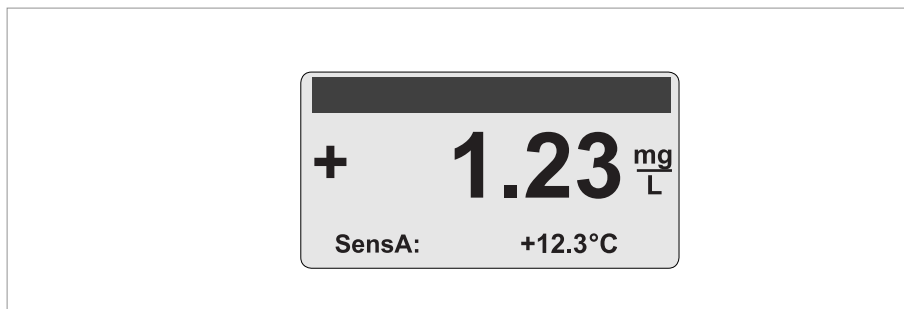


Figure 6-1: Example of first measuring page

Pressing ↑ will bring you to the second measuring page. Pressing ↓ will bring you to the trend diagram.

6.2.2 Second measuring page

The second measuring page is the only one with a different appearance in the default status depending on the device version:

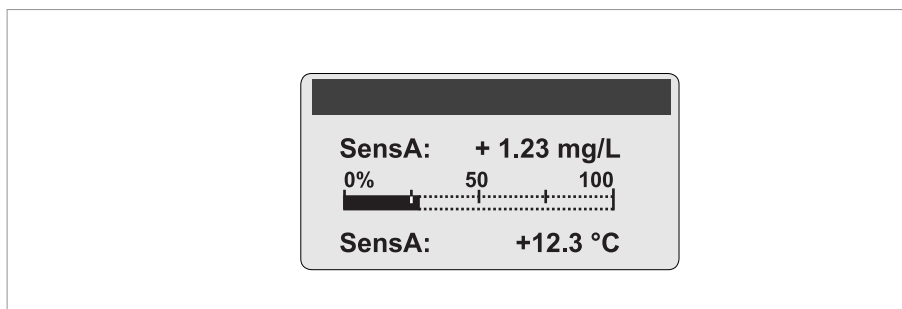


Figure 6-2: Version with 1 channel



INFORMATION!

The bargraph in the middle line of the previous display shows the complete measuring range as percent designation (on the left side the minimum, on the right side the maximum). The bar indicates the current status.

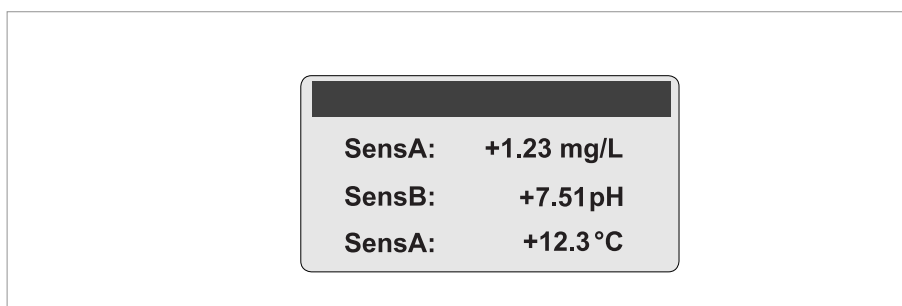


Figure 6-3: Version with 2 channels

Pressing ↑ will bring you to the status page. Pressing ↓ will bring you to the first measuring page.

6.2.3 Status page

The software groups all status messages in a predefined order of importance. The following drawing shows an example of a display with different status messages:

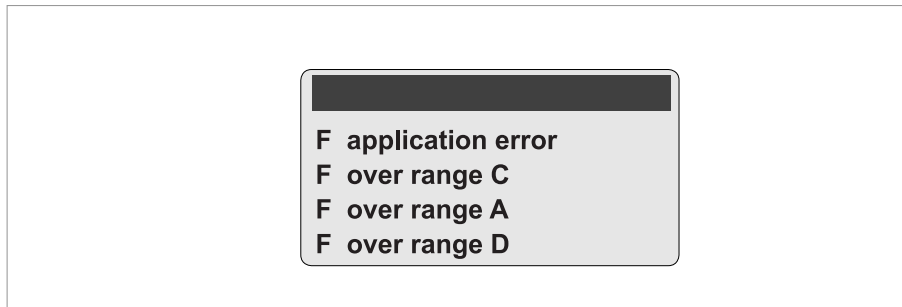


Figure 6-4: Status page

In front of each message there is a letter indicating the category of a message. Furthermore there is a message explaining the error category in front of each group of messages (in the previous drawing this is the message "application error"). The following table lists all categories and represents their defined order of importance.

Letter	Category	Consequence	Example
F	Error in device	A measurement is not possible. Note: the " F " is bold to make a difference from the normal "F" for all application errors!	One CPU is not present.
F	Application error	Some or all measured values are not reliable.	Over range, value constant because of limitation.
S	Out of specification	A measurement is possible but with uncertain accuracy!	Too high conductivity (i.e. the conductivity in the medium exceed the measurement range to produce a reliable signal).
C	Check in progress	A test function is active, the displayed value is not the true value!	Manual hold function is active (i.e. all outputs are frozen).
I	Information	Informational character, no direct impact on the measuring results.	Control input active.

Also regard the following characteristics of the status messages:

- Each status message must not exceed one line; a single screen can contain up to four messages.
- If there are more messages present, the other messages appear on separate and alternating screens.
- The total number of displayed messages is limited to 16; the current software contains more than 70 status messages.
- You can reset all error messages with the help of the submenu "A5 reset errors" within the main menu "A quick setup" If the error appears again, the problem is not solved and has to be checked again.

For further information about the status messages refer to *Status messages and diagnostic information* on page 67. Pressing ↑ will bring you to the trend diagram. Pressing ↓ will bring you to the second measuring page.

6.2.4 Trend diagram

This screen shows the first value of the first measuring page as a trend plot.

The scale of the Y-axis is in percent units related to the limits selected for first value of the first measuring page. The range of the Y-axis can be fixed or automatic (see function table of C5.5).

The X-axis represents the time. You can select the range which appears in the lower right corner of the screen. Every dot on the screen is an average over the corresponding time. The following drawing is an example of the trend diagram:

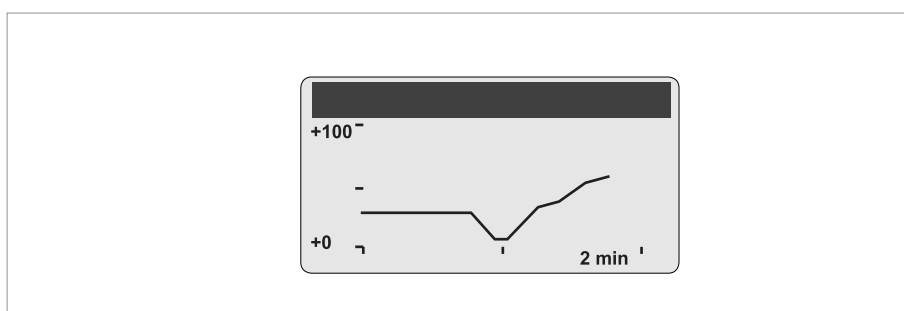


Figure 6-5: Trend diagram



INFORMATION!

Be aware that just the curve is stored, you have no further access to the values. All values beyond the time limit are deleted. Furthermore the trend diagram is deleted after any warm start (e.g. by changing a parameter).

Pressing ↑ will bring you to the first measuring page. Pressing ↓ will bring you to the status page.

6.3 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 level
- First and second sub-menu level
- Parameter level

6.3.1 Navigating through the menus

To switch from the measuring mode to the menu mode you have to execute the following steps:



- Press > for at least 2.5 seconds (meanwhile the display shows the text "keep key pressed" and a time counting back).
- After 2.5 seconds release the pressed key (you have to do this within the next 2.5 seconds during which the display shows the text "release key now" and a time counting back).
- ➡ You are in the main menu level of the menu mode. The display always looks as follows:

Display in main menu level

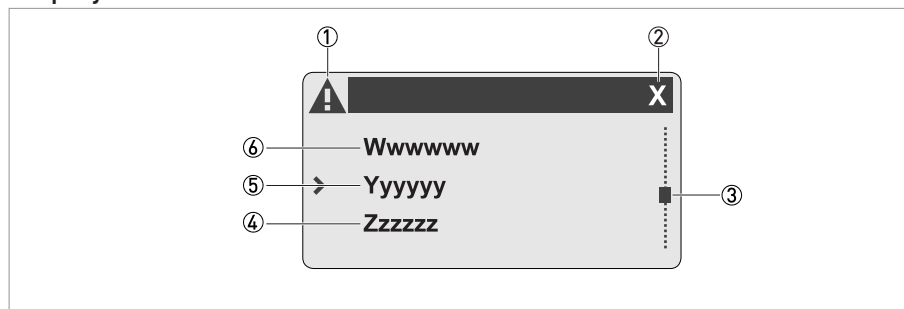


Figure 6-6: Example for selection in main menu level

- ① Indicates a possible status message in the status list (only if there are one or more messages)
- ② Menu code of selected menu item (see table of menu structure or function tables)
- ③ Indicates position within the current item list
- ④ Next menu item, reachable by pressing ↓ (if "- -" in this line indicates, this signals the end of the list)
- ⑤ Selected menu item in bold characters
- ⑥ Previous menu item, reachable by pressing ↑ (if "- -" in this line indicates, this signals the beginning of the list)

The main menu mode consists of the main menus "quick setup", "test", "setup" and "service". You can either leave the main menu level and return to the measuring mode or choose and enter a main menu:



- Press <↵ to return to the measuring mode (in this case a prompt appears and asks if you want to save the changed data; choose "Yes" or "No" with the help of ↓ or ↑ and confirm by pressing <↵).
- If you do not want to leave the main menu level, press > to enter the first main menu ("quick setup") or choose another main menu with the help of ↑ or ↓ and enter it by pressing >.
- ➡ You are in the submenu level. The display always looks like the drawing on the following page.

Display in submenu level

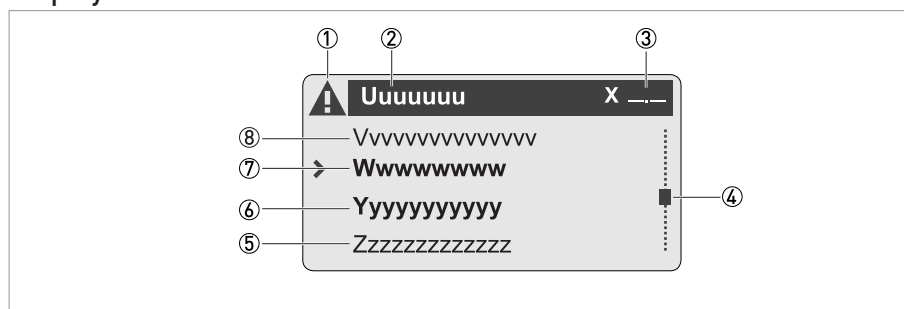


Figure 6-7: Example for selection in submenu menu level

- ① Indicates a possible status message in the status list (only if there are one or more messages)
- ② Superior main menu
- ③ Menu code of selected menu item (see table of menu structure or function tables); up to two figures can appear right beside the character indicating the main menu (one if you are on the first submenu level and two on the second submenu level)
- ④ Indicates position within the current item list
- ⑤ Next menu item, reachable by pressing ↓ (if " - - " in this line indicates, this signalises the beginning of the list)
- ⑥ Selected menu item, in bold characters
- ⑦ Currently setting of the chosen menu item in bold character
- ⑧ Previous menu item, reachable by pressing ↑ (if " - - " in this line indicates, this signalises the end of the list)

The submenu level consists of the first and second submenu level. The principle of choosing a menu item is always the same:



- Press > to enter the first menu item or choose another menu item with the help of ↑ or ↓ and enter it by pressing >.
- ➡ You navigate through the tree structure of the submenu level, finally you always reach the parameter or data level.
- If you want to return to the main menu level without saving the input, press > and ↑ at the same time.
- If you want to return to the main menu level and save your input, press ↵ one or more times depending on the level you are (pressing ↵ results in moving one level upwards until you reach the main menu level).

**INFORMATION!**

Like the lowest menu level (i.e. the parameter or data level) some submenus also offer the possibility to make adjustments. The procedure is similar to the procedure on the parameter level, see next page.

On the parameter level you see a list with one or more parameters or data. You can scroll through this list using ↑ or ↓:



INFORMATION!

In this list all parameters or data which have been changed (i.e. they deviate from the default setting) have a hook at the right end of their line (see position number ④ in the following drawing).

Display with list of parameters or data

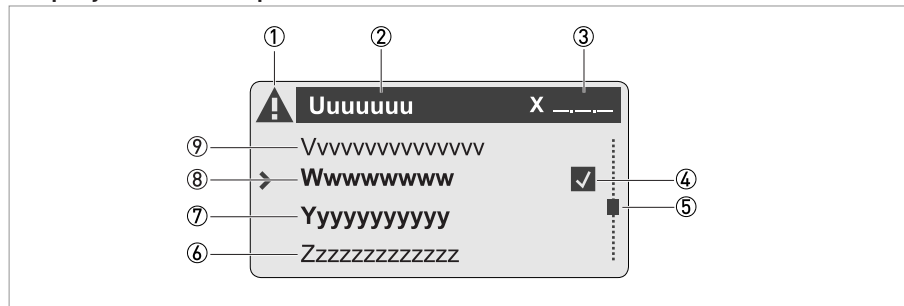


Figure 6-8: Example of a list with parameters and data

- ① Indicates a possible status message in the status list (only if there are one or more messages)
- ② Superior submenu or subsequent submenu
- ③ Menu code of selected parameter (see table of menu structure or function tables)
- ④ Denotes the change of a parameter (this marking allows to simply and quickly identify all data which differ from the default setting when browsing through the list); instead of the check mark there can also appear a lock symbol at this position, it indicates a parameter that cannot be changed because of the parameter lock on the front.
- ⑤ Indicates position within the current item list
- ⑥ Next menu item, reachable by pressing ↓ (if "- -" in this line indicates, this signals the beginning of the list)
- ⑦ Currently setting of the chosen menu item, also in bold character
- ⑧ Selected menu item, in bold characters
- ⑨ Previous menu item, reachable by pressing ↑ (if "- -" in this line indicates, this signals the end of the list)

On the parameter or data level you have the possibility to change the decimal point, numbers, units or settings. Before that you have to choose the desired parameter or data and open to edit it:



- Press > to open and edit the first list item or choose another item with the help of ↑ or ↓ and press >.
- ➔ You are in the parameter edit mode now. All changeable values are highlighted and shown reverse (if nothing is shown reverse, you are in the read-only view and you cannot change the setting).
- Use ↑ or ↓ to change the highlighted area; if there are numerical values or a decimal point to be changed, you can move the cursor with > to the desired position and change its value with the help of ↑ or ↓.
- If you want to return to the parameter or data list and save your input, press ↵; afterward you can press ↵ one or more times to return to the main menu.
- If you want to return to the next higher level without saving the input, press > and ↑ to the same time.

Display with parameter or data ready to edit

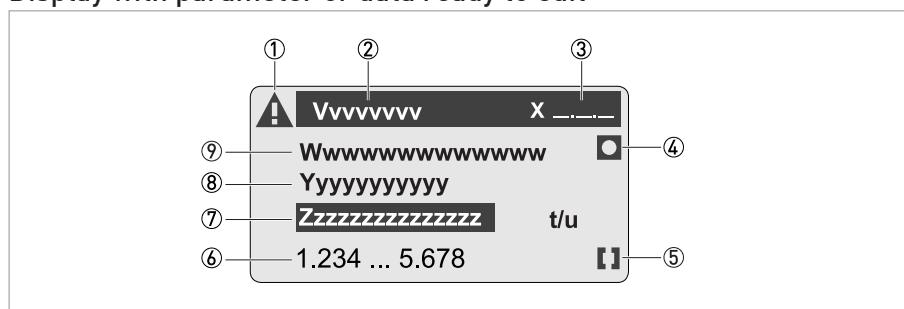


Figure 6-9: Example of parameter or data ready to edit

- ① Indicates a possible status message in the status list (only if there are one or more messages)
- ② Superior submenu or subsequent submenu
- ③ Menu code of selected parameter (see table of menu structure or function tables)
- ④ Symbol denotes that there is a factory setting
- ⑤ Symbol denotes that there is a permissible value range
- ⑥ Permissible value range (for numerical values)
- ⑦ Currently set value, unit or function that you can change (always appears with highlighted background)
- ⑧ Current selected parameter
- ⑨ Factory setting of parameter (non-alterable)

Some parameters allow to select and move the decimal point. If you do so and the point reaches the right (left) end of the related number, further pressing the key $\uparrow$ ($\downarrow$) changes the format to exponential. In the following example the exponential syntax means 54000×10^3 , where the 10 is suppressed to save space. The exponent is increased (decreased) by a factor of three every time you press the key $\uparrow$ ($\downarrow$). The change of the exponent to zero resets the exponential syntax to the normal presentation.

Decimal point and exponential format in the parameter edit mode

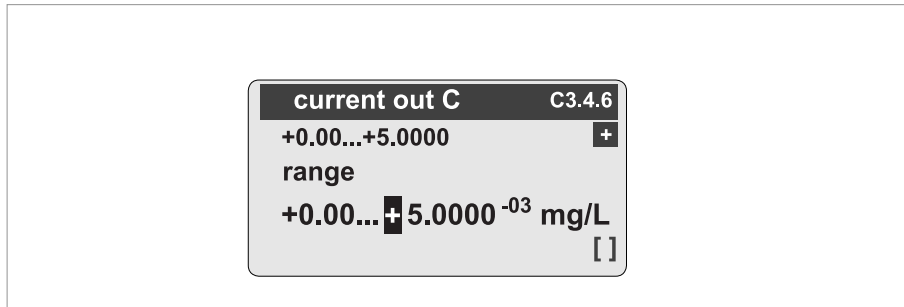


Figure 6-10: Example of parameter edit mode

6.3.2 Menu "quick setup"

The menu structure consists of four main menus. The first one is the main menu "quick setup", which groups the most important functions of the other main menus. In this way you have the possibility to configure the signal converter quickly.

6.4 Menu mode structure



INFORMATION!

The following table just presents an overview. When programming the device, always consult the function tables additionally as they contain further information!

Measuring mode	Main menu		Submenu			Parameter		
3 or 4 pages, scrolling with ↓ or ↑	> 2.5 s ↩	A quick setup	> ↩	A1 language		> ↩	For further information see function tables.	
				A2 Tag				
				A3 manual hold				
				A4 set clock				
				A5 reset errors				
				A6 analog outputs	> ↩			A6.1 measurement
								A6.2 unit
								A6.3 range
								A6.4 time constant
				A9...A11: calibration menus for process input A; existence of the single sub-menus depends on the hardware setting and the used sensor (e.g. if you use a pH sensor then only the menu A8 with the name "pH cal." appears); refer to sensor manual for further information.				
A12...A16: calibration sub-menus for process input B, existence also depending on the hardware setting and the used sensor.								
	↕		↕		↕			
> 2.5 s ↩	B test	> ↩	B1 Simulation Process Input A	> ↩	B1.1...B1.7: simulation menus for process input A; existence of the single sub-menus depends on the hardware setting and the used sensor, refer to sensor manual for further information.	> ↩	For further information see function tables.	
					B2.1...B2.7: simulation menus for process input B; existence of the single sub-menus depends on the hardware setting and the used sensor, refer to sensor manual for further information.			
			B2 Simulation Process Input B					
	↕		↕		↕		↕	

Measuring mode	Main menu	Submenu			Parameter
3 or 4 pages, scrolling with ↓ or ↑	> 2.5 s ←	B test	> ←	B3 simulation IO	> ← For further information see function tables.
				B3.1 - / current output A	
				B3.2 - / current output B	
				B3.3 - / current output C	
				B3.4 - / control input D	
				B3.5 - / status output R1 or limit switch R1	
				B3.6 - / status output R2 or limit switch R2	
				B3.7 - / status output R3 or limit switch R3	
				B4 actual values	
				B4.1...B4.8: menus which show the corresponding actual reading; existence of the single sub-menus depends on the hardware setting and the used sensor; refer to sensor manual for further information.	
				B5 logbooks	
				B5.1 status log	
				B5.2 calibration log	
				B6 information	
				B6.1 C number	
				B6.2 process input A	
				B6.3 process input B	
				B6.4 SW.REV. MS	
				B6.5 SW.REV. UIS	
				B6 Electronic Revision ER	
	↓↑		↓↑	↓↑	↓↑
> 2.5 s ←	C setup	> ←	C1 process input A	C1.1...C1.18: menus for the setup of the corresponding process input; existence of the single sub-menus depends on the hardware setting and the used sensor; refer to sensor manual for further information.	> ←
			C2 process input B	C2.1...C2.17: menus for the setup of the corresponding process input; existence of the single sub-menus depends on the hardware setting and the used sensor; refer to sensor manual for further information.	
	↓↑		↓↑	↓↑	↓↑

Measuring mode	Main menu		Submenu				Parameter	
3 or 4 pages, scrolling with ↓ or ↑	> 2.5 s ↵	C setup	> C3 I/O ↵	> ↵	C3.1 hardware	> ↵	For further information see function tables.	
				C3.2 current output A				
				C3.3 current output B				
				C3.4 current output C				
				C3.5 control input D				
				C3.6 status output R1 or limit switch R1				
				C3.7 status output R2 or limit switch R2				
				C3.8 status output R3 or limit switch R3				
			C5 device	> ↵	C5.1 device info			
				C5.2 display				
				C5.3 1.meas.page				
				C5.4 2.meas.page				
				C5.5 graphic page				
				C5.6 special functions				
				C5.7 units				
		↓↑			↓↑	↓↑		
D service: This menu is password protected and contains functions to be used by service personnel only.								

6.5 Function tables

6.5.1 Menu A, quick setup

**INFORMATION!**

Note that the appearance of some sub-menus depends on the hardware setting and the used sensor(s). E.g. if you use a pH sensor then only the menu A8 with the name "process input A pH calibration" appears.

A1, language

Language selection (depends on the region for which the converter has been ordered). Available languages: German, English, French, Spanish

A2, tag

Measuring point identifier (Tag no.), helps to identify the device in a plant, appears in the LC display header in the normal measuring mode (up to 8 digits).

A3, manual hold

Manual shift into the simulation mode for maintenance; device aborts measuring and holds all analog measurements from the process inputs. Options: On (enter the simulation mode) / Off (enter the normal measuring mode again.)

A4, set clock

Manual setting of date and time.

A5, reset errors

This functions allows to reset all errors that are not reset automatically (e.g. power fail or counter overflow). You can answer the question "reset?" with the following options: no (exit without reset) / yes (reset and exit the function).

A6, analog outputs

Level	Designation / function	Settings / descriptions
Depending on the hardware setting this menu is applicable to the current outputs A/B/C, the limit switches R1/R2/R3 and the first line of the first measuring page.		
A6.1	measurement	Value used for driving the current output C. You can answer the question "use all outputs?" with the following options: no (exits the function using the value only of current output C) / yes (exits the function copying the value to all analog outputs).
A6.2	unit	Unit for the current output range, the class of the unit depends on the measurement used at this current output (for further information refer to function C5.7 "Units").
A6.3	range	Range of the main current output C of the device. You can answer the question "use at all output?" with the following options: no (exits the function using the value only of current output C) / yes (exits the function copying the value to all analog outputs).
A6.4	time constant	Time constant of the current output C

A7...A16

The existence of the single menus depends on the hardware setting and the used sensor; refer to sensor manual for further information.

6.5.2 Menu B, test



INFORMATION!

Note that the appearance of some sub-menus depends on the hardware setting and the used sensor(s). E.g. if you use a single pH sensor then only the sub-menu B1 "Simulation Process Input A" appears and B2 "Simulation Process Input B" does not appear. Within the sub-menu B1 you would find the sub-menu B1.7 "pH".

B1, Simulation Process Input A

This menu groups several functions to simulate the measuring values of the corresponding process input; the existence of the single sub-menus depends on the hardware setting and the used sensor, refer to sensor manual for further information. The procedure to start the simulation process is the same for all functions, refer to *Simulation of measured values* on page 61.

B2, Simulation Process Input B

This menu groups several functions to simulate the measuring values of the corresponding process input; the existence of the single sub-menus depends on the hardware setting and the used sensor, refer to sensor manual for further information. The procedure to start the simulation process is the same for all functions, refer to *Simulation of measured values* on page 61.

B3, Simulation I/O

Level	Designation / function	Settings / descriptions
This menu groups several functions to simulate the input and output values. The procedure to start the simulation process is the same for all function, refer to <i>Simulation of measured values</i> on page 61.		
B3.1	- / current output A	Allows simulation of the corresponding output value.
B3.2	- / current output B	
B3.3	- / current output C	
B3.4	- / control input D	Allows simulation of the input value.
B3.5	- / status output R1 or limit switch R1	Allows simulation of the corresponding frequency output, status output or limit switch.
B3.6	- / status output R2 or limit switch R2	
B3.7	- / status output R3 or limit switch R3	

B4, actual values

This menu groups several functions which allow to display the corresponding actual reading; the existence of the single sub-menus depends on the hardware setting and the used sensor, refer to sensor manual for further information.

B5, logbooks

Level	Designation / function	Settings / descriptions
B5.1	status log	Contains the latest changes of the device status; for further information refer to <i>Status log and calibration log</i> on page 62.
B5.2	calibration log	Contains the results of the latest calibrations; for further information refer to <i>Status log and calibration log</i> on page 62.

B6, information

Level	Designation / function	Settings / descriptions
This menu groups several other menus which contain device specific information. The build-up of the display is the same for all menus: • 1st line: ID No. of the circuit board • 2nd line: software version • 3rd line: production date		
B6.1	C number	Identifies the type of electronics, is also located on the converter nameplate.
B6.2	process input A	Gives information about the electrical part of process input A.
B6.3	process input B	Gives information about the electrical part of process input B.
B6.4	SW.REV.MS	Gives information about the main software of the electronics.
B6.5	SW.REV.UIS	Gives information about the user interface of the device.
B6.6	Electronic Revision ER	Reference identification number, electronic revision and production date of the device; includes all hardware and software changes.

6.5.3 Menu C, setup


INFORMATION!

The converter has two process inputs, input A and input B. Each process input has an own submenu in this main menu. Process input A is always present, i.e. there is always a board in the interface "Pos. A" in the connection area. The interface of process input B only has a board with the two channel converter. Be aware that the definition which kind of measurement a process input can do is defined when ordering the device. The configuration cannot be changed later.


INFORMATION!

Note that the appearance of some sub-menus depends on the hardware setting and the used sensor(s).

C1, process input A

The structure of this menu within your device depends on the hardware setting and the kind of sensor connected to the process input. Refer to the sensor manual for further information!

C2, process input B

The structure of this menu within your device depends on the hardware setting and the kind of sensor connected to the process input. Refer to the sensor manual for further information!

C3, I/O (Inputs/outputs)

Level	Designation / function	Settings / descriptions
This menu groups all I/O functions together.		
C3.1	hardware	This sub-menu allows to select different settings of the output terminals. The menus for the different terminals are identical, if they have the same function (e.g. the menus of all status outputs are identical). Note that a change of the configuration is completely available after restart of the device (leave the menu accepting the changes)! The menu structure of the changed output will be immediately available after the change. Parameters can be set immediately as well, but simulations and test functions will be functional after restart.
C3.1.1	terminals A	Setting for current output A, B or C. Options: current output (current output active) / off (no function at terminals).
C3.1.2	terminals B	
C3.1.3	terminals C	
C3.1.4	terminals D	Setting for control input. Options: control input (control input active) / off (no function at terminals).
C3.1.5	terminals R1	Setting for status output or limit switch (R1, R2 or R3, if existent). Options: - status output: status output active - limit switch: limit switch active - off: no function at terminals
C3.1.6	terminals R2	
C3.1.7	terminals R3	
C3.2	current output A	Fine adjustment of the corresponding current output.
C3.2.1	range 0%...100%	Current range for the selected measurement (0...100%). Range: 0.00...20 mA (condition: 0 mA ≤ 1st value ≤ 2nd value ≤ 21.5 mA)
C3.2.2	extended range	Defines the min. and max. limits (the limits defined in the previous function are exceeded linearly up to these values). Range: 3.5...21.5 mA (condition: 3.5 mA ≤ 1st value ≤ 2nd value ≤ 22 mA)

Level	Designation / function	Settings / descriptions
C3.2.3	error current	This function allows to define the current which indicates the error condition, for further information refer to <i>Error current of current output</i> on page 63. Range: 3...22 mA (condition: outside of extended range)
C3.2.4	error condition	This function allows to define which error categories will be indicated (for further information refer to <i>Status messages and diagnostic information</i> on page 67). Options: - error in device: only errors of category F - application error: errors of categories F and F - out of specification: errors of categories F, F and S
C3.2.5	measurement	This function allows to define the value which activates the output. The available options depend on the hardware setting and the kind of the sensor used, refer to the sensor manual for further information.
C3.2.6	range	Range for the measurement (0...100%) which has been set in the previous function: 0...xx.xx _ _ _ (format and unit depend on the measurement, see above).
C3.2.7	limitation	Limitation before applying the time constant. Range: -150...+150%
C3.2.8	time constant	Range: 000.1... 100 seconds
C3.2.9	information	Contains serial number, software version number and production date of the circuit board.
C3.2.10	simulation	This function allows to simulate the output values for the corresponding current output. For further information refer to <i>Menu B, test</i> on page 53 and refer to <i>Simulation of measured values</i> on page 61.
C3.3	current output B	Refer to submenus of current output A (all submenus and options are identical, except that they start with C3.3).
C3.4	current output C	Refer to submenus of current output A (all submenus and options are identical, except that they start with C3.4).
C3.5	control input	Fine adjustment of the control input.
C3.5.1	mode	This function allows to define the function of the control input. Note that the actual selection list may be reduced according to the available functions. Options: - off: control input is disabled. - hold all outputs: all outputs are fixed to the current value; a message of the category "C" is generated when active, this does not include the display. - all outputs to zero: all outputs excluding display are set to 0%. - flow control (only for pH/ORP, conductivity, free chlorine, chlorine dioxide and ozone sensors): process inputs monitor control input; error level is set to "application error" if control input is set, note that ASR is disabled in this case! - cleaning (only for OPTISYS CL 1100): cleaning procedure starts.
C3.5.2	invert signal	This function allows to define how the control input is activated. Options: off (control input is activated when a current is applied at the input, i.e. by voltage to passive inputs or low resistor to active input) / on (control input is activated when no current is applied at the input, i.e. low voltage to passive inputs or high resistor to active inputs).
C3.5.3	information	Contains serial number, software version number and production date of the circuit board.

Level	Designation / function	Settings / descriptions
C3.5.4	simulation	This function allows to simulate input values for the control input. For further information refer to <i>Menu B, test</i> on page 53 and refer to <i>Simulation of measured values</i> on page 61.
C3.6	status output R1 or limit switch R1	Fine adjustment of the corresponding status output or limit switch; the function of the following sub-menus depend on the hardware setting.
C3.6.1	"mode" (status output) or "measurement" (limit switch)	Status output: this function allows to select the mode; note that the following option list can be reduced depending on the available functions; for further information about the messages refer to <i>Status messages and diagnostic information</i> on page 67). Options: • application error: output is activated if the errors "F error in device" or "F application error" emerge • out of specification: output is activated if the errors "F error in device" or "F application error" emerge, it is also activated if a warning of the category "out of specification" is present • control input: signal from control input is forwarded to the status output • off: status output deactivated • error in device: output is activated if the error "F error in device" emerges Limit switch: this function allows to define the value which activates the limit switch. The available options depend on the hardware setting and the kind of the sensor used, refer to the sensor manual for further information.
C3.6.2	"invert signal" (status output) or "threshold" (limit switch)	Status output: this function allows to define how the status output is activated. Options: off (activated status output generates a high current) / on (activated output generates a low current). Limit switch: this function allows to define the switching level. The first value defines the level, the second level defines a hysteresis.
C3.6.3	"information" (status output) or "time constant" (limit switch)	Status output: contains serial number, software version number and production date of the circuit board. Limit switch: filter for limit switch.
C3.6.4	"simulation" (status output) or "invert signal" (limit switch)	This function allows to simulate the status of the corresponding status input. For further information refer to <i>Menu B, test</i> on page 53 and refer to <i>Simulation of measured values</i> on page 61. Limit switch: this function allows to define how the limit switch is activated. Options: off (exceeded limit generates a high current at the output) / on (exceeded limit generates a low current at the output).
C3.6.5	information	Only available for limit switch; contains serial number, software version number and production date of the circuit board.
C3.6.6	simulation	This function allows to simulate the status for the corresponding limit switch. For further information refer to <i>Menu B, test</i> on page 53 and refer to <i>Simulation of measured values</i> on page 61.
C3.7	status output R2 or limit switch R2	Refer to submenus of status output or limit switch R1 (all submenus and options are identical, except that they start with C3.7).
C3.8	status output R2 or limit switch R2	Refer to submenus of status output or limit switch R1 (all submenus and options are identical, except that they start with C3.8).

C5, device

Level	Designation / function	Settings / descriptions
This menu groups all functions that have no effect on the measurement or any output directly.		
C5.1	device info	Information about the device.
C5.1.1	Tag	Refer to A2 "tag".
C5.1.2	C number	Refer to B6.1 "C number".
C5.1.3	device serial no.	Serial number of the system.
C5.1.4	electronic serial no.	Serial number of the electronics assembly.
C5.1.5	SW.REV.MS	Refer to B6.4 "SW.REV.MS".
C5.1.6	Electronic Revision ER	Refer to B6.6 "Electronic Revision ER".
C5.2	display	Groups several function for the fine adjustment of the display.
C5.2.1	language	Refer to A1 "language".
C5.2.2	contrast	This function allows to adjust the contrast of the display (e.g. at extreme temperatures). Note that a change of the contrast takes place immediately, not just when the menu mode is excited! You cannot reset a change when leaving the programming mode without saving the changes! Range: -9...0...+9
C5.2.3	default display	This function allows to set the default page in the normal measuring mode; after a short delay period the display always returns to this page automatically. Options: • none: no default measuring page, i.e. the display always stays on the currently selected page. • 1. meas. page: set this page as default. • 2. meas. page: set this page as default. • status page: show only status messages as default page. • graphic page: show only trend display of the first measuring result as default page.
C5.2.5	information	Contains serial number, user interface software version number and production date of the circuit board.
C5.3	1. meas. page	This menu groups all settings for the first measuring page. The menus are equal for the first and second measuring page.
C5.3.1	function	This function allows to specify the number of lines which display the measured value(s). Options: • two lines: display shows two lines of measuring results on this page. • three lines: display shows two three of measuring results on this page. • one line: display shows one line of measuring results on this page.
C5.3.2	measurement 1.line	This function allows to define which measured value appears in the first line of the display. The available options depend on the hardware setting and the kind of the sensor used, refer to the sensor manual for further information.
C5.3.3	range	Range for the measurement (0...100%) which has been set in the previous function: 0...xx.xx __ _ (format and unit depend on the measurement, see above).
C5.3.4	limitation	Limitation before applying the time constant. Range: -150...+150%
C5.3.5	time constant	Range: 000.1...100 seconds

Level	Designation / function	Settings / descriptions
C5.3.6	format 1.line	This function allows to define the number of digits after the decimal point (i.e. the decimal places). Options: automatic (adaptation carried out automatically according to the available space) / X (= none) ...X.XXXXXXXX (max. 8 digits).
C5.3.7	measurement 2.line	This function allows to define which measured value appears in the second line of the display. The existence and structure of this menu within your device depends on the hardware setting and the kind of sensor connected to the process input. Refer to the sensor manual for further information!
C5.3.8	format 2.line	This function allows to define the number of digits after the decimal point (i.e. the decimal places). The existence of this menu depends on the hardware setting, the options comply with the options for the format of the first line of the display (see C5.3.7).
C5.3.9	measurement 3.line	This function allows to define which measured value appears in the third line of the display. The existence and structure of this menu within your device depends on the hardware setting and the kind of sensor connected to the process input. Refer to the sensor manual for further information!
C5.3.10	format 3.line	This function allows to define the number of digits after the decimal point (i.e. the decimal places). The existence of this menu depends on the hardware setting, the options comply with the options for the format of the first line of the display (see C5.3.7).
C5.4	2. meas. page	Refer to sub-menus of C5.3 "1. meas. page" (all submenus and options are identical, except that they start with C5.4 or C5.4.X).
C5.5	graphic page	The graphic page always shows the trend curve of the first measured value of the first measuring page (see menu C5.3.2). With the help of the functions in this submenu you can scale the X-axis (time) and the Y-axis.
C5.5.1	select range	This functions allows to define the scaling of the Y-axis. Options: manual (set range in the following function C5.5.2) / automatic (automatic depiction based on the measured values; the range will be reset after a parameter change or a new start-up of the device only).
C5.5.2	range	If the option "manual" is selected in the previous function, you can define the scaling of the Y-axis manually with the help of this function.
C5.5.3	time scale	This function allows to define the scaling of the X-axis (i.e. total time span of the trend).
C5.6	special functions	This menu groups several special functions.
C5.6.1	reset errors	Refer to A5 "reset".
C5.6.2	save settings	This function allows to save all settings and choose a storage place. For further information refer to <i>Save settings</i> on page 66.
C5.6.3	load settings	This function allows to load saved settings from different storage places. For further information refer to <i>Load settings</i> on page 66.
C5.6.4	password quick set	This function allows to define and activate a password for the access to the quick setup menu. Options: XXXX (if you enter four digits in the range of 0001...9999, then the password protection is enabled) / 0000 (password protection disabled).
C5.6.5	password setup	This function allows to define and activate a password for the access to the setup menu. Options: XXXX (if you enter four digits in the range of 0001...9999, then the password protection is enabled) / 0000 (password protection disabled).

C5.7	units	This menu groups several functions to define the units of the measuring results. These unit are used for all values of the related unit group on the display (measuring screen and parameters).
C5.7.1	concentration absolute	This function allows to define the absolute concentration unit used for amperometric measurements. Options: mg/l, µg/l, ppm (parts per million), ppb (parts per billion), free unit.
C5.7.2	Text free unit	This function allows to define a text if a free unit was chosen for the absolute concentration (see previous function C5.7.1). Conditions: at most three characters before and three after the slash!
C5.7.3	[g/l]*factor	This function allows to define the conversion factor if a free unit was chosen for the absolute concentration (see previous function C5.7.1). With this factor the measurement value in g/l is multiplied to get a value in the free unit.
C5.7.4	rel. concentration DO	This function allows to define the relative concentration unit used for the measurement of DO (dissolved oxygen). Options: %, ppm (parts per million), ppb (parts per billion).
C5.7.5	conc.solution	This function allows to define the concentration unit used for solution measurement. Options: %, ppm (parts per million), ppb (parts per billion).
C5.7.6	spec.conductivity	This function allows to define the specific conductivity unit. Options: mS/cm, µS/cm, free unit.
C5.7.7	Text free unit	Properties comply with C5.7.2.
C5.7.8	[S/m]*factor	Properties comply with C5.7.3 except that the measurement value is [S/m].
C5.7.9	spec.resistance	This function allows to define the specific resistance unit. Options: MOhm x cm, free unit.
C5.7.10	Text free unit	Properties comply with C5.7.2.
C5.7.11	[Ohm x m]*factor	Properties comply with C5.7.3 except that the measurement value is [Ohm/m].
C5.7.12	temperature	This function allows to define the temperature unit. Options: °C, °F, K.
C5.7.13	air pressure	This function allows to define the air pressure unit. Options: Pa, kPa, bar, mbar, Torr, atm.
C5.7.14	probe current	This function allows to define the probe current unit. Options: mA, free unit.
C5.7.15	Text free unit	Properties comply with C5.7.2.
C5.7.16	[A]*factor	Properties comply with C5.7.3 except that the measurement value is [A].

6.5.4 Menu D, service

This menu is password protected and contains functions to be used by service personnel only.

6.6 Functions in detail

6.6.1 Manual hold

To avoid alarms on the distributed control system (DLC) when temporary removing the sensor (i.e. for maintenance), the converter has a hold function (A3 "manual hold"). This function "freezes" all outputs (i.e. the display and the current outputs) on the last measured value.



INFORMATION!

As an indication that the manual hold function is active, the "warning sign" in the upper left corner of the display appears. Meanwhile the status messages show "checks in progress".

For further information about the status messages refer to *Status messages and diagnostic information* on page 67.

6.6.2 Simulation of measured values

The device offers the possibility to simulate the measured values of the process inputs as well as the values for the control input and the output values (functions B1...B3, C3.2.10, C3.5.4, C3.6.4, C3.6.6). Depending on the hardware setting and the used sensor(s) the main menu B "TEST" contains up to three sub-menus. Also depending on the hardware setting and the used sensor(s) these submenus contain functions which can initiate the simulation process. The procedure is the same for all functions:



- Choose the function with the help of ↓ or ↑ and press ←.
- ➔ You see the two options "set value" (opens the editor to enter the simulation value) and "break" (exits the menu without simulation).
- Choose the desired option with the help of ↑ or ↓ and press ←.
- ➔ If you chose "set value", the device asks "start simulation" and offers the options "no" (exits the menu without simulation) or "yes" (starts the simulation finally).
- Choose the desired option with the help of ↑ or ↓ and press ←.
- ➔ If you chose "yes", the simulation starts.

6.6.3 Status log and calibration log

The calibration log (B5.2) contains the results of the latest calibrations. Also within this log you can move up or down with the help of ↑ or ↓ and you can exit it with ↵.

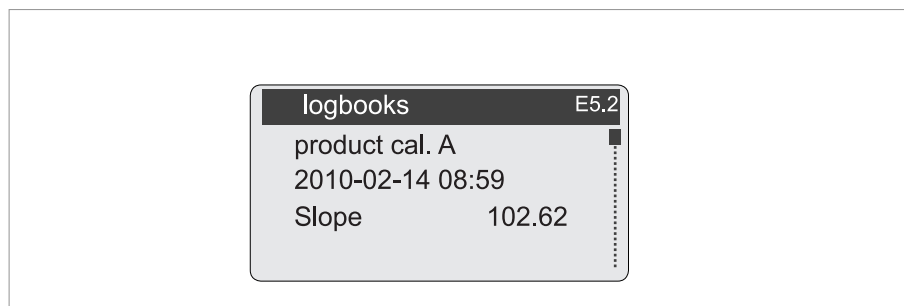


Figure 6-11: Example for calibration log

The status log (B5.1) contains the latest changes of the device status. Within the log you can move up or down with the help of ↑ or ↓, you can exit the log with ↵. There are two type of status messages:

- Checked boxes: they have a hook in a square to the right of them and stand for emerging events (e.g. current loop open).
- Unchecked boxes: they have a square without a hook to the right of them and stand for leaving events (e.g. if an application error is not longer available).

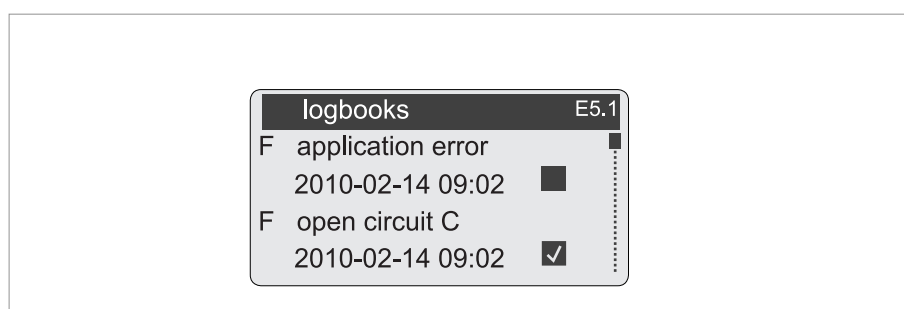


Figure 6-12: Example for status log

6.6.4 Error current of current output

The function C3.2.3 "error current" allows to define the current which indicates the error condition:

Current output in mA

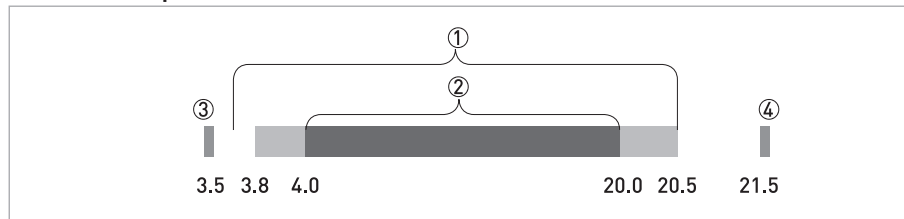


Figure 6-13: Current output in mA

- ① Extended range
- ② Nominal range
- ③ Range of lower error current
- ④ Range of upper error current

NAMUR current output in mA

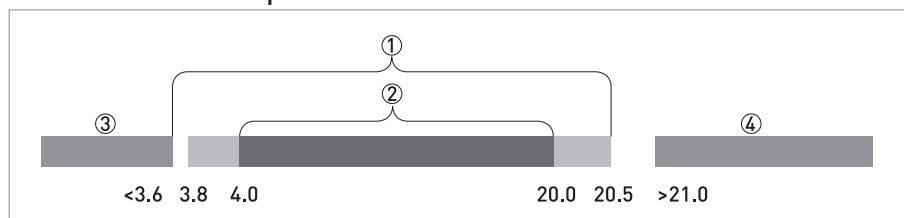


Figure 6-14: NAMUR current output in mA

- ① Extended range
- ② Nominal range
- ③ Range of lower error current
- ④ Range of upper error current

6.6.5 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. For this purpose the corresponding function C5.3.6, C5.3.8 or C5.3.10 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:

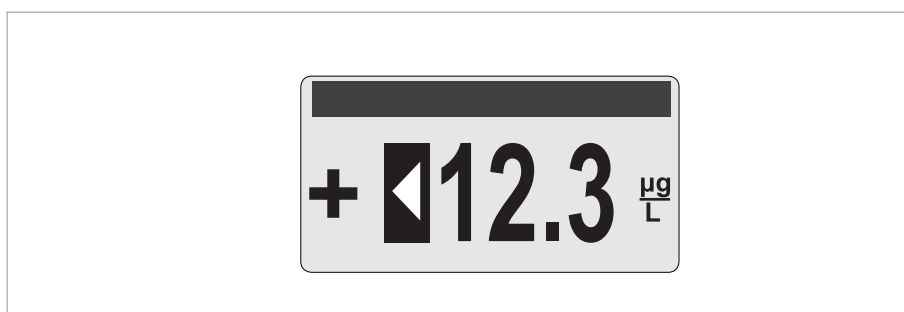


Figure 6-15: Overflow, one line

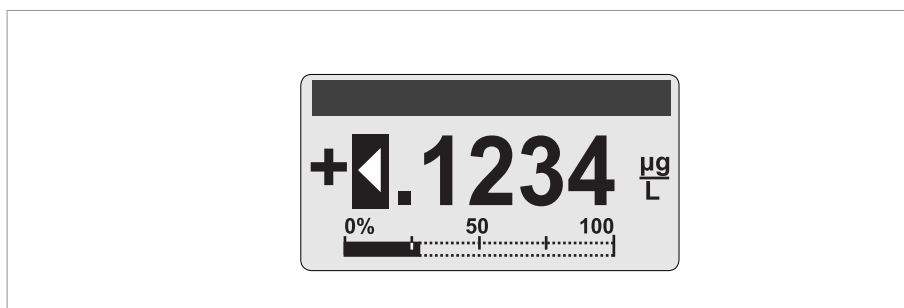


Figure 6-16: Overflow, two lines

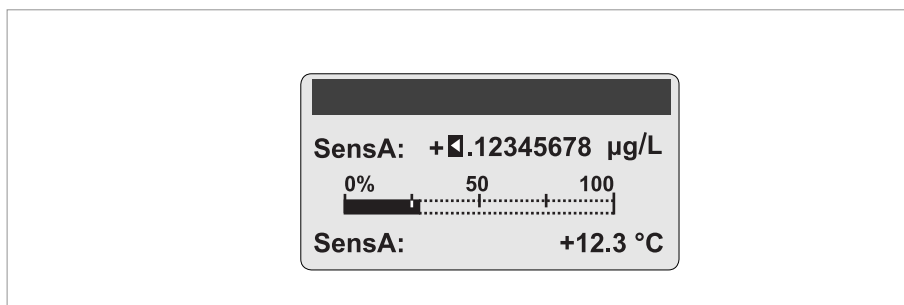


Figure 6-17: Overflow, three lines

Exponential format

If the format of the related display line is set to "automatic" (function C5.3.6, C5.3.8 or C5.3.10), long measuring results appear in an exponential format:



Figure 6-18: Exponential format, one line

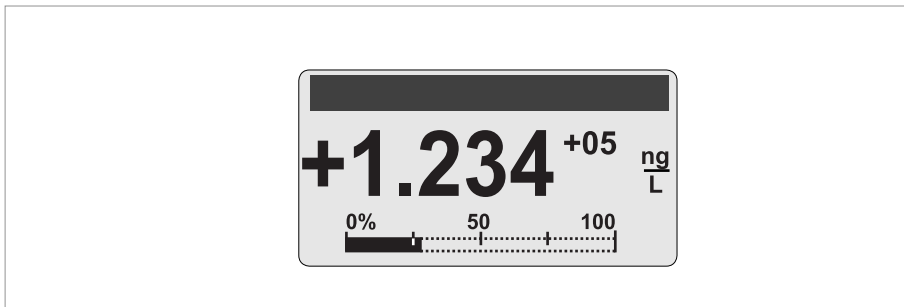


Figure 6-19: Exponential format, two lines

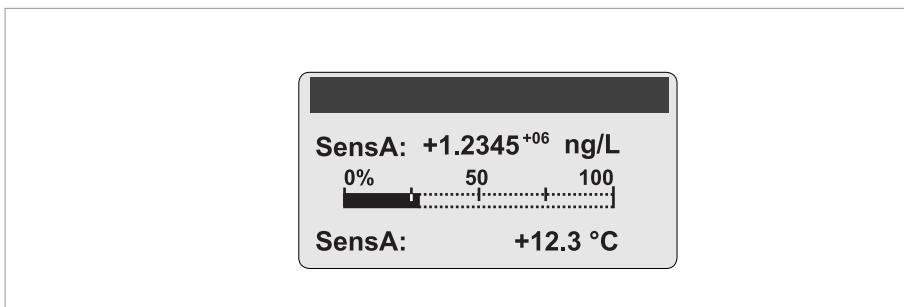


Figure 6-20: Exponential format, three lines

6.6.6 Save settings

The device offers the possibility to save all settings in different storage places:



- Go into the menu mode and call up the menu C5.6.2 "save settings".
- Enter the menu with >.
- ➔ You see three options: "break" (exits the menu without saving), "backup 1" (saves the settings in the backup 1 storage place)", "backup 2" (saves the settings in the backup 2 storage place).
- Choose the desired option with the help of ↑ or ↓ and press ←.
- ➔ If you chose "backup 1" or "backup 2", the device asks "go on with copy?" and offers two options: "no" (exit without saving) and "yes" (copy the actual settings to the selected storage place; note that there is no possibility to undo this command!)
- Choose the desired option with the help of ↑ or ↓ and press ←.
- ➔ The device has successfully saved the settings in the chosen storage place.

6.6.7 Load settings

The device offers the possibility to load settings from different storage places where they have been saved before:



- Go into the menu mode and call up the menu C5.6.3 "load settings".
- Enter the menu with >.
- ➔ You see four options: "break" (exits the menu without saving), "factory settings" (loads the settings from the delivery), "backup 1" (loads the settings from the backup 1 storage place) and "backup 2" (loads the settings from the backup 2 storage place).
- Choose the desired option with the help of ↑ or ↓ and press ←.
- ➔ If you chose one of the options except "break", the device asks "go on with copy?" and offers two options: "no" (exit without saving) and "yes" (copy the selected settings from their storage place; note that there is no possibility to undo this command!)
- Choose the desired option with the help of ↑ or ↓ and press ←.
- ➔ The device has successfully loaded the settings from the chosen storage place.

6.6.8 Passwords

You can activate passwords for different menu levels (function C5.6.4 and C5.6.5):

Password levels

Menu	Required password	Point of query	Preview of setting possible
Quick setup	For quick setup	At entry to the parameter edit mode	Yes
Test	For setup		
Setup	For setup		
Service	For service	At entry to the service menu	No

Common usage

- Protection of the menus "Test" and "Setup" with a password, free access to the menu "Quick setup". You can achieve this by activating a setup password only.
- Protection of the quick setup with a known password and confidential setup password to protect the quick setup against arbitrary use and the setup and test menus against misuse. This is done by activating a password for the menus "setup" and "quick setup".



INFORMATION!

If you activate a password for the menu "Quick setup" only and not for the menu "Setup", the menus "Setup" and "Test" will also be protected by the quick setup password.

6.7 Status messages and diagnostic information



INFORMATION!

Note the following information concerning the tables with the status messages in the following subsections:

- *The devices groups all error messages and maps them according to their category and importance; the following subsections and their tables represent the categories and the order of importance. You find a short description of the error category in the table below this admonition.*
- *On the display you recognize the error category with the help of the character in front of the message (e.g. all failure messages start with a bold "F"); these characters are independent of the used language, they were individually defined by the manufacturer.*
- *If messages of the category F, F and S appear and the device is in the normal measuring mode, a triangle in the header appears (this triangle does not appear if only information is shown).*

**INFORMATION!**

Note that messages are shown in the GDC device for information purposes, too. They do not effect any status change of the device or the measured values.

Explanation of the error categories

Letter on display	Error category according to:		Description	Action
	NE64	VDI/VDE 2650 and NE107		
Bold "F"	Failure	Device failure	Whole device or single component(s) defective, replacement necessary, measured values are not valid; mA output ≤ 3.6 mA or set fault current (depending on the seriousness of the fault).	Repair or replacement necessary!
F (not bold)	-	Application failure	No internal error, but application error has occurred; device okay, but measurement not possible.	Application test or operator action necessary!
S	-	Out of specification	Measurement out of specification; measurement continues, but measured values only restrictedly usable.	Maintenance and an accurate check required!
C	Check request	Passivated	Either the device is outside operation (standby, measured value is fixed or specified), or the output values are partially simulated or fixed.	Maintenance required
I	-	-	Information, current measurement is okay and values unrestrictedly valid.	Depends on error message, see table in relevant section.

6.7.1 Error category "Device failure" (bold "F")



INFORMATION!

Regard that in case of an error message of the category "**F**" the measured values are not valid!

Messages on the display	Description	Actions
F error in device	Error or failure (breakdown) of the complete device; parameter or hardware error; measurement not possible.	Group message, when one of the following or some other severe error occurs.
F IO 1	Error or failure of corresponding IO; parameter or hardware error; measurement not possible.	Load settings (see C5.6.3: backup 1, backup 2 or factory settings). If status message still does not disappear, replace electronic unit.
F IO 2		
F parameter	Error or failure of data manager; parameter or hardware error; measurement not possible.	
F configuration	Invalid configuration: display, software, bus parameter or main software do not match existing configuration. This error message also appears if a module has been added or removed, but configuration has not been confirmed.	If device configuration has not been changed, but message appears though: replace electronic unit.
F display	Error or failure of the display; parameter or hardware error; measurement not possible.	Replace electronic unit.
F sensor electronic A (or B)	Error or failure of the electronics of sensor A (or B); parameter or hardware error; measurement not possible.	Check sensor and connection; if both are okay, replace the electronic unit.
F sensor global A (or B)	Data error in the global data of the electronics of sensor A (or B); measurement with the affected sensor not possible.	Load settings (see C5.6.3: backup 1, backup 2 or factory settings). If status message still does not disappear, replace electronic unit.
F sensor local A (or B)	Data error in the local data of the electronics of sensor A (or B); measurement with the affected sensor not possible.	Replace electronic unit.
F current output A (or B or C)	Error or failure of the current output of terminal A (or B or C); parameter or hardware error; affected current output not usable.	Check connection of current output; if it is okay, replace the electronic unit.
F software user interface	Fault revealed by CRC check of operation software.	Replace electronic unit.
F hardware settings	The set hardware parameters do not match the identified hardware; a dialogue appears in the display.	Answer queries in dialogue mode, follow directions; replace defective electronic unit.
F hardware detection	Existing hardware cannot be identified; modules are either unknown or defective.	Replace electronic unit.
F RAM/ROM error IO1	A RAM or ROM error is detected during the CRC check.	
F RAM/ROM error IO2		

6.7.2 Error category "Application error" ("F", not bold)


INFORMATION!

Regard that also in case of an error message of the category "F" the measured values are not valid!

Messages on the display	Description	Actions
F application error	Application-dependent fault, but device is okay.	Group message, when errors as described below or other application errors occur.
temperature A (or B)	Temperature sensor A (or B) is not connected properly or measurement is out of range.	Check cabling or replace the sensor!
pH compensation	The pH value is not in the working range of the compensation function (required range for a working compensation).	Assure that the measured liquid has a pH value in the range below 9.
polarisation sens. A (or B)	Pre-amplifier is over-ranged by DC offsets due to polarisation.	Check installation of sensor!
Flow control	The flow control which is connected to the control input transmits that the flow is too low for an amperometric measurement.	Check the sample flow!
F open circuit A (or B or C)	Load on current output A (or B or C) too high, effective current too low.	Current not correct, mA output cable has open circuit or load too high. Check cable, reduce load to less than 550 Ω!
Over range CO A (or B or C)	The current or the corresponding measured value is limited by a filter setting.	Extend function C3.2.6 ("range") and function C3.2.7 ("limitation").
F active settings	Error during the CRC check of the active settings.	Upload backup 1 or backup 2 settings, check and adjust if necessary.
F factory settings	Error during the CRC check of the factory settings.	
F backup 1 settings (or backup 2 settings)	Error during the CRC check of the backup 1 or 2 settings.	Save active settings in backup 1 or 2.

6.7.3 Error category "Out of specification" (S)


INFORMATION!

Regard that in case of an error message of the category "S" the measured values are only conditionally usable!

Messages on the display	Description	Actions
S uncertain measurem.	Group message, when errors as described below or other influences occur; measured values are only conditionally usable.	Device maintenance necessary.
S sensor electronic A (or B)	Measured values from sensor electronic A (or B) are only conditionally usable.	Sensor maintenance necessary.
S temperature A (or B)	Measured temperature values from sensor electronic A (or B) are only conditionally usable.	Temperature sensor maintenance necessary.
S slope A (or B)	Slope of the sensor A (or B)	Replace the sensor

6.7.4 Error category "Check request" or "Run check" (C)

Messages on the display	Description	Actions
C checks in progress	Test mode of the device. Measured values are possibly simulated values or values with fixed settings.	None
C sensor electronic A (or B)	Test function of the sensor electronic A (or B) is activated.	None
C manual hold	The measurements from the sensor A and B are simulated.	Deactivate manual hold (A3)

6.7.5 Error category "Information" (I)

Messages on the display	Description	Actions
I control input active	Signal "High" on the control input.	None
I over range display 1 (or 2)	1st line on measuring page 1 (or 2) of display limited by filter setting.	Select 1st or 2nd meas. page and increase values in function C5.3.3 / C5.4.3 range and/or C5.3.4 / C5.4.4 limitation
I backplane sensor	The data on the backplane are not usable because they have been generated with an incompatible version.	None
I backplane settings	The global settings on the backplane are not usable because they have been generated with an incompatible version.	None
I backplane difference	The data on the backplane differ from the data in the display. If the data are usable, a dialogue is indicated in the display.	None
I write cycles overfl.	The maximum number of write cycles of the EEPROM has been exceeded.	None

6.8 Timeout function

**INFORMATION!**

Independent of the mode (menu mode or test mode, see below), all changes done until an automatic return are lost if this return happens!

Menu mode

If the user does not press any key for 5 minutes and the device is not in the test mode, it automatically returns to the measuring mode (i.e. the display shows one or more measuring results).

Test mode

If the device performs a test on the local user interface (e.g. during the simulation function of a current at the current output), the test run is terminated after 60 minutes. The device automatically returns to the measuring mode (i.e. the display shows one or more measuring results).

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.



CAUTION!

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.*



CAUTION!

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 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:	
Tel. no.:		Fax no. and/or Email address:	
Manufacturer's order no. or serial no.:			
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 through any residual media contained in the device when it is returned.			
Date:		Signature:	
Stamp:			

7.5 Disposal



CAUTION!

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

Separate collection of WEEE (Waste Electrical and Electronic Equipment) in the European Union:



According to the directive 2012/19/EU, 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.

8.1 Measuring principle

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

8.2 Technical data table



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 sensor(s), for further information refer to the sensor manual(s).
Application range	Continuous measurement of parameters in liquid analysis applications.
Measuring range	The measuring range depends on the used sensor(s), for further information refer to the sensor manual(s).

Design

Construction	A typical measuring system consists of: • MAC 100 multiparameter signal converter • 1 (or up to 2) sensors of the OPTISENS series • Sensor cable • SENSOFIT mounting assembly
Option	The device is available as a one channel (one signal input) or a two channel version (two signal inputs). You can connect one sensor to the one channel version and up to two sensors to the two channel version.
Sensors	For further information refer to the manual of the relevant sensor. Also note the table with the sensor input combinations on page 14.

Display and user interface	
Graphic display	LC display, backlit white
	128 x 64 pixels
	Note: ambient temperatures below -25°C / -13°F may affect the readability of the display!
Operating elements	4 push buttons for operator control of the signal converter without opening the housing.
Operating menu	The operation menu consists of the measuring mode and the menu mode:
	Measuring mode: 4 pages (first and second measuring page with measuring results, status message and trend diagram).
	Menu mode: variety of main and submenus that allow to customise the device according to the demands of the measuring point.
Operating and display languages	English, German, French, Spanish
Units	Metric, British and US units selectable as required from lists.

Measuring accuracy

Maximum measuring error	For further information refer to the manual of the relevant sensor.
Repeatability	For further information refer to the manual of the relevant sensor.
Resolution	Temperature: 0.1°C / 0.1°F
	For further information refer to the manual of the relevant sensor.

Operating conditions

Temperature	
Ambient	-15...+55°C / +5...131°F
	Note: the manufacturer strongly recommends to protect the signal converter from external heat sources such as direct sunlight as higher temperatures reduce the life cycle of all electronic components!
Storage	-40...+70°C / -40...+158°F

Other conditions	
Humidity (ambient)	Max. 90% at 55°C / 131°F (not condensing)
Pressure	For information about the process pressure of the used sensor(s) refer to the relevant sensor documentation!
Ingress protection	IP66/67 acc. to IEC 60529 IP69 (only stainless steel housing) acc. to IEC 60529 NEMA 4/4X

Installation conditions

Installation	Only wall mounting is possible, always assure a vertical mounting orientation!
Dimensions and weights	For detailed information see chapter "Dimensions and weights".

Materials

Signal converter housing	Die-cast aluminium (polyurethane coated) Stainless steel 1.4404 (AISI 316L)
Sensor	For housing materials, process connections, liners, grounding electrodes and gaskets, see the technical documentation for the sensor.

Electrical connections

General	Electrical connection is carried out in conformity with the VDE 0100 directive "Regulations for electrical power installations with line voltages up to 1000 V" or equivalent national regulations.
Power supply	
Voltage	100...230 VAC (-15% / +10%), 50/60 Hz; 240 VAC + 5% is included in the tolerance range.
	24 VAC/DC (AC: -25 / +30% or DC: +15% / -10%)
Power consumption	5 W at 24 VDC 8 VA at 230 VAC
Fuse	0.8 AT/250 V (high breaking capacity), 5 x 20 mm / 0.2 x 0.8"
Line frequencies	50/60 Hz
Power rating	22 VA (maximum)
Inrush current	$I_{N, eff} = 97 \text{ mA}$, $t_{15} = 1.5 \text{ ms}$, $t_{Peak} = 200 \text{ }\mu\text{s}$, $I_{Peak} = 22.6 \text{ A}$
Cable glands	4 x M20 M20x1.5: Plastic (polyamid 6) M20 to 1/2-NPT (female): Brass M20x 1.5: Stainless steel (IP69)

Inputs and outputs

General	All in- and outputs are electrically isolated from each other and from all other circuits.
	All operating data and output values can be adjusted.
Description of used abbreviations	U_{ext} = external voltage; R_L = load + resistance; U_0 = terminal voltage; I_{nom} = nominal current
Inputs	
Sensor inputs	Up to 2, depending on the version. For further information refer to the manual of the relevant sensor.
Control input	Passive, not polarity sensitive, $U_{\text{ext, max}} \leq 32 \text{ VDC}$, $I_{\text{nom}} = 6.5 \text{ mA}$ with $U_{\text{ext}} = 24 \text{ VDC}$, $I_{\text{nom}} = 8.2 \text{ mA}$ with $U_{\text{ext}} = 32 \text{ VDC}$
	Switching point for identifying "contact open or closed": contact open ("off") at $U_0 \leq 2.5 \text{ V}$ with $I_{\text{nom}} = 0.4 \text{ mA}$, contact closed ("on") at $U_0 \geq 8 \text{ V}$ with $I_{\text{nom}} = 2.8 \text{ mA}$
Outputs	
Current outputs	Three isolated outputs (4...20 mA), all galvanic isolated, errors signals 3.25 mA and 22 mA, active mode
	Output data: depending on sensor
	Operating data: $U_{\text{int, nom}} = 15 \text{ VDC}$, $I = 0(4)...22 \text{ mA}$, $I_{\text{max}} \leq 22 \text{ mA}$, $R_L \leq 550 \Omega$
Relay outputs	Three electro-mechanical relays that can work as alarm relays or limit switches
	Possible conditions: NO (normally open) or NC (normally closed)
	Contact ratings: - Relays for low voltages: $U \leq 30 \text{ VDC}$, $I \leq 1 \text{ A}$, resistive load (PELV / SELV) or $U \leq 50 \text{ VAC}$, $I \leq 4 \text{ A}$, resistive load (PELV / SELV) - Relays for high voltages: $U = 100...230 \text{ VAC}$, $I \leq 4 \text{ A}$, max. 1000 VA resistive load

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 European 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.	
Other approvals and standards	
NAMUR recommendation	NE 21 and NE 43
Shock resistance	IEC 60068-2-27

8.3 Dimensions and weight

8.3.1 Housing die-cast aluminium

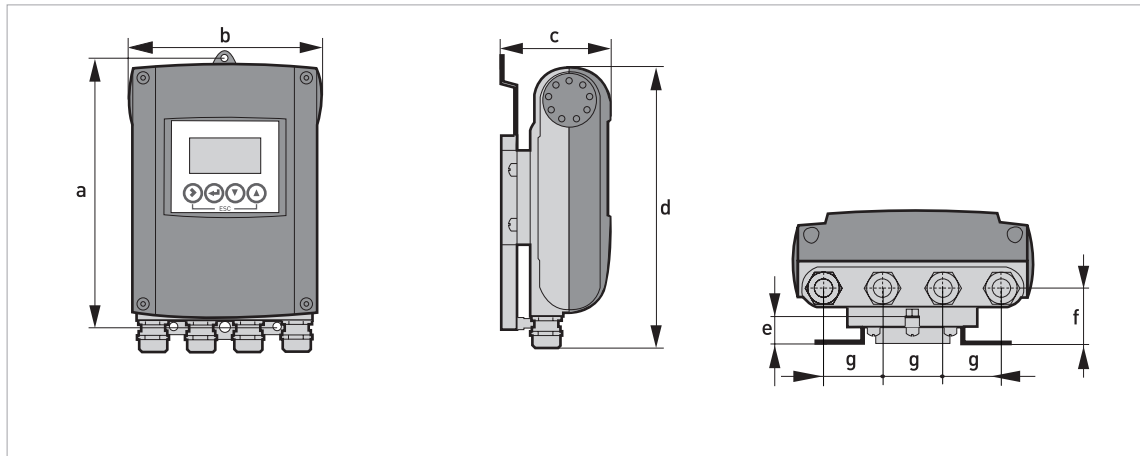


Figure 8-1: Dimensions die-cast aluminium housing

Dimensions and weights in mm and kg

	Dimensions [mm]							Weight [kg]
	a	b	c	d	e	f	g	
Wall-mounted version	241	161	95.2	257	19.3	39.7	40	1.9

Dimensions and weights in inch and lb

	Dimensions [inch]							Weight [lb]
	a	b	c	d	e	f	g	
Wall-mounted version	9.50	6.34	3.75	10.12	0.76	1.56	1.57	4.2

8.3.2 Housing stainless steel

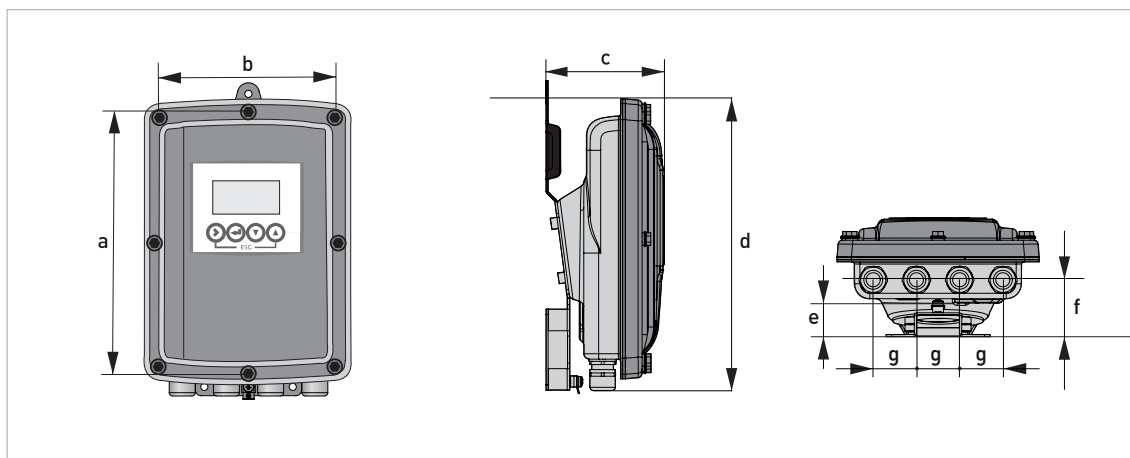


Figure 8-2: Dimensions stainless steel housing

Dimensions and weights in mm and kg

	Dimensions [mm]							Weight [kg]
	a	b	c	d	e	f	g	
Wall-mounted version	268	187	110	276	29	53	40	Approx. 3.5

Dimensions and weights in inch and lb

	Dimensions [inch]							Weight [lb]
	a	b	c	d	e	f	g	
Wall-mounted version	10.55	7.36	4.33	10.87	1.14	2.09	1.57	Approx. 7.2

8.3.3 Mounting plate die-cast aluminium

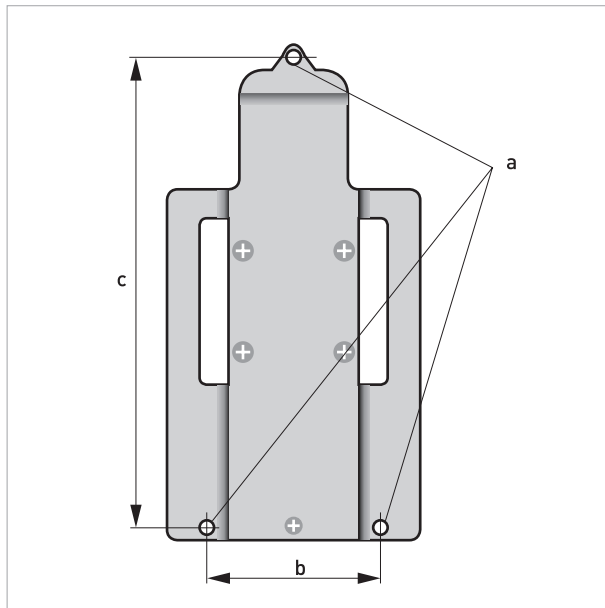


Figure 8-3: Dimensions mounting plate

Dimensions mounting plate

	[mm]	[inch]
a	Ø6.5	Ø0.26
b	87.2	3.4
c	241	9.5

8.3.4 Mounting plate stainless steel

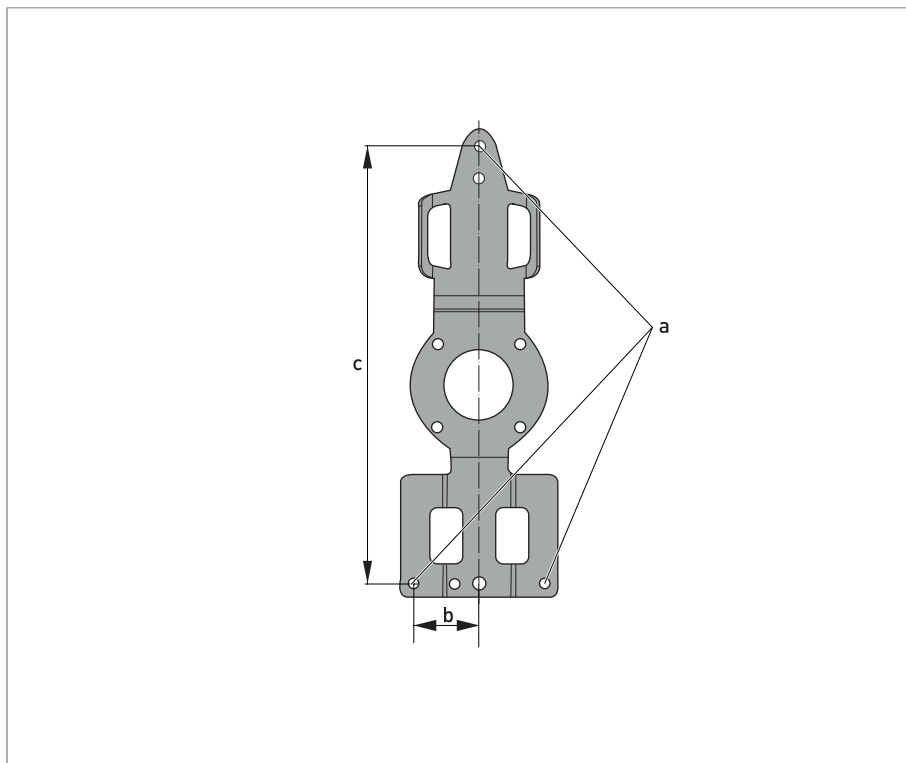


Figure 8-4: Dimensions mounting plate

Dimensions mounting plate

	[mm]	[inch]
a	Ø6.5	Ø0.26
b	40	1.6
c	268	10.5





KROHNE – Process instrumentation and measurement solutions

- Flow
- Level
- Temperature
- Pressure
- Process Analysis
- Services

Head Office KROHNE Messtechnik GmbH
Ludwig-Krohne-Str. 5
47058 Duisburg (Germany)
Tel.: +49 203 301 0
Fax: +49 203 301 10389
info@krohne.com

The current list of all KROHNE contacts and addresses can be found at:
www.krohne.com

KROHNE