



IFC 300 Handbook

Signal converter for electromagnetic flowmeters

Electronic revision:
ER 3.4.x

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

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1.1 Software history

The "Electronic Revision" (ER) is consulted to document the revision status of electronic equipment according to NE 53 for all 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.

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
	N	PROFINET IO
	X	all interfaces
3- _	Downwards compatible hardware and/or software change of inputs and outputs:	
	I	Current output
	P, F	Pulse output, frequency 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.	

Table 1-1: Description of changes

Release date (ER)	Electronic revision (ER)	Changes and compatibility	Documentation
01/2013	ER 3.3.5_	1; 3-S; 4	MA IFC 300 R05
10/2014	ER 3.3.6_	1	MA IFC 300 R05
09/2014	ER 3.3.7_	1	MA IFC 300 R05
09/2016	ER 3.3.8_	1; 2-F	MA IFC 300 R05
01/2017	ER 3.4.0_	1; 2-N; 4; 5 ①	MA IFC 300 R05
07/2017	ER 3.4.1_	1	MA IFC 300 R05
04/2018	ER 3.4.2_	1; 2-P	MA IFC 300 R05
06/2023	ER 3.4.5_	1	MA IFC 300 R06, R07
	ER 3.4.3_ ER 3.4.6_	1; 2-X; 5 ②	
	ER 3.4.12_		
08/2023	ER 3.4.12_		

Table 1-2: Changes and effect on compatibility

- ① Due to the changes in the data model, there is no compatibility with respect to the backplane. This means, in case of a signal converter change from a previous version, the settings cannot be used from the backplane.
- ② New display unit with hardware update

1.2 Intended use

The electromagnetic flowmeters are designed exclusively to measure the flow and conductivity of electrically conductive, liquid media.



DANGER!

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



WARNING!

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



INFORMATION!

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

1.3 Certification

Product marking



Figure 1-1: Examples of marking logo

The manufacturer certifies successful testing of the product by applying the conformity mark on the device.

This device fulfils the statutory requirements of the relevant directives and regulations.

For more information on the directives, regulations, standards and certifications, please refer to the declaration of conformity supplied with the device or downloadable from the manufacturer's website.

Other approvals and standards

- NAMUR recommendations NE 21 and NE 43
- CSA OL Class 2252 86 & Class 2252 06



DANGER!

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

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.

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

1.4.2 Disclaimer

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

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

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

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

1.4.3 Product liability and warranty

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

1.4.4 Information concerning the documentation

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

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

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

1.4.5 Warnings and symbols used

Safety warnings are indicated by the following symbols.



DANGER!

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



DANGER!

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



DANGER!

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



DANGER!

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



WARNING!

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



CAUTION!

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



INFORMATION!

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



LEGAL NOTICE!

This note contains information on statutory directives and standards.



• **HANDLING**

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

➔ **RESULT**

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

1.5 Safety instructions for the operator



WARNING!

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

2.1 Scope of delivery



INFORMATION!

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



INFORMATION!

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



INFORMATION!

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

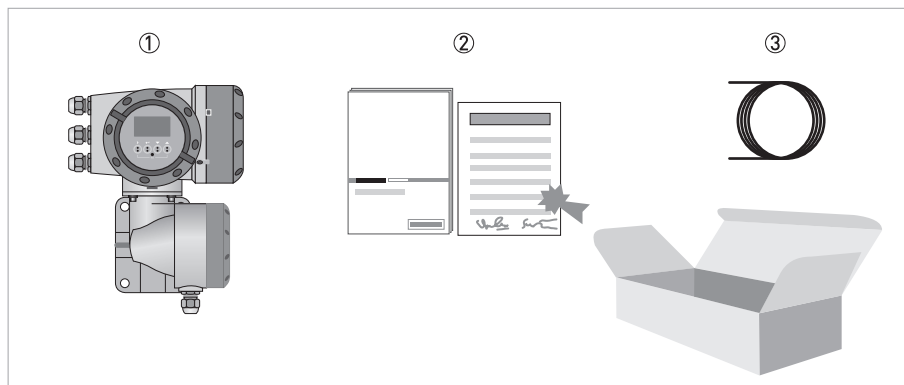


Figure 2-1: Scope of delivery

- ① Device in the version as ordered
- ② Documentation (calibration report, product documentation)
- ③ Signal cable (only for remote version)

Flow sensor	Flow sensor + signal converter IFC 300			
	Compact version	Remote field housing	Remote wall-mounted housing	Remote rack-mounted housing
OPTIFLUX 1000	OPTIFLUX 1300 C	OPTIFLUX 1300 F	OPTIFLUX 1300 W	OPTIFLUX 1300 RL
OPTIFLUX 2000	OPTIFLUX 2300 C	OPTIFLUX 2300 F	OPTIFLUX 2300 W	OPTIFLUX 2300 RL
OPTIFLUX 4000	OPTIFLUX 4300 C	OPTIFLUX 4300 F	OPTIFLUX 4300 W	OPTIFLUX 4300 RL
OPTIFLUX 5000	OPTIFLUX 5300 C	OPTIFLUX 5300 F	OPTIFLUX 5300 W	OPTIFLUX 5300 RL
OPTIFLUX 6000	OPTIFLUX 6300 C	OPTIFLUX 6300 F	OPTIFLUX 6300 W	OPTIFLUX 6300 RL
OPTIFLUX 7000	OPTIFLUX 7300 C	-	-	-
WATERFLUX 3000	WATERFLUX 3300 C	WATERFLUX 3300 F	WATERFLUX 3300 W	WATERFLUX 3300 RL
TIDALFLUX 2000	-	TIDALFLUX 2300 F	-	-
OPTIPROBE	OPTIPROBE 300 C	OPTIPROBE 300 F	OPTIPROBE 300 W	

Table 2-1: Signal converter/flow sensor combination possibilities

2.2 Device description

Electromagnetic flowmeters are designed exclusively to measure the flow and conductivity of electrically conductive, liquid media.

The measuring device is supplied ready for operation. The factory settings for the operating data have been made in accordance with the order specifications.

The following versions are available:

- Compact version (the signal converter is mounted directly on the flow sensor)
- Remote version (electrical connection to the flow sensor via field current and signal cable)

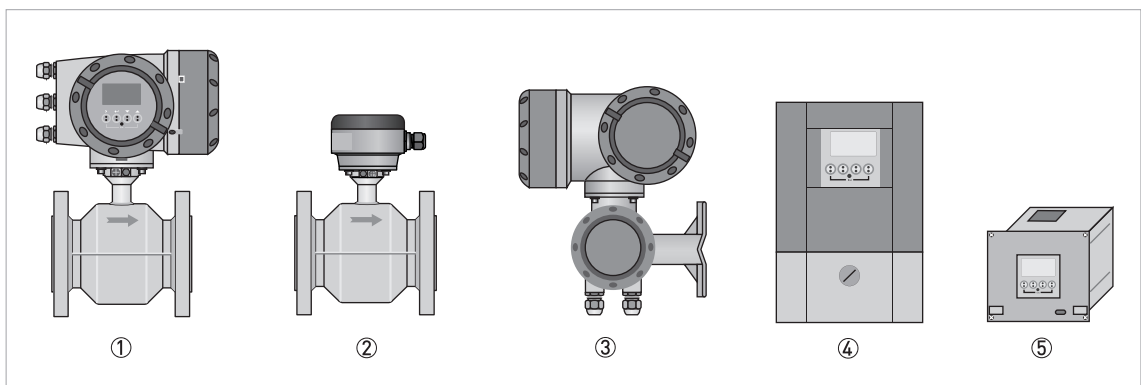


Figure 2-2: Device versions

- ① Compact version
- ② Flow sensor with connection box
- ③ Field housing
- ④ Wall-mounted housing
- ⑤ 19" rack-mounted housing

2.2.1 Field housing

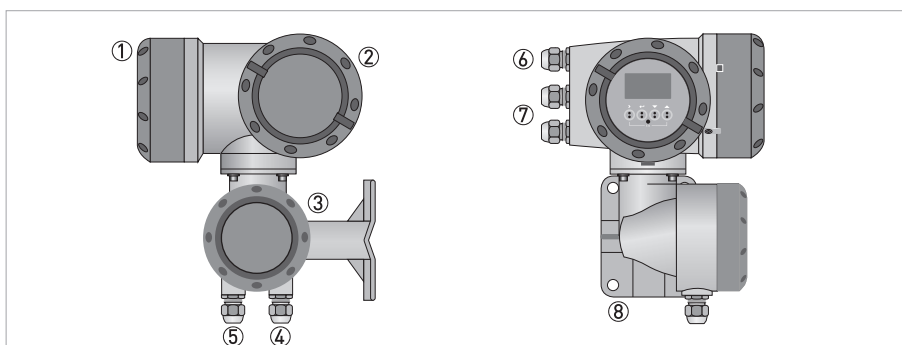


Figure 2-3: Construction of the field housing

- ① Cover for electronics and display
- ② Cover for power supply and inputs/outputs terminal compartment
- ③ Cover for flow sensor terminal compartment
- ④ Cable entry for flow sensor signal cable
- ⑤ Cable entry for flow sensor field current cable
- ⑥ Cable entry for power supply
- ⑦ Cable entry for inputs and outputs
- ⑧ Mounting plate for pipe and wall mounting

**CAUTION!**

The design of the TIDALFLUX 2000 field housing is different to the standard version shown here. For detailed information on the electrical connection please refer to the manual of TIDALFLUX 2000.

**INFORMATION!**

Each time a housing cover is opened, the thread should be cleaned and greased. Use only resin-free and acid-free grease. Ensure that the housing gasket is properly fitted, clean and undamaged.

2.2.2 Wall-mounted housing

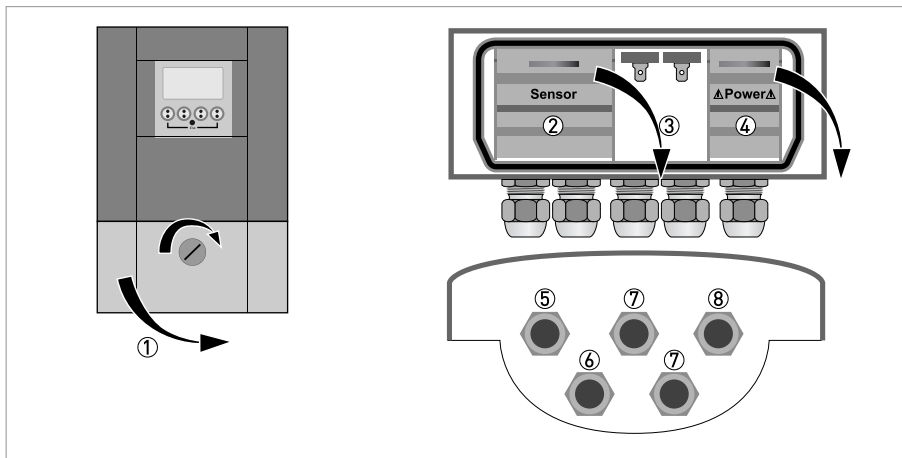


Figure 2-4: Construction of wall-mounted housing

- ① Cover for terminal compartments
- ② Terminal compartment for measuring sensor
- ③ Terminal compartment for inputs and outputs
- ④ Terminal compartment for power supply with safety cover (shock-hazard protection)
- ⑤ Cable entry for signal cable
- ⑥ Cable entry for field current cable
- ⑦ Cable entry for inputs and outputs
- ⑧ Cable entry for power supply



- ① Turn lock to the right and open the cover.

2.3 Nameplates



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.

2.3.1 Nameplate (example)

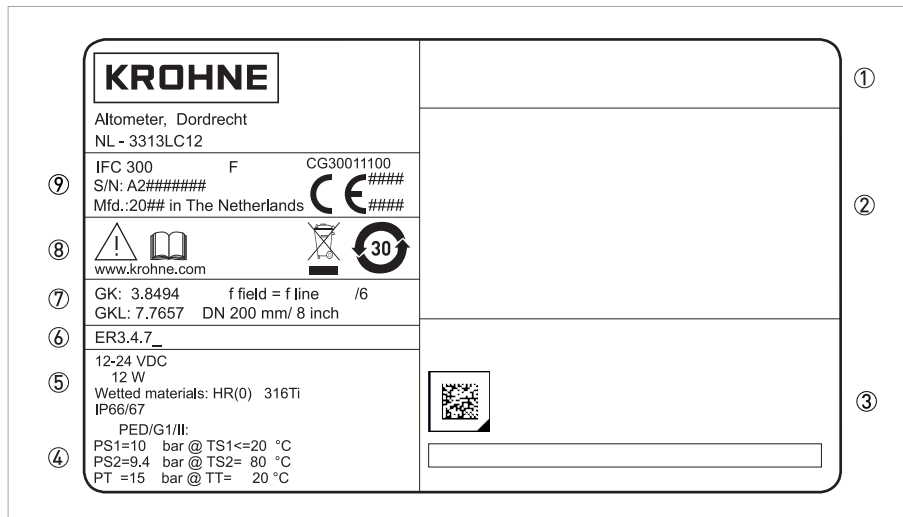


Figure 2-5: Example of a nameplate

- ① Approvals-related information: Ex approval, EC type test certificate, hygienic approvals, etc.
- ② Approvals-related thresholds
- ③ Data Matrix code
- ④ Approvals-related data (e.g. temperature thresholds and pressure thresholds)
- ⑤ Data for power supply, ingress protection and materials of wetted parts
- ⑥ Software revision number (Electronic Revision)
- ⑦ GK/GKL values (flow sensor constants), size [mm/inch] and field frequency
- ⑧ Safety instructions, disposal and China RoHS marking
- ⑨ Product designation, serial number, manufacturing date and country, CG number and conformity mark

Auto ID according to DIN specifications

The auto ID code (data matrix) guides you directly to the PICK server (Product Information Center KROHNE).

Scan the auto ID code on the device nameplate to download all product specific information.

- Handbooks, Quick Starts and Supplementary instructions
- Calibration certificates
- Factory settings as bin file
- Parameter data sheets
- Digital nameplates

2.3.2 Electrical connection data of inputs/outputs (example of basic version)




①	POWER / PE (FE) L(L+) N(L-)	CG 3x xxxxxx S/N: XXXxxxxx		
		  A = Active P = Passive NC = Not connected		
②	INPUT / OUTPUT	D -	P	PULSE OUT / STATUS OUT I _{max} = 100 mA@f<= 10 Hz; = 20 mA@f<=12 kHz V _o = 1.5 V @ 10 mA; U _{max} = 32 VDC
		D		
③		C -	P	STATUS OUT I _{max} = 100 mA; V _{max} = 32 VDC
		C		
④		B -	P	STATUS OUT / CONTROL IN I _{max} = 100 mA V _{on} > 19 VDC, V _{off} < 2.5 VDC; V _{max} = 32 VDC
		B		
⑤		A +	A	CURRENT OUT (HART) Active (Terminals A & A+); R _{Lmax} = 1 kohm
		A -	P	Passive (Terminals A & A-); V _{max} = 32 VDC

Figure 2-6: Example of a nameplate for electrical connection data of inputs and outputs

- ① Power supply (AC: L and N; DC: L+ and L-; PE for ≥ 24 VAC; FE for ≤ 24 VAC and DC)
- ② Connection data of connection terminal D/D-
- ③ Connection data of connection terminal C/C-
- ④ Connection data of connection terminal B/B-
- ⑤ Connection data of connection terminal A/A-; A+ only operable in the basic version

- A = active mode; the signal converter supplies the power for connection of the subsequent devices
- P = passive mode; external power supply required for operation of the subsequent devices
- N/C = connection terminals not connected



WARNING!

Do not use the terminals A+ and A- at the same time. The system will be damaged by the direct voltage of 24 VDC and a 1 A peak current.

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

- Store the device in a dry, dust-free location.
- Avoid continuous direct sunlight.
- Store the device in its original packing.
- Storage temperature: -50...+70°C / -58...+158°F

3.3 Transport

Signal converter

- No special requirements.

Compact version

- Do not lift the device by the signal converter housing.
- Do not use lifting chains.
- To transport flange devices, use lifting straps. Wrap these around both process connections.

3.4 Installation specifications

**INFORMATION!**

The following precautions must be taken to ensure reliable installation.

- *Make sure that there is adequate space to the sides.*
- *The device must not be heated by radiated heat to an electronics housing surface temperature above the maximum permissible ambient temperature. If it is necessary to prevent damage from heat sources, a heat protection (e.g. sun shade) has to be installed.*
- *Signal converters installed in control cabinets require adequate cooling, e.g. by fan or heat exchanger.*
- *Do not expose the signal converter to intense vibrations. The measuring devices are tested for a vibration level as described in the chapter "Technical data".*
- *Protect the device from excessive solar heat or UV light. Install an adequate protection (e.g. sun shade) to prevent damage to the housing and electronics.*
- *Avoid using high pressure jets close to the device. The measuring devices are tested for an ingress protection level as described in the chapter "Technical data".*

3.5 Mounting of the compact version



CAUTION!

Turning the housing of the compact version is not permitted.



INFORMATION!

The signal converter is mounted directly on the flow sensor. For installation of the flowmeter, please observe the instructions in the supplied product documentation for the flow sensor.

3.6 Mounting the field housing, remote version



CAUTION!

Remarks for sanitary applications

- *To prevent contamination and dirt deposits behind the mounting plate, a cover plug must be installed between the wall and the mounting plate.*
- *Pipe mounting is not suitable for sanitary applications!*



INFORMATION!

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

3.6.1 Pipe mounting

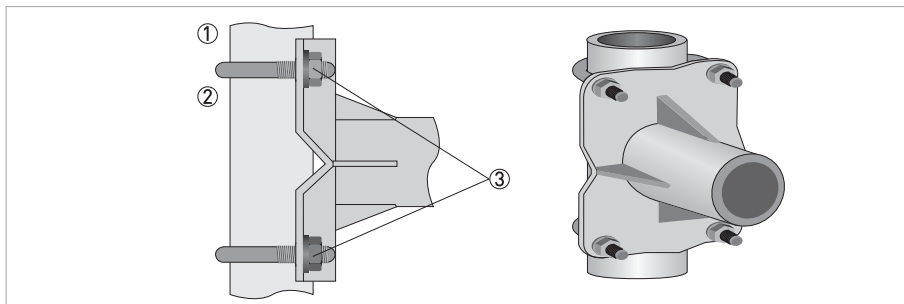


Figure 3-1: Pipe mounting of the field housing



- ① Fix the mounting bracket of the signal converter to the pipe.
- ② Fasten the mounting bracket of the signal converter using standard U-bolts and washers.
- ③ Tighten the nuts.

3.6.2 Wall mounting

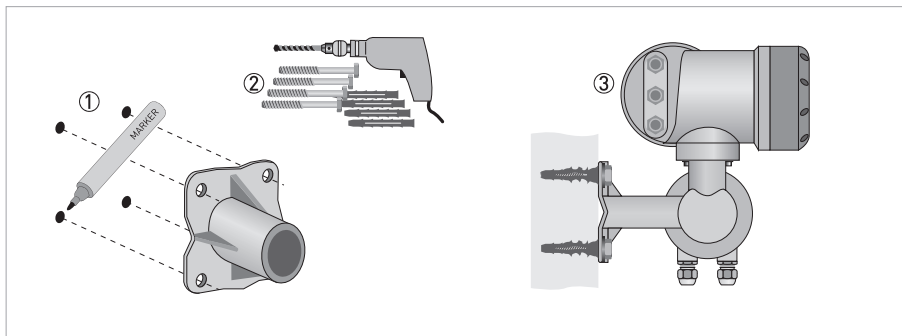


Figure 3-2: Wall mounting of the field housing



- ① Prepare the holes with the aid of the mounting plate. For further information refer to *Mounting plate of field housing* on page 160.
- ② Fasten the mounting plate securely to the wall.
- ③ Screw the mounting bracket of the signal converter to the mounting plate with the nuts and washers.

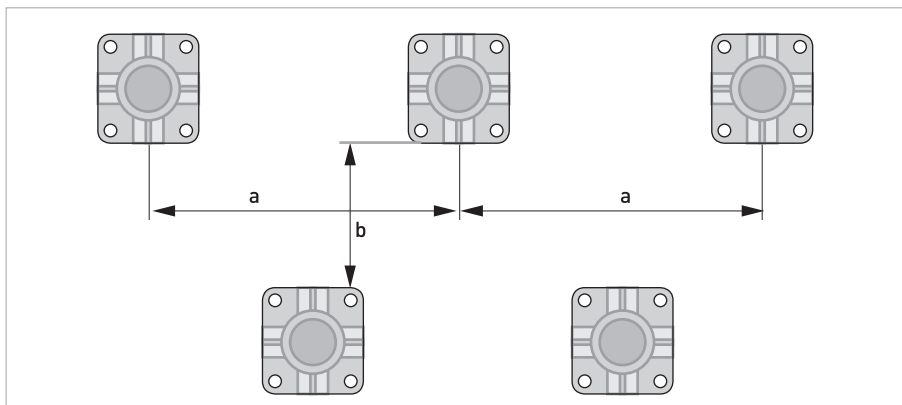


Figure 3-3: Mounting multiple devices next to each other

$a \geq 600 \text{ mm} / 23.6''$

$b \geq 250 \text{ mm} / 9.8''$

3.6.3 Turning the display of the field housing version

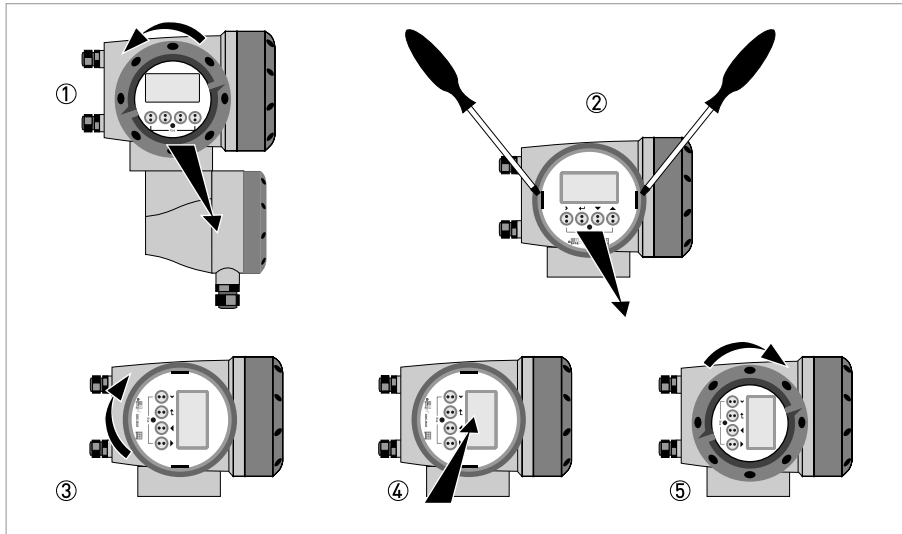


Figure 3-4: Turning the display of the field housing version



The display of the field housing version can be turned in 90° increments

- ① Unscrew the cover from the display and operation control unit.
- ② Using a suitable tool, pull out the two metal puller devices to the left and right of the display.
- ③ Pull out the display between the two metal puller devices and rotate it to the required position.
- ④ Slide the display and then the metal puller devices back into the housing.
- ⑤ Re-fit the cover and tighten it by hand.



CAUTION!

The ribbon cable of the display must not be folded or twisted repeatedly.



INFORMATION!

*Each time a housing cover is opened, the thread should be cleaned and greased.
Use only resin-free and acid-free grease.
Ensure that the housing gasket is properly fitted, clean and undamaged.*

3.7 Mounting the wall-mounted housing, remote version



INFORMATION!

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

3.7.1 Pipe mounting

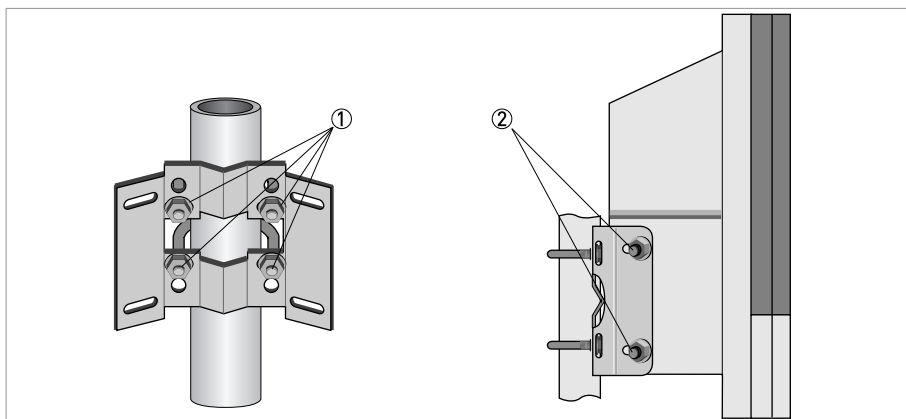


Figure 3-5: Pipe mounting of the wall-mounted housing



- ① Fasten the mounting plate to the pipe with standard U-bolts, washers and fastening nuts.
- ② Screw the signal converter to the mounting plate with the nuts and washers.

3.7.2 Wall mounting

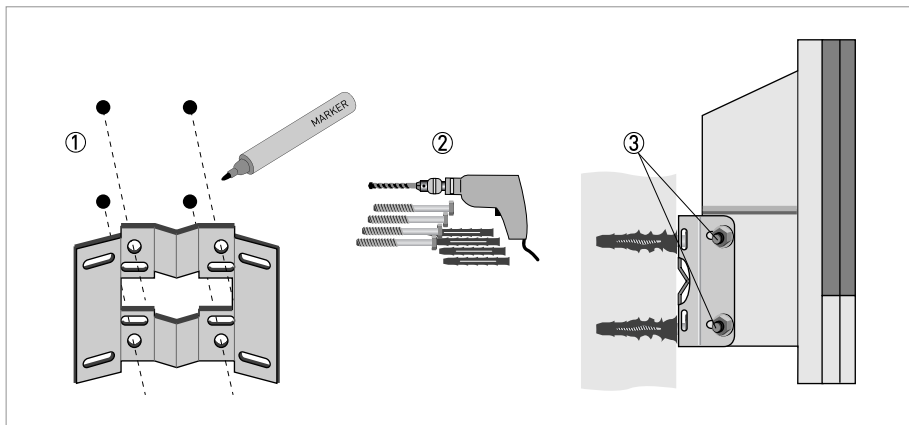


Figure 3-6: Wall mounting of the wall-mounted housing



- ① Prepare the holes with the aid of the mounting plate. For further information refer to *Mounting plate of wall-mounted housing* on page 160.
- ② Fasten the mounting plate securely to the wall.
- ③ Screw the signal converter to the mounting plate with the nuts and washers.

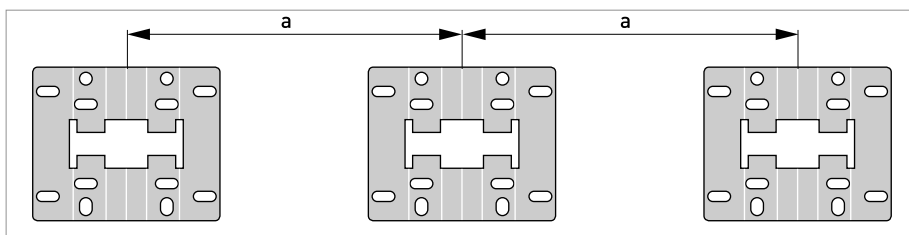


Figure 3-7: Mounting multiple devices next to each other

$a \geq 240 \text{ mm} / 9.4''$

4.1 Safety instructions

**DANGER!**

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

**DANGER!**

Observe the national regulations for electrical installations!

**DANGER!**

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

**WARNING!**

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

**INFORMATION!**

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

4.2 Important notes on electrical connection

**DANGER!**

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.

**DANGER!**

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

**CAUTION!**

- Use suitable cable entries for the various electrical cables.
- The flow sensor and signal converter have been configured together at the factory. For this reason, please connect the devices in pairs. Ensure that the flow sensor constant GK/GKL (refer to nameplates) are identically set.
- If delivered separately or when installing devices that were not configured together, set the signal converter to the DN size and GK/GKL of the flow sensor, refer to Function tables on page 100.

4.3 Electrical cables for remote device versions, notes

4.3.1 Notes on signal cables A and B



INFORMATION!

The signal cables A (type DS 300) with double shield and B (type BTS 300) with triple shield ensure proper transmission of measured values.

Observe the following notes:

- Lay the signal cable with fastening elements.
- It is permissible to lay the signal cable in water or in the ground.
- The insulating material is flame-retardant.
- The signal cable does not contain any halogens and is unplasticized, and remains flexible at low temperatures.
- The connection of the inner shield (10) is carried out via the stranded drain wire (1).
- The connection of the outer shield is carried out via the shield (60) or the stranded drain wire (6), depending on the housing version. Observe the following notes.
- The signal cable type B cannot be used with options with "virtual reference"!

4.3.2 Notes on field current cable C



DANGER!

All versions except TIDALFLUX:

*A non-shielded 3-wire copper cable is sufficient for the field current cable. If you nevertheless use shielded cables, the shield must **NOT** be connected in the housing of the signal converter.*

Only TIDALFLUX:

*A shielded 2-wire copper cable is used for the field current cable. The shielding **MUST** be connected in the housing of the flow sensor and signal converter.*



INFORMATION!

The field current cable is not part of the scope of delivery.

4.3.3 Requirements for signal cables provided by the customer

**INFORMATION!**

If the signal cable was not ordered, it is to be provided by the customer.

The following requirements regarding the electrical values of the signal cable must be observed:

Electrical safety

- According to low voltage directive or equivalent national regulations.

Capacitance of the insulated conductors

- Insulated conductor / insulated conductor < 50 pF/m
- Insulated conductor / shield < 150 pF/m

Insulation resistance

- $R_{ISO} > 100 \text{ G}\Omega \times \text{km}$
- $V_{max} < 24 \text{ V}$
- $I_{max} < 100 \text{ mA}$

Test voltages

- Insulated conductor / inner shield 500 V
- Insulated conductor / insulated conductor 1000 V
- Insulated conductor / outer shield 1000 V

Twisting of the insulated conductors

- At least 10 twists per meter, important for screening magnetic fields.

4.4 Preparing the signal and field current cables (except TIDALFLUX)



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.

The electrical connection of the outer shield is different for the various housing variants. Please observe the corresponding instructions.

4.4.1 Signal cable A (type DS 300), construction

- Signal cable A is a double-shielded cable for signal transmission between the flow sensor and signal converter.
- Bending radius: $\geq 50 \text{ mm} / 2''$

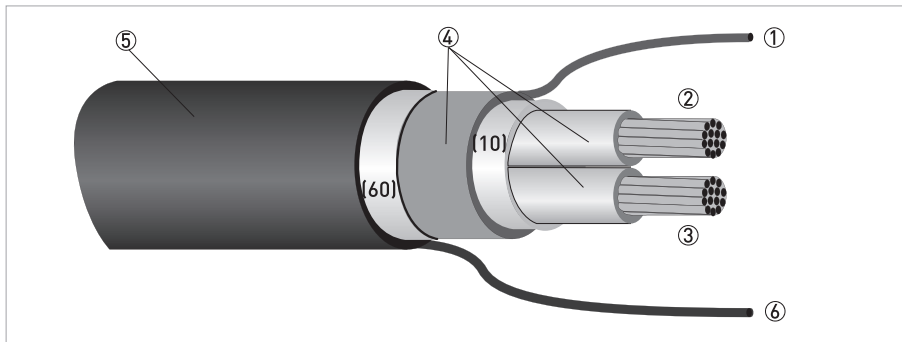


Figure 4-1: Construction of signal cable A (standard version)

- ① Stranded drain wire (1) for the inner shield (10), $1.0 \text{ mm}^2 \text{ Cu} / \text{AWG } 17$ (not insulated, bare)
- ② Insulated wire (2), $0.5 \text{ mm}^2 \text{ Cu} / \text{AWG } 20$
- ③ Insulated wire (3), $0.5 \text{ mm}^2 \text{ Cu} / \text{AWG } 20$
- ④ Insulation layers
- ⑤ Outer sheath
- ⑥ Stranded drain wire (6) for the outer shield (60)

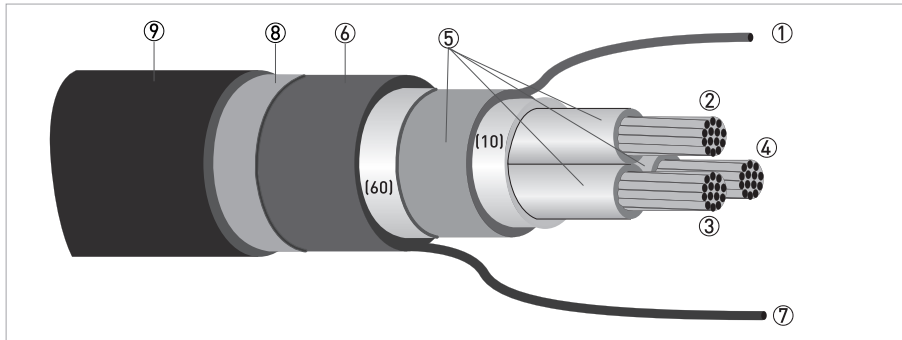


Figure 4-2: Construction of signal cable A (armoured version)

- ① Stranded drain wire (1) for the inner shield (10), 1.0 mm² Cu / AWG 17 (not insulated, bare)
- ② Insulated wire (2), 0.5 mm² Cu / AWG 20
- ③ Insulated wire (3), 0.5 mm² Cu / AWG 20
- ④ Insulated wire (4), 0.5 mm² Cu / AWG 20
- ⑤ Insulation layers
- ⑥ Outer sheath
- ⑦ Stranded drain wire (6) for the outer shield (60)
- ⑧ Armoured braiding layer
- ⑨ Outer jacket

4.4.2 Preparing signal cable A, connection to signal converter

Field housing



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.

- The outer shield (60) is connected in the field housing directly via the shield and a clip.
- Bending radius: $\geq 50 \text{ mm} / 2''$

Required materials:

- PVC insulating tube, $\varnothing 2.5 \text{ mm} / 0.1''$
- Heat-shrinkable tubing
- Wire end ferrule to DIN 46228: E 1.5-8 for the stranded drain wire (1)
- 2 wire end ferrules to DIN 46228: E 0.5-8 for the insulated conductors

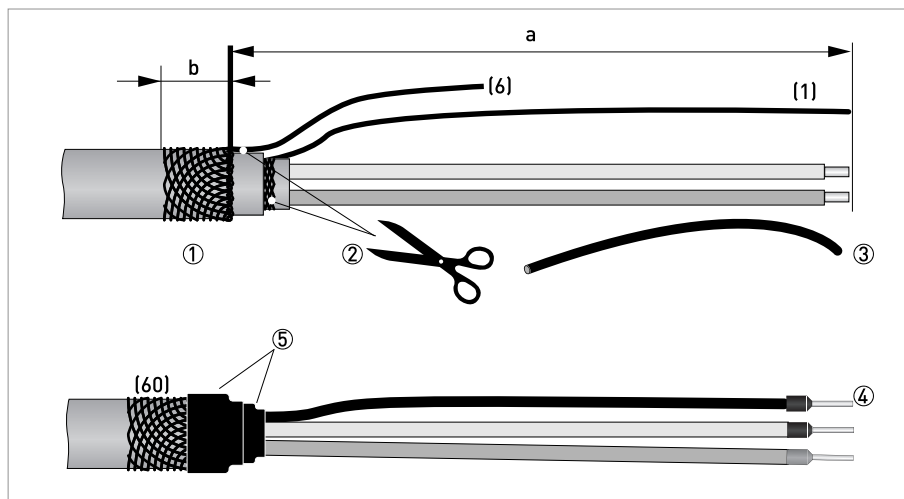


Figure 4-3: Signal cable A, preparation for field housing

$a = 80 \text{ mm} / 3.15''$

$b = 10 \text{ mm} / 0.4''$



- ① Strip the conductor to dimension a.
Trim the outer shield to dimension b and pull it over the outer sheath.
- ② Cut off the inner shield and the stranded drain wire (6). Make sure not to damage the stranded drain wire (1).
- ③ Slide an insulating tube over the stranded drain wire (1).
- ④ Crimp the wire end ferrules onto the conductors and stranded drain wire (1).
- ⑤ Pull the heat-shrinkable tubing over the prepared signal cable.

Wall-mounted housing



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.

- The connection of the outer shield is carried out in the wall-mounted housing via the stranded drain wire (6).
- Bending radius: $\geq 50 \text{ mm} / 2''$

Required materials

- Push-on connector 6.3 mm / 0.25", insulation for conductor $\text{Ø}0.5\text{...}1 \text{ mm}^2 / \text{AWG } 20\text{...}17$
- PVC insulating tube, $\text{Ø}2.5 \text{ mm} / 0.1''$
- Heat-shrinkable tubing
- Wire end ferrule to DIN 46228: E 1.5-8 for the stranded drain wire (1)
- 2 wire end ferrules to DIN 46228: E 0.5-8 for the insulated conductors

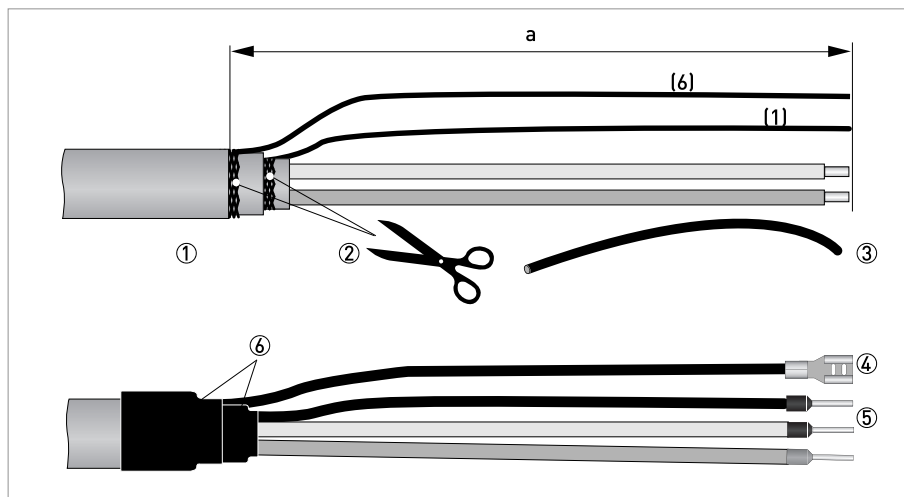


Figure 4-4: Signal cable A, preparation for wall-mounted housing (standard version)

$a = 80 \text{ mm} / 3.15''$



- ① Strip the conductor to dimension a.
- ② Cut off the inner shield and the outer shield. Make sure not to damage the stranded drain wires (1) and (6).
- ③ Slide the insulating tube over the stranded drain wires.
- ④ Crimp the push-on connector onto the stranded drain wire (6).
- ⑤ Crimp the wire end ferrules onto the conductors and stranded drain wire (1).
- ⑥ Pull the heat-shrinkable tubing over the prepared signal cable.

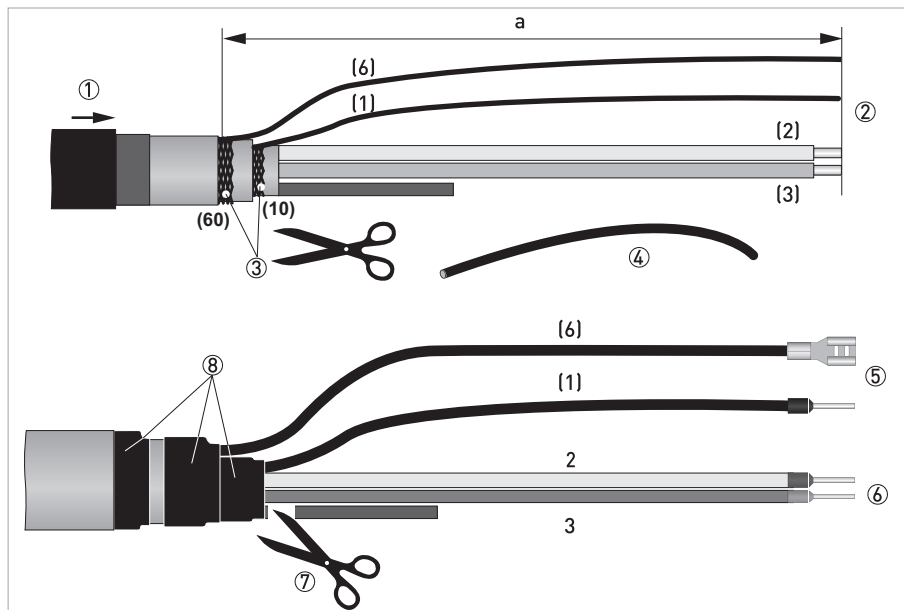


Figure 4-5: Signal cable A, preparation for wall-mounted housing (armoured version)

a = 80 mm / 3.15"



- ① Pull the heat-shrinkable tubing over the signal cable.
- ② Strip the conductor to dimension a.
- ③ Cut off the inner shield (10) and the outer shield (60). Make sure not to damage the stranded drain wires (1), (6).
- ④ Slide the insulating tubes over the stranded drain wires (1), (6).
- ⑤ Crimp the push-on connector onto the stranded drain wire (6).
- ⑥ Crimp the wire end ferrules onto the conductors 2, 3 and stranded drain wire (1).
- ⑦ Cut the outer sheath and armoured layer and isolate with heat-shrinkable tubing.
- ⑧ Shrink the heat-shrinkable tubing.

4.4.3 Length of signal cable A



INFORMATION!

For temperatures of the medium above 150°C / 300°F, a special signal cable and a ZD intermediate socket are necessary. These are available including the changed electrical connection diagrams. The minimal electrical conductivity depends on the type and length of the signal cable used.

Flow sensor	Nominal size		Min. electrical conductivity [µS/cm]	Curve for signal cable A
	DN [mm]	NPS [inch]		
OPTIFLUX 1000 F	10...150	3/8...6	5	A1
OPTIFLUX 2000 F	25...150	1...6	5	A1
	200...2000	8...80	5	A2
OPTIFLUX 4000 F	2.5...150	1/10...6	1	A1
	200...2000	8...80	1	A2
OPTIFLUX 5000 F	2.5...100	1/10...4	1	A1
	150...250	6...10	1	A2
OPTIFLUX 6000 F	2.5...150	1/10...6	1	A1
WATERFLUX 3000 F	25...600	1...24	20	A1
OPTIPROBE F	80...3200	3...128	300	A1

Table 4-1: Length of signal cable A



INFORMATION!

The electrical conductivity for demineralised water is $\geq 20 \mu\text{S/cm}$.

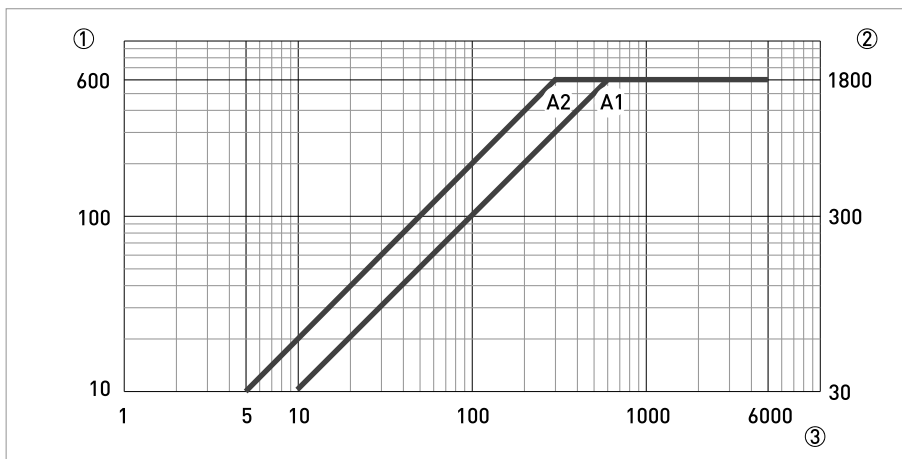


Figure 4-6: Maximum length of signal cable A

- ① Maximum length of signal cable A between the flow sensor and signal converter [m]
- ② Maximum length of signal cable A between the flow sensor and signal converter [ft]
- ③ Electrical conductivity of the medium being measured [µS/cm]

4.4.4 Signal cable B (type BTS 300), construction

- Signal cable B is a triple-shielded cable for signal transmission between the flow sensor and signal converter.
- Bending radius: $\geq 50 \text{ mm} / 2''$

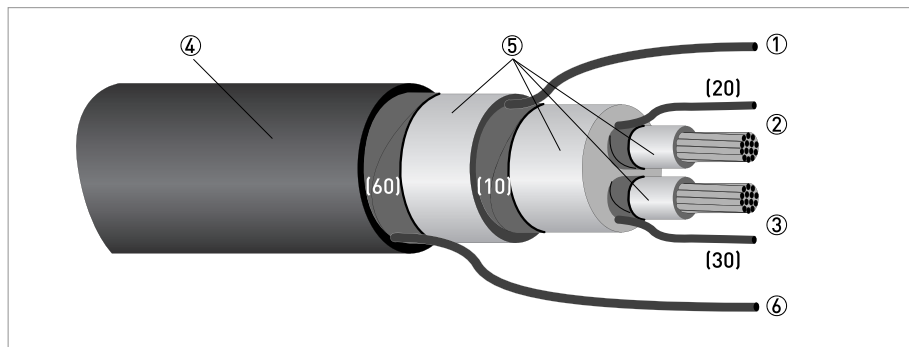


Figure 4-7: Construction of signal cable B

- ① Stranded drain wire for the inner shield (10), $1.0 \text{ mm}^2 \text{ Cu} / \text{AWG } 17$ (not insulated, bare)
- ② Insulated wire (2), $0.5 \text{ mm}^2 \text{ Cu} / \text{AWG } 20$ with stranded drain wire (20) of shield
- ③ Insulated wire (3), $0.5 \text{ mm}^2 \text{ Cu} / \text{AWG } 20$ with stranded drain wire (30) of shield
- ④ Outer sheath
- ⑤ Insulation layers
- ⑥ Stranded drain wire (6) for the outer shield (60), $0.5 \text{ mm}^2 \text{ Cu} / \text{AWG } 20$ (not insulated, bare)

4.4.5 Preparing signal cable B, connection to signal converter

Field housing



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.

- The outer shield (60) is connected in the field housing directly via the shield and a clip.
- Bending radius: $\geq 50 \text{ mm} / 2''$

Required materials

- PVC insulating tube, $\varnothing 2.0 \dots 2.5 \text{ mm} / 0.08 \dots 0.1''$
- Heat-shrinkable tubing
- Wire end ferrule to DIN 46228: E 1.5-8 for the stranded drain wire (1)
- 4 wire end ferrules to DIN 46228: E 0.5-8 for the insulated conductors 2 and 3 and the stranded drain wires (20, 30)

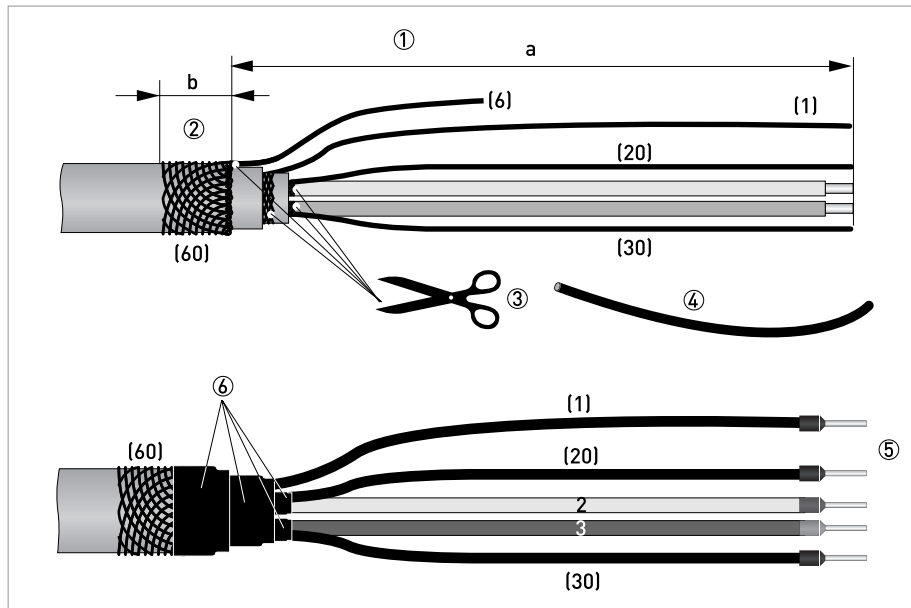


Figure 4-8: Signal cable B, preparation for field housing

a = 80 mm / 3.15"

b = 10 mm / 0.4"



- ① Strip the conductor to dimension a.
- ② Trim the outer shield to dimension b and pull it over the outer sheath.
- ③ Cut off the inner shield, the stranded drain wire (6) and the shields of the insulated conductors. Make sure not to damage the stranded drain wires (1, 20, 30).
- ④ Slide the insulating tube over the stranded drain wires (1, 20, 30).
- ⑤ Crimp the wire end ferrules onto the conductors and stranded drain wires.
- ⑥ Pull the heat-shrinkable tubing over the prepared signal cable.

Wall-mounted housing



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.

- The connection of the outer shield is carried out in the wall-mounted housing via the stranded drain wire (6).
- Bending radius: $\geq 50 \text{ mm} / 2''$

Required materials:

- Push-on connector 6.3 mm / 0.25", insulation for conductor $\text{Ø}0.5\text{...}1 \text{ mm}^2 / \text{AWG } 20\text{...}17$
- PVC insulating tube, $\text{Ø}2.5 \text{ mm} / 0.1''$
- Heat-shrinkable tubing
- Wire end ferrule to DIN 46228: E 1.5-8 for the stranded drain wire (1)
- 4 wire end ferrules to DIN 46228: E 0.5-8 for insulated conductors 2 and 3 and the stranded drain wires (20, 30)

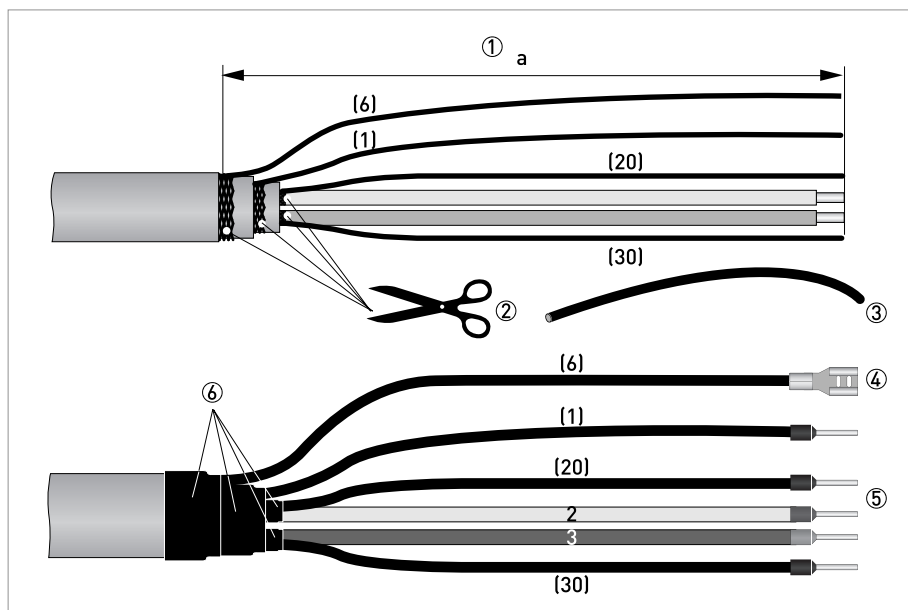


Figure 4-9: Signal cable B, preparation for wall-mounted housing

$a = 80 \text{ mm} / 3.15''$



- ① Strip the conductor to dimension a.
- ② Cut off the inner shield, the outer shield and the shields for the conductor (2, 3). Make sure not to damage the stranded drain wires (1, 6, 20, 30).
- ③ Slide the insulating tube over the stranded drain wires.
- ④ Crimp the push-on connector onto the stranded drain wire (6).
- ⑤ Crimp the wire end ferrules onto the conductors and stranded drain wires (1, 20, 30).
- ⑥ Pull the heat-shrinkable tubing over the prepared signal cable.

4.4.6 Length of signal cable B



INFORMATION!

For temperatures of the medium above 150°C / 300°F, a special signal cable and a ZD intermediate socket are necessary. These are available including the changed electrical connection diagrams. The minimal electrical conductivity depends on the type and length of the signal cable used.

Flow sensor	Nominal size		Min. electrical conductivity [μS/cm]	Curve for signal cable B
	DN [mm]	NPS [inch]		
OPTIFLUX 1000 F	10...150	3/8...6	5	B2
OPTIFLUX 2000 F	25...150	1...6	5	B3
	200...2000	8...80	5	B4
OPTIFLUX 4000 F	2.5...15 (VN02)	1/10...1/2	10	B1
	10...150	3/8...6	1	B3
	200...2000	8...80	1	B4
OPTIFLUX 5000 F	2.5	1/10	10	B1
	4...15	1/6...1/2	5	B2
	25...100	1...4	1	B3
	150...250	6...10	1	B4
OPTIFLUX 6000 F	2.5...15	1/10...1/2	10	B1
	25...150	1...6	1	B3
WATERFLUX 3000 F	25...600	1...24	20	B1
OPTIPROBE F	80...3200	3...128	300	B1

Table 4-2: Length of signal cable B



INFORMATION!

The electrical conductivity for demineralised water is $\geq 20 \mu\text{S/cm}$.

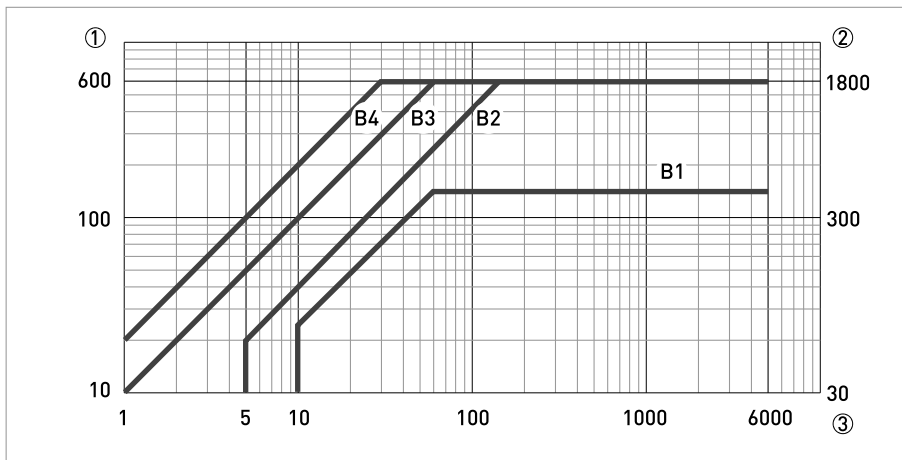


Figure 4-10: Maximum length of signal cable B

- ① Maximum length of signal cable B between the flow sensor and signal converter [m]
- ② Maximum length of signal cable B between the flow sensor and signal converter [ft]
- ③ Electrical conductivity of the medium being measured [μS/cm]

4.4.7 Preparing field current cable C, connection to signal converter



DANGER!

A non-shielded 3-wire copper cable is sufficient for the field current cable. If you nevertheless use shielded cables, the shield must **NOT** be connected in the housing of the signal converter.



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.

- Field current cable C is not part of the scope of delivery.
- Bending radius: $\geq 50 \text{ mm} / 2''$

Required materials:

- Shielded 3-wire copper cable with suitable heat-shrinkable tubing
- Wire end ferrules to DIN 46228: size according to the cable being used

Length		Cross-section A_F (Cu)	
[m]	[ft]	[mm ²]	[AWG]
0...150	0...492	3 x 0.75 Cu ①	3 x 18
150...300	492...984	3 x 1.5 Cu ①	3 x 14
300...600	984...1968	3 x 2.5 Cu ①	3 x 12

Table 4-3: Length and cross-section of field current cable C

① Cu = copper cross-section

In the wall-mounted housing version the connection terminals are designed for the following cable cross-sections:

- Flexible cable $\leq 1.5 \text{ mm}^2$ / AWG 14
- Solid cable $\leq 2.5 \text{ mm}^2$ / AWG 12

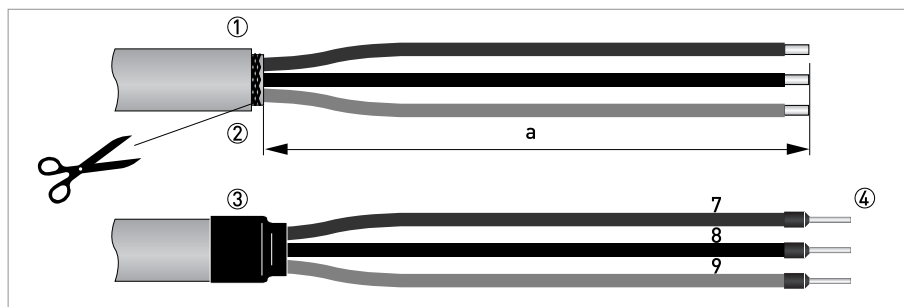


Figure 4-11: Field current cable C, preparation for the signal converter

a = 80 mm / 3.15"



- ① Strip the conductor to dimension a.
- ② Remove any shield that is present.
- ③ Pull a shrinkable tube over the prepared cable.
- ④ Crimp the wire end ferrules onto the conductors 7, 8 and 9.

4.4.8 Preparing signal cable A, connection to flow sensor



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.

- The outer shield (60) is connected in the terminal compartment of the flow sensor directly via the shield and a clip.
- Bending radius: $\geq 50 \text{ mm} / 2''$

Required materials

- PVC insulating tube, $\varnothing 2.0 \dots 2.5 \text{ mm} / 0.08 \dots 0.1''$
- Heat-shrinkable tubing
- Wire end ferrule to DIN 46228: E 1.5-8 for the stranded drain wire (1)
- 2 wire end ferrules to DIN 46228: E 0.5-8 for the insulated conductors 2, 3

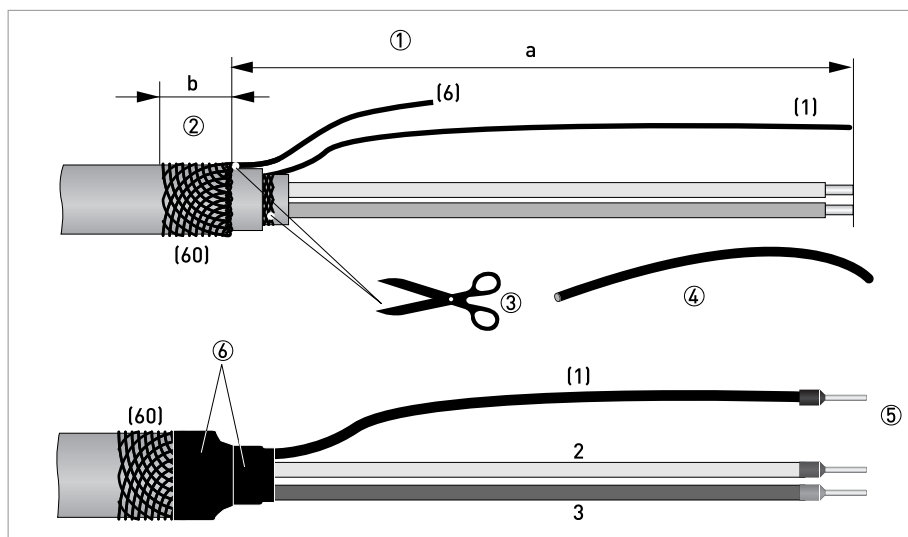


Figure 4-12: Preparing signal cable A, connection to flow sensor

$a = 50 \text{ mm} / 2''$

$b = 10 \text{ mm} / 0.4''$



- ① Strip the conductor to dimension a.
- ② Trim the outer shield (60) to dimension b and pull it over the outer sheath.
- ③ Remove the stranded drain wire (6) of the outer shield and the inner shield. Make sure not to damage the stranded drain wire (1) of the inner shield.
- ④ Slide an insulating tube over the stranded drain wire (1).
- ⑤ Crimp the wire end ferrules onto conductors 2 and 3 and the stranded drain wire (1).
- ⑥ Pull the heat-shrinkable tubing over the prepared signal cable.

4.4.9 Preparing signal cable B, connection to flow sensor

**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.

- The outer shield (60) is connected in the terminal compartment of the flow sensor directly via the shield and a clip.
- Bending radius: $\geq 50 \text{ mm} / 2''$

Required materials

- PVC insulating tube, $\varnothing 2.0 \dots 2.5 \text{ mm} / 0.08 \dots 0.1''$
- Heat-shrinkable tubing
- Wire end ferrule to DIN 46228: E 1.5-8 for the stranded drain wire (1)
- 2 wire end ferrules to DIN 46228: E 0.5-8 for the insulated conductors (2, 3)

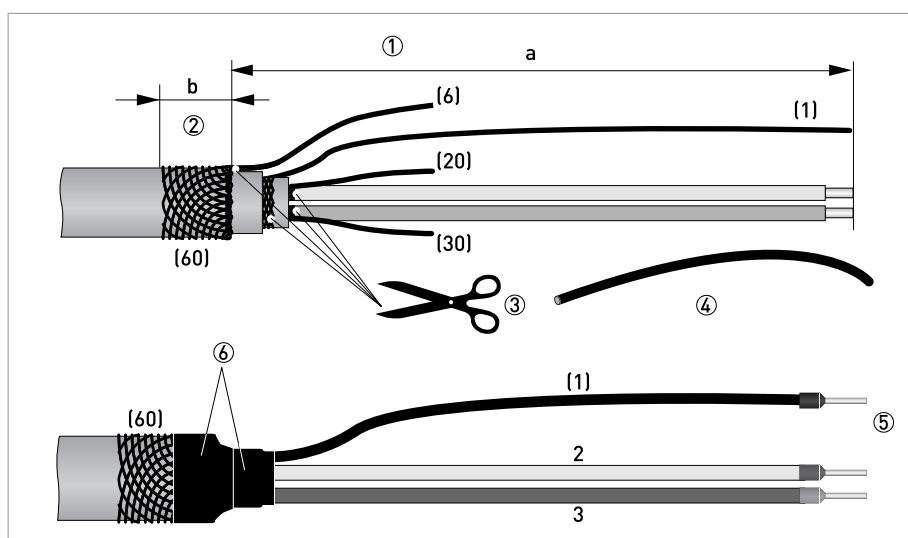


Figure 4-13: Preparing signal cable B, connection to flow sensor

$a = 50 \text{ mm} / 2''$

$b = 10 \text{ mm} / 0.4''$



- ① Strip the conductor to dimension a.
- ② Trim the outer shield (60) to dimension b and pull it over the outer sheath.
- ③ Remove the stranded drain wire (6) of the outer shield and the shields and stranded drain wires of the insulated conductors (2, 3). Remove the inner shield. Be sure not to damage the stranded drain wire (1).
- ④ Slide an insulating tube over the stranded drain wire (1).
- ⑤ Crimp the wire end ferrules onto conductors 2 and 3 and the stranded drain wire (1).
- ⑥ Pull the heat-shrinkable tubing over the prepared signal cable.

4.4.10 Preparing field current cable C, connection to flow sensor



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.

- Field current cable C is not part of the scope of delivery.
- The shield for field current cable C can be connected to the flow sensor.
- Bending radius: $\geq 50 \text{ mm} / 2''$

Required materials

- Heat-shrinkable tubing
- 3 wire end ferrules to DIN 46228: size according to the cable being used

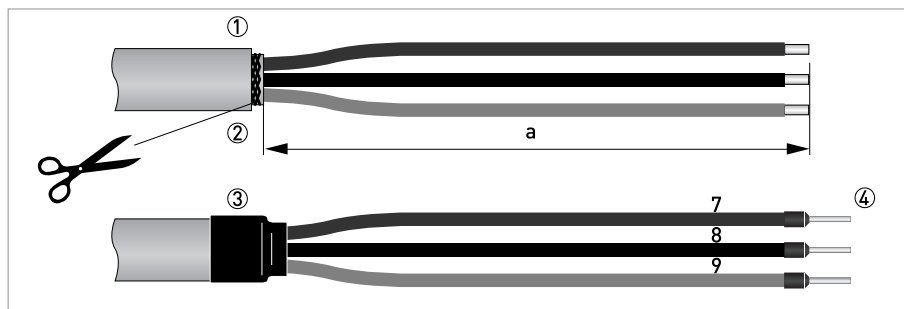


Figure 4-14: Field current cable C, preparation for the flow sensor

$a = 50 \text{ mm} / 2''$



- ① Strip the conductor to dimension a.
- ② Remove any shield that is present.
- ③ Pull a shrinkable tube over the prepared cable.
- ④ Crimp the wire end ferrules onto the conductors 7, 8 and 9.

4.5 Connecting the signal and field current cables (except TIDALFLUX)



DANGER!

Cables may only be connected when the power is switched off.



DANGER!

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



DANGER!

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



WARNING!

Observe without fail the local occupational health and safety regulations.

Any work done on the electrical components of the measuring device may only be carried out by properly trained specialists.

4.5.1 Connecting the signal and field current cables, field housing

- The outer shield of signal cable A and/or B is connected electrically with the housing via the clip of the strain relief.
- If a shielded field current cable is used, the shield must **NOT** be connected in the housing of the signal converter.
- Bending radius: $\geq 50 \text{ mm} / 2''$

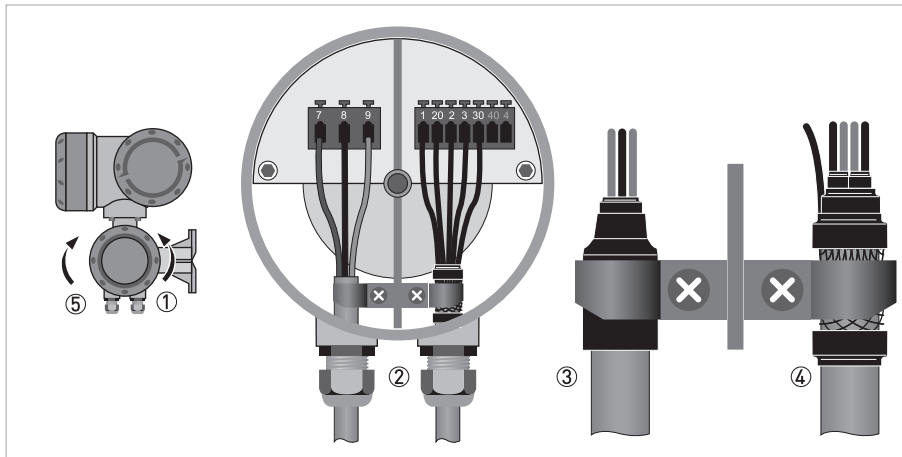


Figure 4-15: Electrical connection of the signal and field current cables, field housing



- ① Unscrew the terminal compartment cover.
- ② Pass the prepared signal and field current cables through the cable entries and connect the corresponding stranded drain wires and conductors.
- ③ Secure the field current cable using the clip.
Any shield that is present must **NOT** be connected.
- ④ Secure the signal cable using the clip. This also connects the outer shield to the housing.
- ⑤ Re-fit the cover and tighten it by hand.



INFORMATION!

Each time a housing cover is opened, the thread should be cleaned and greased.

Use only resin-free and acid-free grease.

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

Wire colour	Wire number	Signal converter terminal	Function
White	2	2	Sensor electrode 1
Red	3	3	Sensor electrode 2
Braided shield drain wire	[1]	1	Inner shield for electrode 1 and 2
Braided shield	[60]	Housing clip strain relief	Outer shield for double shielding cable

Table 4-4: Signal cable A (DS300-2)

Wire colour	Wire number	Signal converter terminal	Function
White	2	2	Sensor electrode 1
Stranded drain wire	[20]	20	Bootstrap shield for electrode 1
Red	3	3	Sensor electrode 2
Stranded drain wire	[30]	30	Bootstrap shield for electrode 2
Braided shield drain wire	1	1	Inner shield for double shielding electrode 1 and 2
Braided shield	[60]	Housing clip strain relief	Outer shield for triple shielding cable

Table 4-5: Signal cable B (BTS300-2)

**INFORMATION!**

- For 3-wire signal cables DS300-3 and BTS300-3, connect the green wire to the signal converter connector 4 and the corresponding drain wire to the connector 40.
- For armoured DS300 cables, do **NOT** connect the armour shield to the housing. Electrically isolated from housing and electronics.

Wire colour	Wire number	Signal converter terminal	Function
White	7	7	Coil 1
Green	8	8	Coil 2
Red	9	9	Middle branch coil 1 and coil 2 ①
Braided shield		DO NOT CONNECT	Braided armour only for mechanical cable protection ①

Table 4-6: Current cable C (coil cable)

① Optional

4.5.2 Connecting the signal and field current cables, wall-mounted housing

- The outer shield of signal cable A and/or B is connected via the stranded drain wire.
- If a shielded field current cable is used, the shield must **NOT** be connected in the housing of the signal converter.
- Bending radius: $\geq 50 \text{ mm} / 2''$

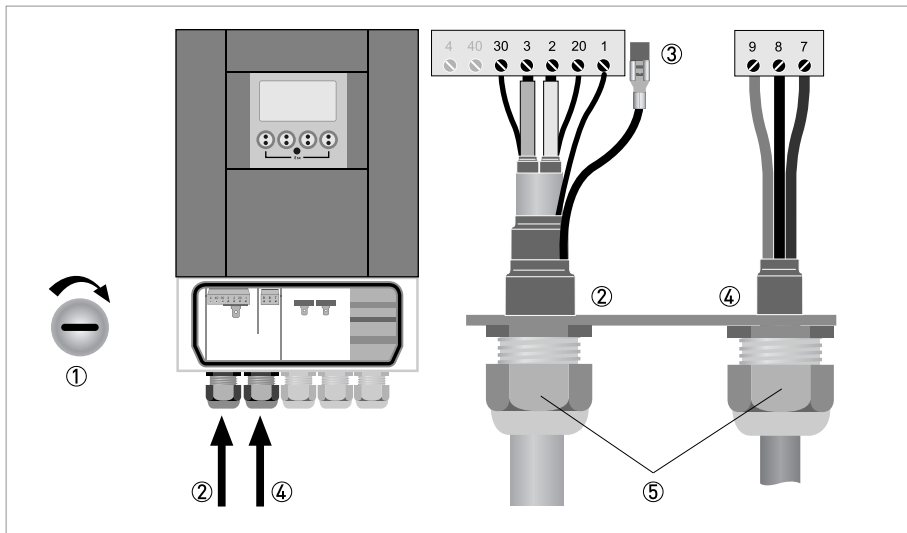


Figure 4-16: Electrical connection of the signal and field current cables, wall-mounted housing



- ① Open the housing cover.
- ② Pass the prepared signal cable through the cable entry and connect the corresponding stranded drain wires and conductors.
- ③ Connect the stranded drain wire of the outer shield.
- ④ Pass the prepared field current cable through the cable entry and connect the corresponding conductor.
Any shield that is present must **NOT** be connected.
- ⑤ Tighten the screw connections of the cable entry and close the housing cover.



INFORMATION!

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

Wire colour	Wire number	Signal converter terminal	Function
White	2	2	Sensor electrode 1
Red	3	3	Sensor electrode 2
Braided shield drain wire	[1]	1	Inner shield for shielding electrode 1 and 2
Braided shield drain wire	[6] ①	Housing clip	Outer shield for double shielding cable

Table 4-7: Signal cable A (DS300-2)

- ① With push-on connector

Wire colour	Wire number	Signal converter terminal	Function
White	2	2	Sensor electrode 1
Stranded drain wire	[20]	20	Bootstrap shield for electrode 1
Red	3	3	Sensor electrode 2
Stranded drain wire	[30]	30	Bootstrap shield for electrode 2
Braided shield drain wire	1	1	Inner shield for double shielding electrode 1 and 2
Braided shield drain wire	[6] ①	Housing clip	Outer shield for triple shielding cable

Table 4-8: Signal cable B (BTS300-2)

① With push-on connector

**INFORMATION!**

- For 3-wire signal cables DS300-3 and BTS300-3, connect the green wire to the signal converter connector 4 and the corresponding drain wire to the connector 40.
- For armoured DS300 cables, do **NOT** connect the armour shield to the housing nor the electronics!

Wire colour	Wire number	Signal converter terminal	Function
White	7	7	Coil 1
Green	8	8	Coil 2
Red	9	9	Middle branch coil 1 and coil 2 ①
Braided shield		DO NOT CONNECT	Braided armour only for mechanical cable protection ①

Table 4-9: Current cable C (coil cable)

① Optional

4.5.3 Connecting the signal and field current cables, 19" rack-mounted housing (21 TE)

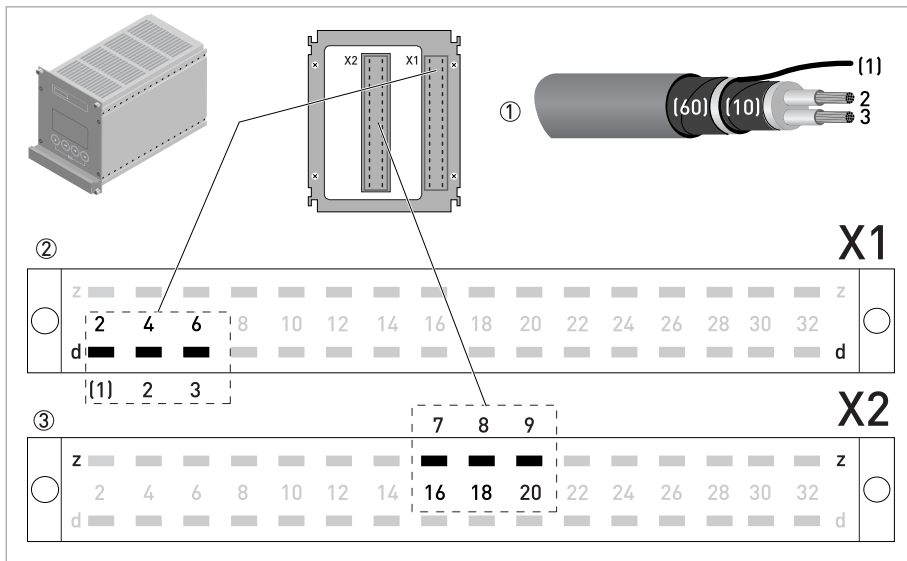


Figure 4-17: Connection signal cable A and field current cable

- ① Signal cable A
- ② Shield and insulated wires 2 and 3
- ③ Field current cable

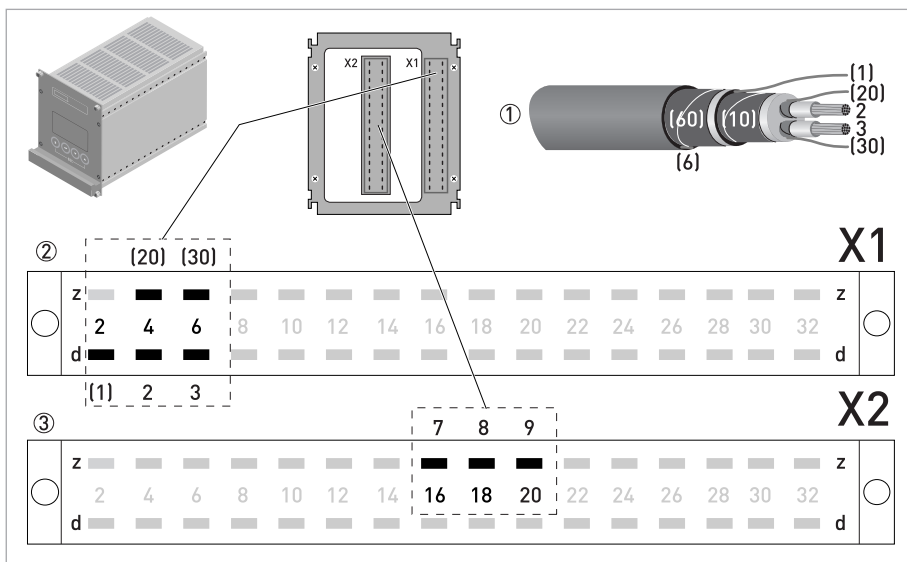


Figure 4-18: Connection signal cable B and field current cable

- ① Signal cable B
- ② Shield and insulated wires 2 and 3
- ③ Field current cable

Wire colour	Wire number	Signal converter terminal	Function
White	2	d-4	Sensor electrode 1
Red	3	d-6	Sensor electrode 2
Braided shield drain wire	[1]	d-2	Inner shield for electrode 1 and 2
Braided shield drain wire	[6]	Housing	Outer shield for double shielding cable

Table 4-10: Signal cable A (DS300-2)

Wire colour	Wire number	Signal converter terminal	Function
White	2	d-4	Sensor electrode 1
Stranded drain wire	[20]	z-4	Bootstrap shield for electrode 1
Red	3	d-6	Sensor electrode 2
Stranded drain wire	[30]	z-6	Bootstrap shield for electrode 2
Braided shield drain wire	[1]	d-2	Inner shield for double shielding electrode 1 and 2
Braided shield drain wire	[6]	Housing	Outer shield for triple shielding cable

Table 4-11: Signal cable B (BTS300-2)

**INFORMATION!**

- For 3-wire signal cables DS300-3 and BTS300-3, connect the green wire to the signal converter connector d-8 and the corresponding drain wire to the connector z-8.
- For armoured DS300 cables, do **NOT** connect the armour shield to the housing nor the electronics!

Wire colour	Wire number	Signal converter terminal	Function
White	7	z-16	Coil 1
Green	8	z-18	Coil 2
Red	9	z-20	Middle branch coil 1 and coil 2 ①
Braided shield		DO NOT CONNECT	Braided armour only for mechanical cable protection ①

Table 4-12: Current cable C (coil cable)

① Optional

4.5.4 Connection diagram for flow sensor, field housing



DANGER!

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

- If a shielded field current cable is used, the shield must **NOT** be connected in the housing of the signal converter.
- The outer shield of signal cable A or B in the signal converter housing is connected via the strain relief terminal.
- Bending radius of signal and field current cable: $\geq 50 \text{ mm} / 2''$
- The following illustration is schematic. The positions of the electrical connection terminals may vary depending on the housing version.

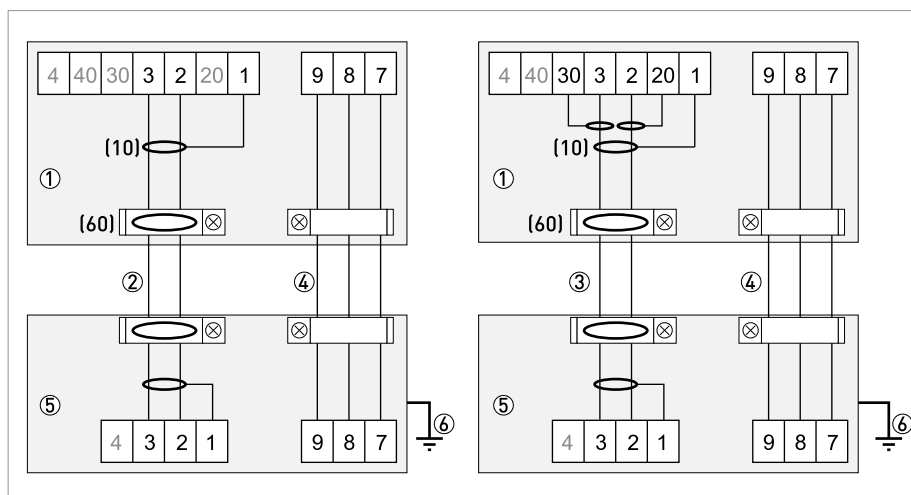


Figure 4-19: Connection diagram for flow sensor, field housing

- ① Electrical terminal compartment in housing of the signal converter for signal and field current cable
- ② Signal cable A (type DS 300)
- ③ Signal cable B (type BTS 300)
- ④ Field current cable C (type LiYCY)
- ⑤ Connection box of flow sensor
- ⑥ Functional ground FE
- (10) inner cable shield
- (60) outer cable shield

4.5.5 Connection diagram for flow sensor, wall-mounted housing

**DANGER!**

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

- If a shielded field current cable is used, the shield must **NOT** be connected in the housing of the signal converter.
- The outer shield of the signal cable is connected in the signal converter housing via the stranded drain wire.
- Bending radius of signal and field current cable: $\geq 50 \text{ mm} / 2''$
- The following illustration is schematic. The positions of the electrical connection terminals may vary depending on the housing version.

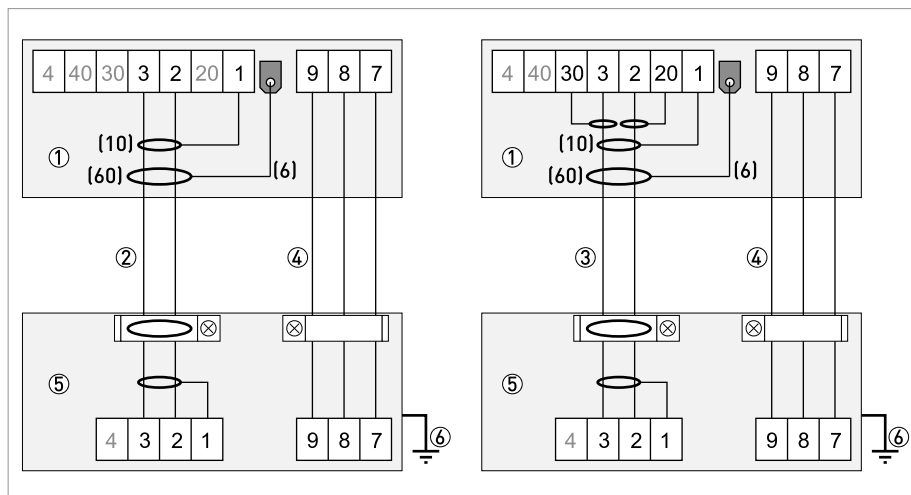


Figure 4-20: Connection diagram for flow sensor, wall-mounted housing

- ① Electrical terminal compartment in housing of the signal converter for signal and field current cable
- ② Signal cable A (type DS 300)
- ③ Signal cable B (type BTS 300)
- ④ Field current cable C (type LiYCY)
- ⑤ Connection box of flow sensor
- ⑥ Functional ground FE
- (10) inner cable shield
- (60) outer cable shield
- (6) wire from outer cable shield

4.5.6 Connection diagram for flow sensor, 19" rack-mounted housing (21 TE)



DANGER!

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

- If a shielded field current cable is used, the shield must **NOT** be connected in the housing of the signal converter.
- The outer shield of the signal cable is connected in the signal converter housing via the stranded drain wire.
- Bending radius of signal and field current cable: $\geq 50 \text{ mm} / 2''$
- The following illustration is schematic. The positions of the electrical connection terminals may vary depending on the housing version.

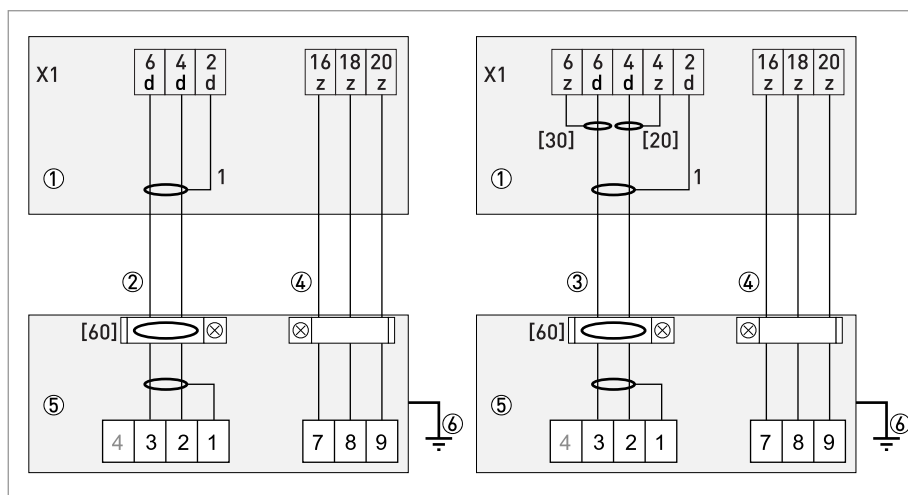


Figure 4-21: Connection diagram for flow sensor, 19" rack-mounted housing (21 TE)

- ① Electrical terminal compartment in housing of the signal converter for signal and field current cable
- ② Signal cable A (type DS 300)
- ③ Signal cable B (type BTS 300)
- ④ Field current cable C (type LiYCY)
- ⑤ Connection box of flow sensor
- ⑥ Functional ground FE
- [20] wire 2 shield
- [30] wire 3 shield
- [60] outer cable shield

4.6 Electrical connection only for TIDALFLUX 2000

**INFORMATION!**

For the connection diagrams and all relevant details for connection of the TIDALFLUX 2000 please refer to the manual of the TIDALFLUX 2000.

4.7 Grounding the flow sensor

4.7.1 Classical method

**CAUTION!**

There should be no difference in potential between the flow sensor and the housing or protective earth of the signal converter!

- The flow sensor must be properly grounded.
- The grounding cable should not transmit any interference voltages.
- Do not use the grounding cable to connect any other electrical devices to ground at the same time.
- In hazardous areas, grounding is used at the same time for equipotential bonding. Additional grounding instructions are provided in the supplementary "Ex documentation", which are only supplied together with hazardous area equipment.
- The flow sensors are connected to ground by means of a functional grounding conductor FE.
- Special grounding instructions for the various flow sensors are provided in the separate documentation for the flow sensor.
- The documentation for the flow sensor also contain descriptions on how to use grounding rings and how to install the flow sensor in metal or plastic pipes or in pipes which are coated on the inside.

4.7.2 Virtual reference (not valid for TIDALFLUX 2000, OPTIFLUX 7300 C, OPTIPROBE)

For pipelines which are electrically insulated on the inside (e.g. have an inner liner or are made completely out of plastic), it is also possible to measure without additional grounding rings or electrodes.

The signal converter input amplifier records the potentials of both measuring electrodes and a patented method is used to create a voltage which corresponds to the potential of the ungrounded medium. This voltage is then the reference potential for signal processing.

That means there are no interfering potential differences between the reference potential and the measuring electrodes during signal processing.

Ungrounded use is also possible for systems with voltages and currents in the pipelines, e.g. electrolysis and galvanic systems.



INFORMATION!

If there is a virtual reference with wall housing, voltage is permitted between PE/FE of the signal converter and the flow sensor!

Size	≥ DN10 / ≥ NPS3/8
Electrical conductivity	≥ 200 μS/cm
Signal cable	Use only A (type DS 300)
Signal cable length	≤ 50 m / ≤ 164 ft

Table 4-13: Thresholds for measuring operation with the virtual reference

4.8 Connecting power - all housing variants



DANGER!

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



DANGER!

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

- The protection category depends on the housing versions (IP65...67 or NEMA4/4X/6).
- The housings of the devices, which are designed to protect the electronic equipment from dust and moisture, should be kept well closed at all times. Creepage distances and clearances are dimensioned to VDE 0110 and IEC 60664 for pollution severity 2. Supply circuits are designed for overvoltage category III and the output circuits for overvoltage category II.
- Fuse protection ($I_N \leq 16 \text{ A}$) for the infeed power circuit, as well as a separator (switch, circuit breaker) to isolate the signal converter should be provided for the device in accordance with applicable regulations. The separator must be marked as the separator for this device.

100...230 VAC (tolerance range: -15% / +10%)

- Note the power supply voltage and frequency (50...60 Hz) on the nameplate.
- The protective ground terminal **PE** of the power supply must be connected to the separate U-clamp terminal in the terminal compartment of the signal converter.
For 19" rack-mounted housing please refer to the connection diagrams.

**INFORMATION!**

240 VAC + 5% is included in the tolerance range.

12...24 VDC (tolerance range for 24 VDC: -55% / +30%)

- Note the data on the nameplate!

**INFORMATION!**

12 VDC - 10% is included in the tolerance range.

24 VAC/DC (tolerance range: AC: -15% / +10%; DC: -25% / +30%)

- AC: Note the power supply voltage and frequency (50...60 Hz) on the nameplate.
- DC: Note the power supply voltage on the nameplate.

**INFORMATION!**

*12 V is **not** included in the tolerance range.*

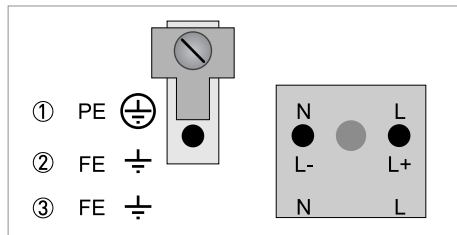


Figure 4-22: Power supply connection (excluding 19" rack-mounted housing)

- ① 100...230 VAC [-15% / +10%], 22 VA
- ② 24 VDC [-55% / +30%], 12 W
- ③ 24 VAC/DC (AC: -15% / +10%; DC: -25% / +30%), 22 VA or 12 W

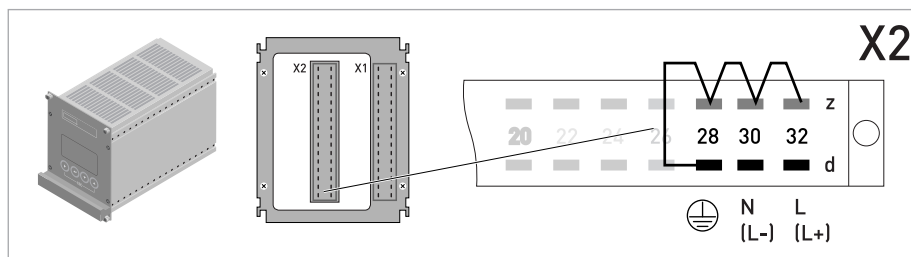


Figure 4-23: Power supply connection for rack-mounted housing (21 TE)



INFORMATION!

For safety reasons the manufacturer has connected the 28d contacts internally to the 28z, 30z and 32z contacts. You are advised to also connect contacts 28z, 30z and 32z to the external protective conductor.



CAUTION!

The protective conductor contacts must not be used to loop through the PE connection.

4.9 Inputs and outputs, overview

4.9.1 Combinations of the inputs/outputs (I/Os)

This signal converter is available with various input/output combinations.

Basic version

- Has 1 current output, 1 pulse output and 2 status outputs / limit switches.
- The pulse output can be set as status output/limit switch and one of the status outputs as a control input.

Ex i version

- Depending on the task, the device can be configured with various output modules.
- Current outputs can be active or passive.
- Optionally available also with Foundation Fieldbus and Profibus PA.

Modular version

- Depending on the task, the device can be configured with various output modules.

Bus systems

- The device allows intrinsically safe and non-intrinsically safe bus interfaces in combination with additional modules.
- For connection and operation of bus systems, please note the separate documentation.

Ex option

- For hazardous areas, all of the input/output variants for the compact and field (remote) housings with terminal compartment in the Ex d (pressure-resistant casing) or Ex e (increased safety) versions can be delivered.
- Please refer to the separate instructions for connection and operation of the Ex devices.

4.9.2 Description of the CG number

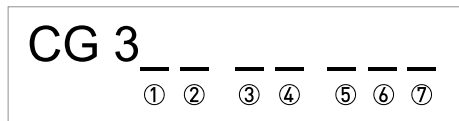


Figure 4-24: Marking (CG number) of the electronics module and input/output variants

- ① ID number: 0
- ② ID number: 0 = standard; 9 = special
- ③ Power supply option / flow sensor option
- ④ Display (language versions)
- ⑤ Input/output version (I/O)
- ⑥ 1st optional module for connection terminal A
- ⑦ 2nd optional module for connection terminal B

The last 3 digits of the CG number (⑤ , ⑥ and ⑦) indicate the assignment of the terminal connections. Please refer to the following examples.

CG 300 11 100	100...230 VAC & standard display; Basic I/O: I_a or I_p & S_p/C_p & S_p & P_p/S_p
CG 300 11 7FK	100...230 VAC & standard display; Modular I/O: I_a & P_N/S_N and optional module P_N/S_N & C_N
CG 300 81 4EB	24 VDC & standard display; Modular I/O: I_a & P_a/S_a and optional module P_p/S_p & I_p

Table 4-14: Examples for CG number

Abbreviation	Identifier for CG no.	Description
I_a	A	Active current output
I_p	B	Passive current output
P_a / S_a	C	Active pulse output, frequency output, status output or limit switch (changeable)
P_p / S_p	E	Passive pulse output, frequency output, status output or limit switch (changeable)
P_N / S_N	F	Passive pulse output, frequency output, status output or limit switch according to NAMUR (changeable)
C_a	G	Active control input
C_p	K	Passive control input
C_N	H	Active control input to NAMUR Signal converter monitors cable breaks and short circuits according to IEC 60947-5-6.
IIn_a	P	Active current input
IIn_p	R	Passive current input
-	8	No additional module installed
-	0	No further module possible

Table 4-15: Description of abbreviations and CG identifier for possible optional modules on terminals A and B

4.9.3 Fixed, non-alterable input/output versions

This signal converter is available with various input/output combinations.

- The grey boxes in the tables denote unassigned or unused connection terminals.
- In the table, only the final digits of the CG no. are depicted.
- Connection terminal A+ is only operable in the basic input/output version.

CG no.	Connection terminals								
	A+	A	A-	B	B-	C	C-	D	D-

Basic I/O (standard)

1 0 0		$I_p + \text{HART}^{\text{®}}$ passive ①	S_p / C_p passive ②	S_p passive	P_p / S_p passive ②
		$I_a + \text{HART}^{\text{®}}$ active ①			

Ex i I/O (option)

2 0 0				$I_a + \text{HART}^{\text{®}}$ active	P_N / S_N NAMUR ②
3 0 0				$I_p + \text{HART}^{\text{®}}$ passive	P_N / S_N NAMUR ②
2 1 0		I_a active	P_N / S_N NAMUR C_p passive ②	$I_a + \text{HART}^{\text{®}}$ active	P_N / S_N NAMUR ②
3 1 0		I_a active	P_N / S_N NAMUR C_p passive ②	$I_p + \text{HART}^{\text{®}}$ passive	P_N / S_N NAMUR ②
2 2 0		I_p passive	P_N / S_N NAMUR C_p passive ②	$I_a + \text{HART}^{\text{®}}$ active	P_N / S_N NAMUR ②
3 2 0		I_p passive	P_N / S_N NAMUR C_p passive ②	$I_p + \text{HART}^{\text{®}}$ passive	P_N / S_N NAMUR ②
2 3 0		$I I n_a$ active	P_N / S_N NAMUR C_p passive ②	$I_a + \text{HART}^{\text{®}}$ active	P_N / S_N NAMUR ②
3 3 0		$I I n_a$ active	P_N / S_N NAMUR C_p passive ②	$I_p + \text{HART}^{\text{®}}$ passive	P_N / S_N NAMUR ②
2 4 0		$I I n_p$ passive	P_N / S_N NAMUR C_p passive ②	$I_a + \text{HART}^{\text{®}}$ active	P_N / S_N NAMUR ②
3 4 0		$I I n_p$ passive	P_N / S_N NAMUR C_p passive ②	$I_p + \text{HART}^{\text{®}}$ passive	P_N / S_N NAMUR ②

CG no.	Connection terminals								
	A+	A	A-	B	B-	C	C-	D	D-

PROFIBUS PA (Ex i) (option)

D 0 0						PA+	PA-	PA+	PA-
						FISCO Device		FISCO Device	
D 1 0		I _a active		P _N / S _N NAMUR C _p passive ②		PA+	PA-	PA+	PA-
						FISCO Device		FISCO Device	
D 2 0		I _p passive		P _N / S _N NAMUR C _p passive ②		PA+	PA-	PA+	PA-
						FISCO Device		FISCO Device	
D 3 0		II _{n_a} active		P _N / S _N NAMUR C _p passive ②		PA+	PA-	PA+	PA-
						FISCO Device		FISCO Device	
D 4 0		II _{n_p} passive		P _N / S _N NAMUR C _p passive ②		PA+	PA-	PA+	PA-
						FISCO Device		FISCO Device	

FOUNDATION Fieldbus (Ex i) (option)

E 0 0						V/D+	V/D-	V/D+	V/D-
						FISCO Device		FISCO Device	
E 1 0		I _a active		P _N / S _N NAMUR C _p passive ②		V/D+	V/D-	V/D+	V/D-
						FISCO Device		FISCO Device	
E 2 0		I _p passive		P _N / S _N NAMUR C _p passive ②		V/D+	V/D-	V/D+	V/D-
						FISCO Device		FISCO Device	
E 3 0		II _{n_a} active		P _N / S _N NAMUR C _p passive ②		V/D+	V/D-	V/D+	V/D-
						FISCO Device		FISCO Device	
E 4 0		II _{n_p} passive		P _N / S _N NAMUR C _p passive ②		V/D+	V/D-	V/D+	V/D-
						FISCO Device		FISCO Device	

PROFINET IO (option)

N 0 0		RX+	RX-	TX+	TX-	TX+	TX-	RX+	RX-
		Port 2				Port 1			

Table 4-16: Fixed, non-alterable input/output versions

① Function changed by reconnecting

② Changeable

4.9.4 Alterable input/output versions

This signal converter is available with various input/output combinations.

- The grey boxes in the tables denote unassigned or unused connection terminals.
- In the table, only the final digits of the CG no. are depicted.
- Term. = (connection) terminal

CG no.	Connection terminals								
	A+	A	A-	B	B-	C	C-	D	D-

Modular I/O (option)

4 __		max. 2 optional modules for term. A + B		I_a + HART® active	P_a / S_a active ①
8 __		max. 2 optional modules for term. A + B		I_p + HART® passive	P_a / S_a active ①
6 __		max. 2 optional modules for term. A + B		I_a + HART® active	P_p / S_p passive ①
B __		max. 2 optional modules for term. A + B		I_p + HART® passive	P_p / S_p passive ①
7 __		max. 2 optional modules for term. A + B		I_a + HART® active	P_N / S_N NAMUR ①
C __		max. 2 optional modules for term. A + B		I_p + HART® passive	P_N / S_N NAMUR ①

PROFIBUS PA (option)

D __		max. 2 optional modules for term. A + B		PA+ (2)	PA- (2)	PA+ (1)	PA- (1)
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FOUNDATION Fieldbus (option)

E __		max. 2 optional modules for term. A + B		V/D+ (2)	V/D- (2)	V/D+ (1)	V/D- (1)
------	--	---	--	----------	----------	----------	----------

PROFIBUS DP (option)

F _0		1 optional module for term. A	Termination P	RxD/TxD-P(2)	RxD/TxD-N(2)	Termination N	RxD/TxD-P(1)	RxD/TxD-N(1)
------	--	-------------------------------	---------------	--------------	--------------	---------------	--------------	--------------

Modbus (option)

G __ ②		max. 2 optional modules for term. A + B			Common	Sign. B (D1)	Sign. A (D0)
H __ ③		max. 2 optional modules for term. A + B			Common	Sign. B (D1)	Sign. A (D0)

Table 4-17: Alterable input/output versions

- ① Changeable
- ② Not activated bus terminator
- ③ Activated bus terminator

4.10 Description of the inputs and outputs

4.10.1 Current output

**INFORMATION!**

The current outputs must be connected depending on the version! The I/O version and inputs/outputs installed in your signal converter are indicated on the sticker in the cover of the terminal compartment.

- All outputs are electrically isolated from each other and from all other circuits.
- All operating data and functions can be adjusted.
- Passive mode:
External power $V_{\text{ext}} \leq 32 \text{ VDC}$ at $I \leq 22 \text{ mA}$
- Active mode:
Load impedance $R_L \leq 1 \text{ k}\Omega$ at $I \leq 22 \text{ mA}$;
 $R_L \leq 450 \Omega$ at $I \leq 22 \text{ mA}$ for Ex i outputs
- Self-monitoring: interruption or load impedance too high in the current output loop
- Error message possible via status output, error indication on LC display.
- Current value error detection can be adjusted.
- Automatic range conversion via threshold or control input. The setting range for the threshold is between 5 and 80% of $Q_{100\%}$, $\pm 0...5\%$ hysteresis (corresponding ratio from smaller to larger range of 1:20 to 1:1.25).
Signaling of the active range possible via a status output (adjustable).
- Forward/reverse flow measurement (F/R mode) is possible.

**INFORMATION!**

For further information refer to Connection diagrams of inputs and outputs on page 69 and refer to Technical data on page 145.

**DANGER!**

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

4.10.2 Pulse output and frequency output

**INFORMATION!**

Depending on the version, the pulse and frequency outputs must be connected passively or actively or according to IEC 60947-5-6 (NAMUR)! The I/O version and inputs/outputs installed in your signal converter are indicated on the sticker in the cover of the terminal compartment.

- All outputs are electrically isolated from each other and from all other circuits.
- All operating data and functions can be adjusted.
- Passive mode:
External power supply required: $V_{\text{ext}} \leq 32 \text{ VDC}$
 $I \leq 20 \text{ mA}$ at $f \leq 10 \text{ kHz}$ (over range up to $f_{\text{max}} \leq 12 \text{ kHz}$)
 $I \leq 100 \text{ mA}$ at $f \leq 100 \text{ Hz}$
- Active mode:
Use of the internal power supply: $V_{\text{nom}} = 24 \text{ VDC}$
 $I \leq 20 \text{ mA}$ at $f \leq 10 \text{ kHz}$ (over range up to $f_{\text{max}} \leq 12 \text{ kHz}$)
 $I \leq 20 \text{ mA}$ at $f \leq 100 \text{ Hz}$
- NAMUR mode: passive in accordance with IEC 60947-5-6, $f \leq 10 \text{ kHz}$, over range up to $f_{\text{max}} \leq 12 \text{ kHz}$
- Scaling:
Frequency output: in pulses per time unit (e.g. 1000 pulses/s at $Q_{100\%}$);
Pulse output: value per pulse.
- Pulse width:
symmetric (pulse duty factor 1:1, independent of output frequency)
automatic (with fixed pulse width, duty factor approx. 1:1 at $Q_{100\%}$) or
fixed (pulse width adjustable as required from 0.05 ms...2 s)
- Forward/reverse flow measurement (F/R mode) is possible.
- All pulse and frequency outputs can also be used as a status output / limit switch.

**INFORMATION!**

For further information refer to Connection diagrams of inputs and outputs on page 69 and refer to Technical data on page 145.

**DANGER!**

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

4.10.3 Status output and limit switch

**INFORMATION!**

Depending on the version, the status outputs and limit switches must be connected passively or actively or according to IEC 60947-5-6 (NAMUR)! The I/O version and inputs/outputs installed in your signal converter are indicated on the sticker in the cover of the terminal compartment.

- The status outputs / limit switches are electrically isolated from each other and from all other circuits.
- The output stages of the status outputs/limit switches during simple active or passive operation behave like relay contacts and can be connected with any polarity.
- All operating data and functions can be adjusted.
- Passive mode:
External power supply required: $V_{\text{ext}} \leq 32 \text{ VDC}$; $I \leq 100 \text{ mA}$

For the Ex i I/O signal converter:

NAMUR characteristic: 4.7 mA / 0.77 mA

- Active mode:
Use of the internal power supply: $V_{\text{nom}} = 24 \text{ VDC}$; $I \leq 20 \text{ mA}$
- For information on the adjustable operating states refer to *Function tables* on page 100.

**INFORMATION!**

For further information refer to *Connection diagrams of inputs and outputs* on page 69 and refer to *Technical data* on page 145.

**DANGER!**

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

4.10.4 Control input

**INFORMATION!**

Depending on the version, the control inputs must be connected passively or actively or according to IEC 60947-5-6 (NAMUR)! The I/O version and inputs/outputs installed in your signal converter are indicated on the sticker in the cover of the terminal compartment.

- All control inputs are electrically isolated from each other and from all other circuits.
- All operating data and functions can be adjusted.
- Passive mode:
External power supply required: $V_{\text{ext}} \leq 32 \text{ VDC}$
- Active mode:
Use of the internal power supply: $V_{\text{nom}} = 24 \text{ VDC}$
- NAMUR mode:
Passive in accordance with IEC 60947-5-6
Active control input according to IEC 60947-5-6 (NAMUR): signal converter monitors cable breaks and short circuits according to IEC 60947-5-6. Errors indicated on LC display.
Error messages possible via status output.
- For information on the adjustable operating states refer to *Function tables* on page 100.

**INFORMATION!**

For further information refer to *Connection diagrams of inputs and outputs* on page 69 and refer to *Technical data* on page 145.

**DANGER!**

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

4.10.5 Current input

**INFORMATION!**

*Depending on the version, the current inputs must be connected passively or actively!
The I/O version and inputs/outputs installed in your signal converter are indicated on the sticker in the cover of the terminal compartment.*

- All current inputs are electrically isolated from each other and from all other circuits.
- All operating data and functions can be adjusted.
- Passive mode:
External power supply required: $V_{\text{ext}} \leq 32 \text{ VDC}$
- Active mode:
Use of the internal power supply: $V_{\text{nom}} = 24 \text{ VDC}$
- For information on the adjustable operating states refer to *Function tables* on page 100.

**INFORMATION!**

*For further information refer to *Connection diagrams of inputs and outputs* on page 69 and refer to *Technical data* on page 145.*

**DANGER!**

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

4.11 Electrical connection of the inputs and outputs



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.

4.11.1 Field housing, electrical connection of the inputs and outputs



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!

- Terminal A+ is only operable in the basic version.

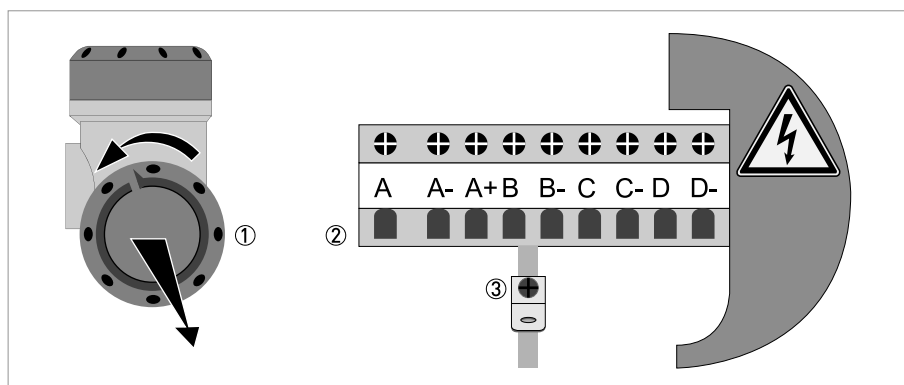


Figure 4-25: Terminal compartment for inputs and outputs in field housing



- ① Open the housing cover
- ② Push the prepared cable through the cable entry and connect the necessary conductors.
- ③ Connect the shield if necessary.



- Close the cover of the terminal compartment.
- Close the housing cover.



INFORMATION!

Each time a housing cover is opened, the thread should be cleaned and greased. Use only resin-free and acid-free grease. Ensure that the housing gasket is properly fitted, clean and undamaged.

4.11.2 Wall-mounted housing, electrical connection of the inputs and outputs



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!

- The shield must be electrically connected using 6.3 mm / 0.25" push-on connectors in the I/O terminal compartment.
- Terminal A+ is only operable in the basic version.

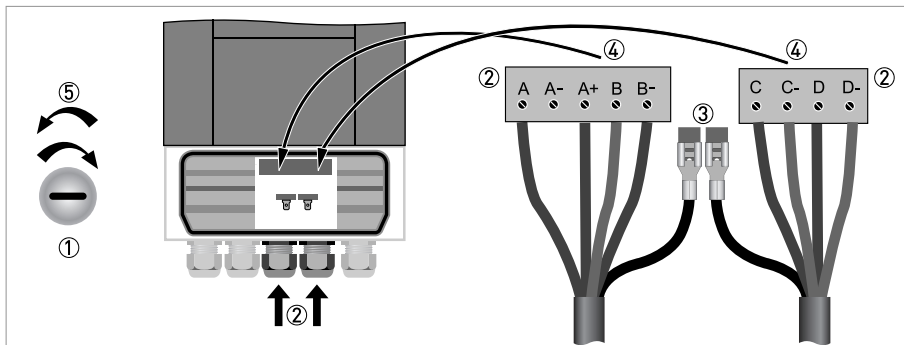


Figure 4-26: Connection of inputs and outputs in wall-mounted housing



- ① Open the housing cover
- ② Push the prepared cables through the cable entry and connect them to the supplied connector plugs ④.
- ③ Connect the shield if necessary.
- ④ Route the connector plugs with the clamped conductors into the sockets provided for that purpose.
- ⑤ Close the housing cover.



INFORMATION!

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

4.11.3 19" rack-mounted housing (21 TE), electrical connection of the inputs and outputs



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!

- Terminal A+ is only operable in the basic version.

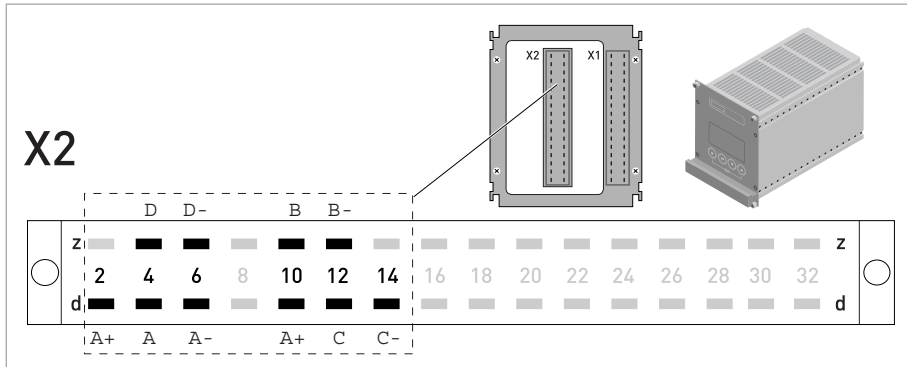


Figure 4-27: Terminal compartment for inputs and outputs in rack-mounted housing



- Connect the conductor to the multipolar plug according to the illustration.
- Press the plug into the connector.

4.11.4 Laying electrical cables correctly

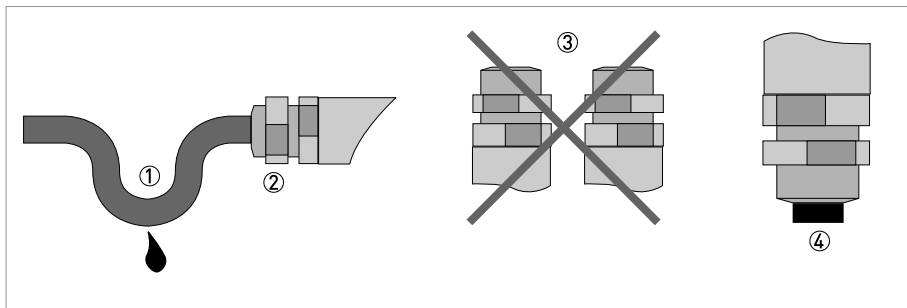


Figure 4-28: Protect housing from dust and water



- ① Lay the cable in a loop just before the housing.
- ② Tighten the screw connection of the cable entry securely.
- ③ Never mount the housing with the cable entries facing upwards.
- ④ Seal cable entries that are not needed with a plug.

4.12 Connection diagrams of inputs and outputs

4.12.1 Important notes



INFORMATION!

Depending on the version, the inputs/outputs must be connected passively or actively or according to IEC 60947-5-6 (NAMUR)! The I/O version and inputs/outputs installed in your signal converter are indicated on the sticker in the cover of the terminal compartment.

- All groups are electrically isolated from each other and from all other input and output circuits.
- Passive mode: An external power supply is necessary to operate (activation) the subsequent devices (V_{ext}).
- Active mode: The signal converter supplies the power for operation (activation) of the subsequent devices, observe max. operating data.
- Terminals that are not used should not have any conductive connection to other electrically conductive parts.



DANGER!

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

I_a	I_p	Current output active or passive
P_a	P_p	Pulse output / frequency output active or passive
P_N		Pulse output / frequency output passive according to IEC 60947-5-6 (NAMUR)
S_a	S_p	Status output / limit switch active or passive
S_N		Status output / limit switch passive according to IEC 60947-5-6 (NAMUR)
C_a	C_p	Control input active or passive
C_N		Control input active according to IEC 60947-5-6 (NAMUR). Signal converter monitors cable breaks and short circuits according to IEC 60947-5-6. Errors indicated on LC display. Error messages possible via status output.

Table 4-18: Description of the used abbreviations

4.12.2 Description of the electrical symbols

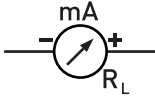
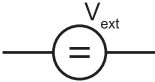

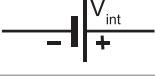
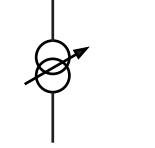
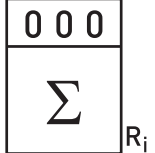
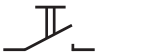
	<p>mA meter 0...20 mA or 4...20 mA and other R_L is the internal resistance of the measuring point including the cable resistance</p>
	<p>DC voltage source (V_{ext}), external power supply, any connection polarity</p>
	<p>DC voltage source (V_{ext}), observe connection polarity according to connection diagrams</p>
	<p>Internal DC voltage source</p>
	<p>Controlled internal current source in the device</p>
	<p>Electronic or electromagnetic counter At frequencies above 100 Hz, shielded cables must be used to connect the counters. R_i Internal resistance of the counter</p>
	<p>Button, N/O contact or similar</p>

Table 4-19: Description of the electrical symbols

4.12.3 Basic inputs/outputs



CAUTION!
Observe connection polarity.



INFORMATION!
For further information refer to *Description of the inputs and outputs* on page 61 and refer to *HART connection* on page 88.

Current output active (HART®), Basic I/O

- $V_{\text{int, nom}} = 24 \text{ VDC}$ nominal
- $I \leq 22 \text{ mA}$
- $R_L \leq 1 \text{ k}\Omega$
- Don't connect the terminals A+ and A- directly to an external input. This will damage the external device!

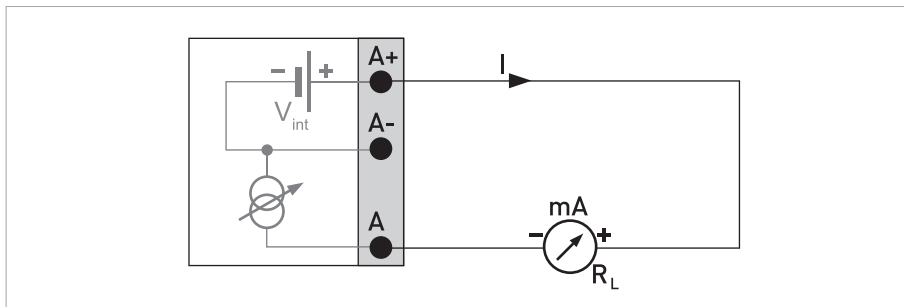


Figure 4-29: Current output active I_a

Current output passive (HART®), Basic I/O

- $V_{\text{int, nom}} = 24 \text{ VDC}$ nominal
- $V_{\text{ext}} \leq 32 \text{ VDC}$
- $I \leq 22 \text{ mA}$
- $V_0 \geq 1.8 \text{ V}$
- $R_L \leq (V_{\text{ext}} - V_0) / I_{\text{max}}$

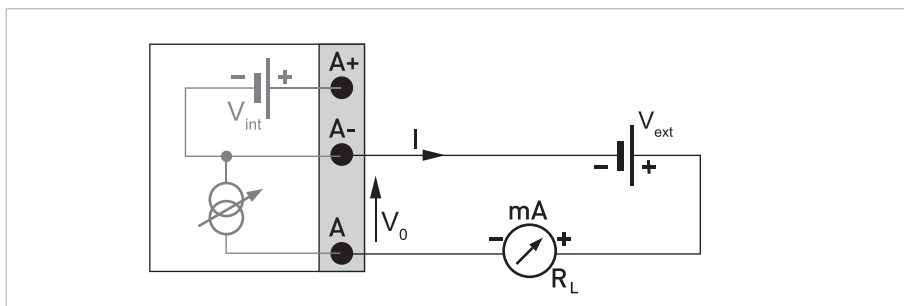


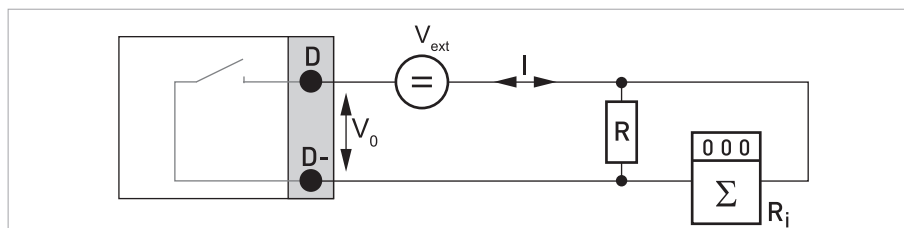
Figure 4-30: Current output passive I_p

**INFORMATION!**

- **Compact and field housing versions:** Shield connected via the cable terminals in the terminal compartment.
- **Wall-mounted versions:** Shield connected using 6.3 mm / 0.25" push-on connectors in the terminal compartment.
- Any connection polarity.

Pulse output / frequency output passive, Basic I/O

- $V_{\text{ext}} \leq 32 \text{ VDC}$
- f_{max} in operating menu set to $f_{\text{max}} \leq 100 \text{ Hz}$:
 $I \leq 100 \text{ mA}$
 open:
 $I \leq 0.05 \text{ mA}$ at $V_{\text{ext}} = 32 \text{ VDC}$
 closed:
 $V_{0, \text{max}} = 0.2 \text{ V}$ at $I \leq 10 \text{ mA}$
 $V_{0, \text{max}} = 2 \text{ V}$ at $I \leq 100 \text{ mA}$
- f_{max} in operating menu set to $100 \text{ Hz} < f_{\text{max}} \leq 10 \text{ kHz}$:
 $I \leq 20 \text{ mA}$
 open:
 $I \leq 0.05 \text{ mA}$ at $V_{\text{ext}} = 32 \text{ VDC}$
 closed:
 $V_{0, \text{max}} = 1.5 \text{ V}$ at $I \leq 1 \text{ mA}$
 $V_{0, \text{max}} = 2.5 \text{ V}$ at $I \leq 10 \text{ mA}$
 $V_{0, \text{max}} = 5.0 \text{ V}$ at $I \leq 20 \text{ mA}$
- If the following maximum load resistance $R_{L, \text{max}}$ is exceeded, the load resistance R_L must be reduced accordingly by parallel connection of R :
 $f \leq 100 \text{ Hz}$: $R_{L, \text{max}} = 47 \text{ k}\Omega$
 $f \leq 1 \text{ kHz}$: $R_{L, \text{max}} = 10 \text{ k}\Omega$
 $f \leq 10 \text{ kHz}$: $R_{L, \text{max}} = 1 \text{ k}\Omega$
- The minimum load resistance $R_{L, \text{min}}$ is calculated as follows:
 $R_{L, \text{min}} = (V_{\text{ext}} - V_0) / I_{\text{max}}$
- Can also be set as status output; for the electrical connection refer to status output connection diagram.

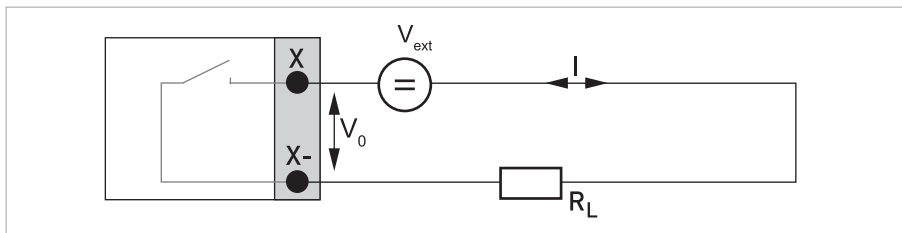
Figure 4-31: Pulse output / frequency output passive P_p

**INFORMATION!**

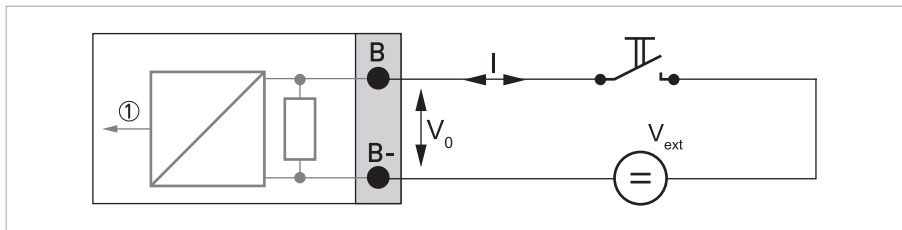
- Any connection polarity.

Status output / limit switch passive, Basic I/O

- $V_{\text{ext}} \leq 32 \text{ VDC}$
- $I \leq 100 \text{ mA}$
- $R_{L, \text{max}} = 47 \text{ k}\Omega$
 $R_{L, \text{min}} = (V_{\text{ext}} - V_0) / I_{\text{max}}$
- open:
 $I \leq 0.05 \text{ mA}$ at $V_{\text{ext}} = 32 \text{ VDC}$
 closed:
 $V_{0, \text{max}} = 0.2 \text{ V}$ at $I \leq 10 \text{ mA}$
 $V_{0, \text{max}} = 2 \text{ V}$ at $I \leq 100 \text{ mA}$
- The output is open when the device is de-energised.
- X stands for the terminals B, C or D. The functions of the connection terminals depend on the settings refer to *Function tables* on page 100.

Figure 4-32: Status output / limit switch passive S_p **Control input passive, Basic I/O**

- $8 \text{ V} \leq V_{\text{ext}} \leq 32 \text{ VDC}$
- $I_{\text{max}} = 6.5 \text{ mA}$ at $V_{\text{ext}} \leq 24 \text{ VDC}$
 $I_{\text{max}} = 8.2 \text{ mA}$ at $V_{\text{ext}} \leq 32 \text{ VDC}$
- Switching point for identifying "contact open or closed":
 Contact open (off): $V_0 \leq 2.5 \text{ V}$ at $I_{\text{nom}} = 0.4 \text{ mA}$
 Contact closed (on): $V_0 \geq 8 \text{ V}$ at $I_{\text{nom}} = 2.8 \text{ mA}$
- Can also be set as a status output; for the electrical connection refer to status output connection diagram.

Figure 4-33: Control input passive C_p

- ① Signal

4.12.4 Modular inputs/outputs and bus systems



CAUTION!
Observe connection polarity.

**INFORMATION!**

- For further information on electrical connection refer to *Description of the inputs and outputs* on page 61.
- For the electrical connection of bus systems, please refer to the supplementary documentation for the respective bus systems.

Current output active (only current output terminals C/C- have HART[®] capability), Modular I/O

- $V_{\text{int, nom}} = 24 \text{ VDC}$
- $I \leq 22 \text{ mA}$
- $R_L \leq 1 \text{ k}\Omega$
- X designates the connection terminals A, B or C, depending on the version of the signal converter.

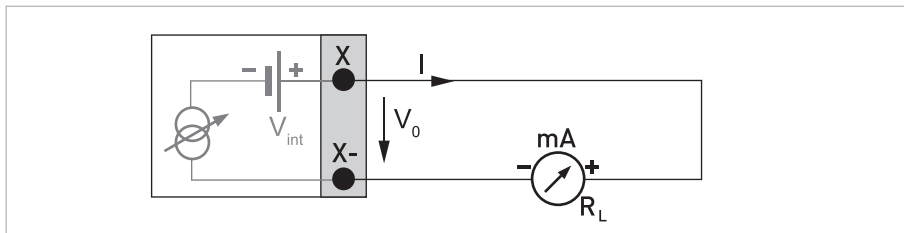


Figure 4-34: Current output active I_a

Current output passive (only current output terminals C/C- have HART[®] capability), Modular I/O

- $V_{\text{ext}} \leq 32 \text{ VDC}$
- $I \leq 22 \text{ mA}$
- $V_0 \geq 1.8 \text{ V}$
- $R_{L, \text{max}} = (V_{\text{ext}} - V_0) / I_{\text{max}}$
- X designates the connection terminals A, B or C, depending on the version of the signal converter.

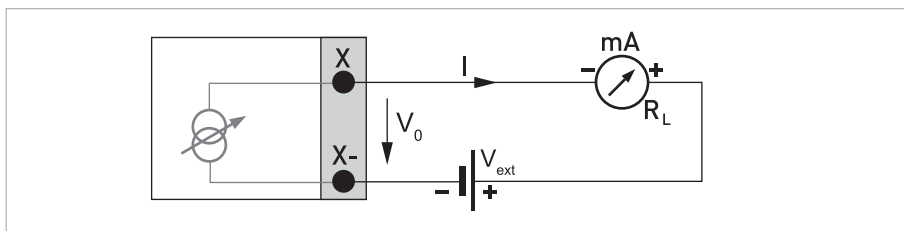


Figure 4-35: Current output passive I_p

**INFORMATION!**

- **Compact and field housing versions:** Shield connected via the cable terminals in the terminal compartment.

Wall-mounted versions: Shield connected using 6.3 mm / 0.25" push-on connectors in the terminal compartment.

- Observe connection polarity.

Pulse output / frequency output active, Modular I/O

- $V_{\text{nom}} = 24 \text{ VDC}$
- f_{max} in operating menu set to $f_{\text{max}} \leq 100 \text{ Hz}$:
 $I \leq 20 \text{ mA}$
 open:
 $I \leq 0.05 \text{ mA}$
 closed:
 $V_{0, \text{nom}} = 24 \text{ V}$ at $I = 20 \text{ mA}$
- f_{max} in operating menu set to $100 \text{ Hz} < f_{\text{max}} \leq 10 \text{ kHz}$:
 $I \leq 20 \text{ mA}$
 open:
 $I \leq 0.05 \text{ mA}$
 closed:
 $V_{0, \text{nom}} = 22.5 \text{ V}$ at $I = 1 \text{ mA}$
 $V_{0, \text{nom}} = 21.5 \text{ V}$ at $I = 10 \text{ mA}$
 $V_{0, \text{nom}} = 19 \text{ V}$ at $I = 20 \text{ mA}$
- If the following maximum load resistance $R_{L, \text{max}}$ is exceeded, the load resistance R_L must be reduced accordingly by parallel connection of R :
 $f \leq 100 \text{ Hz}$: $R_{L, \text{max}} = 47 \text{ k}\Omega$
 $f \leq 1 \text{ kHz}$: $R_{L, \text{max}} = 10 \text{ k}\Omega$
 $f \leq 10 \text{ kHz}$: $R_{L, \text{max}} = 1 \text{ k}\Omega$
- The minimum load resistance $R_{L, \text{min}}$ is calculated as follows:
 $R_{L, \text{min}} = V_0 / I_{\text{max}}$
- X designates the connection terminals A, B or D, depending on the version of the signal converter.

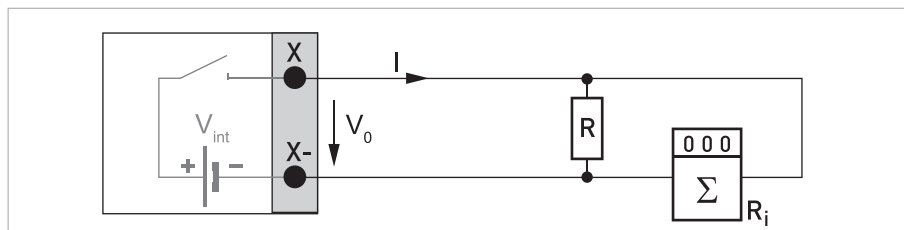
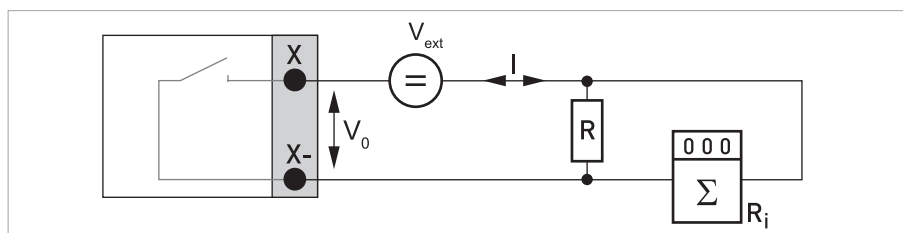


Figure 4-36: Pulse output / frequency output active P_a

Pulse output / frequency output passive, Modular I/O

- $V_{\text{ext}} \leq 32 \text{ VDC}$
- f_{max} in operating menu set to $f_{\text{max}} \leq 100 \text{ Hz}$:
 $I \leq 100 \text{ mA}$
 open:
 $I \leq 0.05 \text{ mA}$ at $V_{\text{ext}} = 32 \text{ VDC}$
 closed:
 $V_{0, \text{max}} = 0.2 \text{ V}$ at $I \leq 10 \text{ mA}$
 $V_{0, \text{max}} = 2 \text{ V}$ at $I \leq 100 \text{ mA}$
- f_{max} in operating menu set to $100 \text{ Hz} < f_{\text{max}} \leq 10 \text{ kHz}$:
 open:
 $I \leq 0.05 \text{ mA}$ at $V_{\text{ext}} = 32 \text{ VDC}$
 closed:
 $V_{0, \text{max}} = 1.5 \text{ V}$ at $I \leq 1 \text{ mA}$
 $V_{0, \text{max}} = 2.5 \text{ V}$ at $I \leq 10 \text{ mA}$
 $V_{0, \text{max}} = 5 \text{ V}$ at $I \leq 20 \text{ mA}$
- If the following maximum load resistance $R_{L, \text{max}}$ is exceeded, the load resistance R_L must be reduced accordingly by parallel connection of R :
 $f \leq 100 \text{ Hz}$: $R_{L, \text{max}} = 47 \text{ k}\Omega$
 $f \leq 1 \text{ kHz}$: $R_{L, \text{max}} = 10 \text{ k}\Omega$
 $f \leq 10 \text{ kHz}$: $R_{L, \text{max}} = 1 \text{ k}\Omega$
- The minimum load resistance $R_{L, \text{min}}$ is calculated as follows:
 $R_{L, \text{min}} = (V_{\text{ext}} - V_0) / I_{\text{max}}$
- Can also be set as status output; for the electrical connection refer to status output connection diagram.
- X designates the connection terminals A, B or D, depending on the version of the signal converter.

Figure 4-37: Pulse output / frequency output passive P_p

**INFORMATION!**

- **Compact and field housing versions:** Shield connected via the cable terminals in the terminal compartment.

Wall-mounted versions: Shield connected using 6.3 mm / 0.25" push-on connectors in the terminal compartment.

- Any connection polarity.

Pulse output / frequency output passive P_N NAMUR, Modular I/O

- Connection according to IEC 60947-5-6.
- open:
 $I_{nom} = 0.6 \text{ mA}$
- closed:
 $I_{nom} = 3.8 \text{ mA}$
- X designates the connection terminals A, B or D, depending on the version of the signal converter.

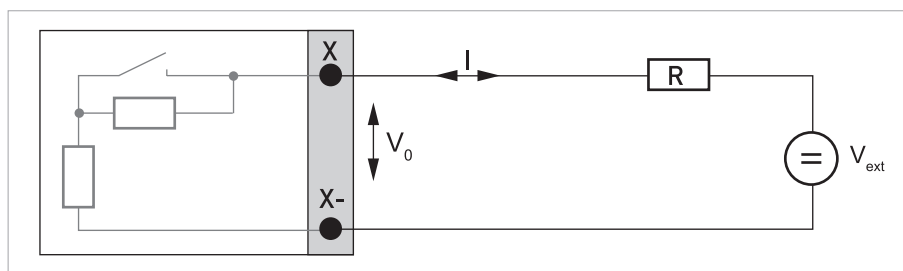
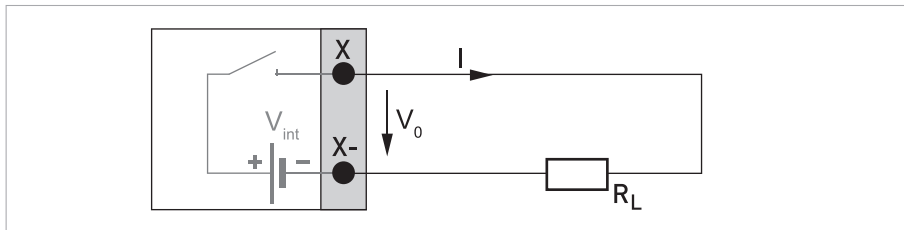


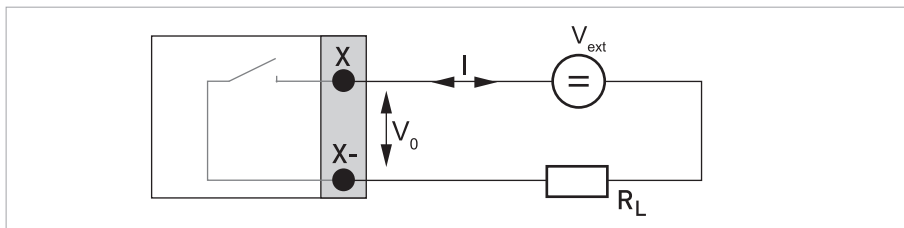
Figure 4-38: Pulse output / frequency output passive P_N according to IEC 60947-5-6 (NAMUR)

Status output / limit switch active, Modular I/O

- Observe connection polarity.
- $V_{\text{int}} = 24 \text{ VDC}$
- $I \leq 20 \text{ mA}$
- $R_L \leq 47 \text{ k}\Omega$
- open:
 $I \leq 0.05 \text{ mA}$
- closed:
 $V_{0, \text{nom}} = 24 \text{ V}$ at $I = 20 \text{ mA}$
- X designates the connection terminals A, B or D, depending on the version of the signal converter.

Figure 4-39: Status output / limit switch active S_a **Status output / limit switch passive, Modular I/O**

- Any connection polarity.
- $V_{\text{ext}} = 32 \text{ VDC}$
- $I \leq 100 \text{ mA}$
- $R_{L, \text{max}} = 47 \text{ k}\Omega$
 $R_{L, \text{min}} = (V_{\text{ext}} - V_0) / I_{\text{max}}$
- open:
 $I \leq 0.05 \text{ mA}$ at $V_{\text{ext}} = 32 \text{ VDC}$
- closed:
 $V_{0, \text{max}} = 0.2 \text{ V}$ at $I \leq 10 \text{ mA}$
 $V_{0, \text{max}} = 2 \text{ V}$ at $I \leq 100 \text{ mA}$
- The output is open when the device is de-energised.
- X designates the connection terminals A, B or D, depending on the version of the signal converter.

Figure 4-40: Status output / limit switch passive S_p

Status output / limit switch S_N NAMUR, Modular I/O

- Any connection polarity.
- Connection according to IEC 60947-5-6.
- open:
 $I_{nom} = 0.6 \text{ mA}$
- closed:
 $I_{nom} = 3.8 \text{ mA}$
- The output is open when the device is de-energised.
- X designates the connection terminals A, B or D, depending on the version of the signal converter.

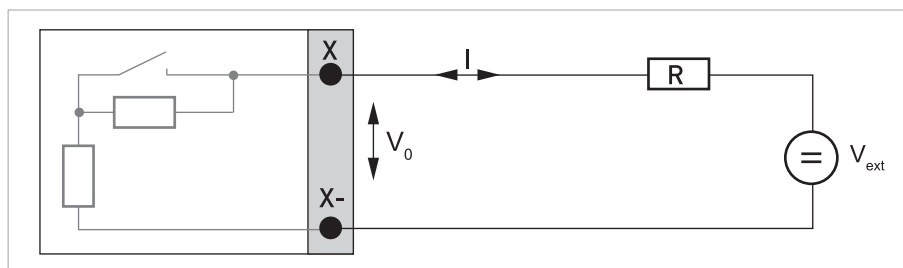


Figure 4-41: Status output / limit switch S_N according to IEC 60947-5-6 (NAMUR)

**CAUTION!**

Observe connection polarity.

Control input active, Modular I/O

- $V_{\text{int}} = 24 \text{ VDC}$
- External contact open:
 $V_{0, \text{nom}} = 22 \text{ V}$
- External contact closed:
 $I_{\text{nom}} = 4 \text{ mA}$
- Switching point for identifying "contact open or closed":
Contact closed (on): $V_0 \leq 10 \text{ V}$ at $I_{\text{nom}} = 1.9 \text{ mA}$
Contact open (off): $V_0 \geq 12 \text{ V}$ at $I_{\text{nom}} = 1.9 \text{ mA}$
- X designates the connection terminals A or B, depending on the version of the signal converter.

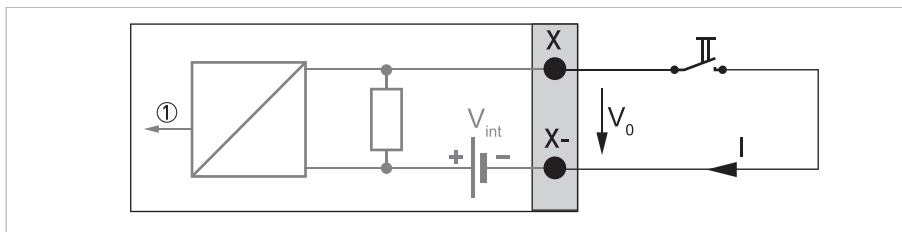


Figure 4-42: Control input active C_a

① Signal

Control input passive, Modular I/O

- $3 \text{ V} \leq V_{\text{ext}} \leq 32 \text{ VDC}$
- $I_{\text{max}} = 9.5 \text{ mA}$ at $V_{\text{ext}} \leq 24 \text{ V}$
 $I_{\text{max}} = 9.5 \text{ mA}$ at $V_{\text{ext}} \leq 32 \text{ V}$
- Switching point for identifying "contact open or closed":
Contact open (off): $V_0 \leq 2.5 \text{ V}$ at $I_{\text{nom}} = 1.9 \text{ mA}$
Contact closed (on): $V_0 \geq 3 \text{ V}$ at $I_{\text{nom}} = 1.9 \text{ mA}$
- X designates the connection terminals A or B, depending on the version of the signal converter.

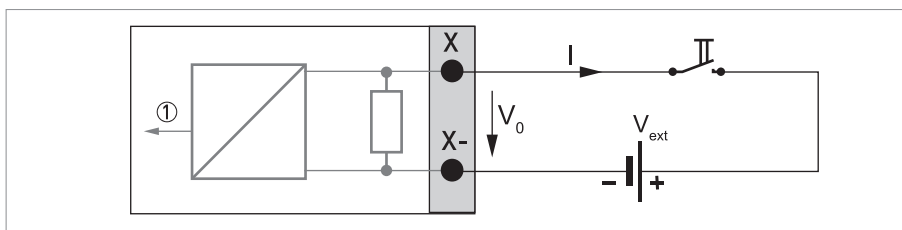


Figure 4-43: Control input passive C_p

① Signal

**CAUTION!**

Observe connection polarity.

Control input active C_N NAMUR, Modular I/O

- Connection according to IEC 60947-5-6.
- Switching point for identifying "contact open or closed":
 Contact open (off): $V_{0, \text{nom}} = 6.3 \text{ V}$ at $I_{\text{nom}} < 1.9 \text{ mA}$
 Contact closed (on): $V_{0, \text{nom}} = 6.3 \text{ V}$ at $I_{\text{nom}} > 1.9 \text{ mA}$
- Detection of cable break:
 $V_0 \geq 8.1 \text{ V}$ at $I \leq 0.1 \text{ mA}$
- Detection of cable short circuit:
 $V_0 \leq 1.2 \text{ V}$ at $I \geq 6.7 \text{ mA}$
- X designates the connection terminals A or B, depending on the version of the signal converter.

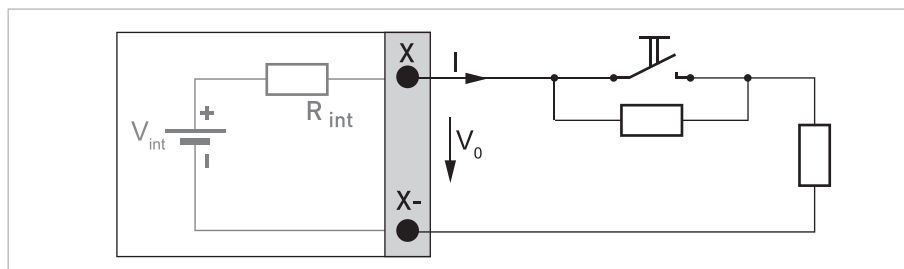
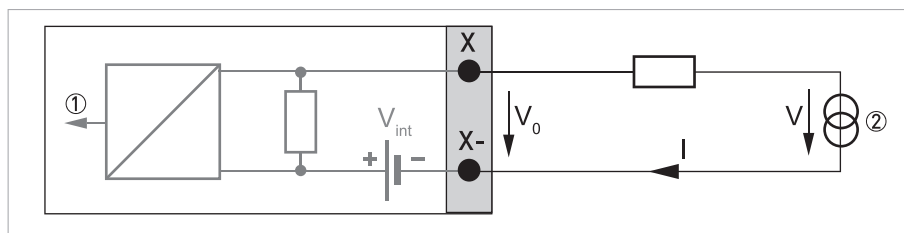


Figure 4-44: Control input active C_N according to IEC 60947-5-6 (NAMUR)

Current input active, Modular I/O

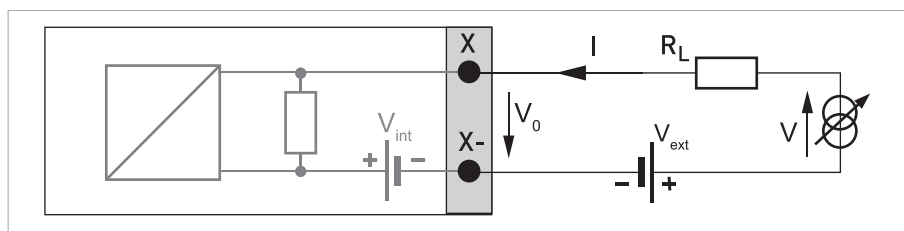
- $V_{\text{int, nom}} = 24 \text{ VDC}$
- $I \leq 22 \text{ mA}$
- $I_{\text{max}} \leq 26 \text{ mA}$ (electronically limited)
- $V_{0, \text{min}} = 19 \text{ V}$ at $I \leq 22 \text{ mA}$
- **no HART®**
- X designates the connection terminals A or B, depending on the version of the signal converter.

Figure 4-45: Current input active II_{n_a}

- ① Signal
- ② 2-wire transmitter (e.g. temperature)

Current input passive, Modular I/O

- $V_{\text{ext}} \leq 32 \text{ VDC}$
- $I \leq 22 \text{ mA}$
- $I_{\text{max}} \leq 26 \text{ mA}$
- $V_{0, \text{max}} = 5 \text{ V}$ at $I \leq 22 \text{ mA}$
- X designates the connection terminals A or B, depending on the version of the signal converter.

Figure 4-46: Current input passive II_{n_p}

- ① Signal
- ② 2-wire transmitter (e.g. temperature)

4.12.5 Ex i inputs/outputs



DANGER!

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



INFORMATION!

For further information on electrical connection refer to Description of the inputs and outputs on page 61.

Current output active (only current output terminals C/C- have HART® capability), Ex i I/O

- Observe connection polarity.
- $V_{\text{int, nom}} = 20 \text{ VDC}$
- $I \leq 22 \text{ mA}$
- $R_L \leq 450 \Omega$
- X designates the connection terminals A or C, depending on the version of the signal converter.

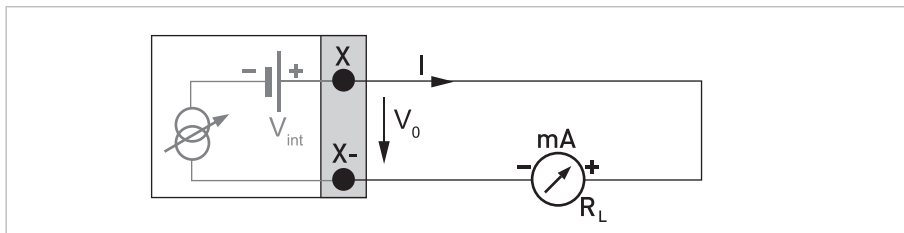


Figure 4-47: Current output active I_a Ex i

Current output passive (only current output terminals C/C- have HART® capability), Ex i I/O

- Any connection polarity.
- $V_{\text{ext}} \leq 32 \text{ VDC}$
- $I \leq 22 \text{ mA}$
- $V_0 \geq 4 \text{ V}$
- $R_{L, \text{max}} = (V_{\text{ext}} - V_0) / I_{\text{max}}$
- X designates the connection terminals A or C, depending on the version of the signal converter.

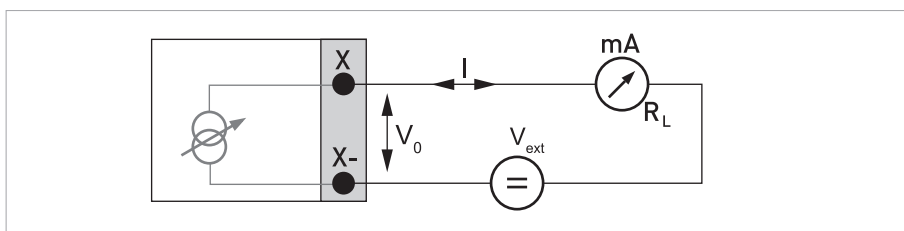


Figure 4-48: Current output passive I_p Ex i

**DANGER!**

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

**INFORMATION!**

- For frequencies above 100 Hz, shielded cables are to be used in order to reduce effects from electrical interferences (EMC).
- **Compact and field housing versions:** Shield connected via the cable terminals in the terminal compartment.
- **Wall-mounted versions:** Shield connected using 6.3 mm / 0.25" push-on connectors in the terminal compartment.
- Any connection polarity.

Pulse output / frequency output passive P_N NAMUR, Ex i I/O

- Connection according to IEC 60947-5-6.
- open:
 $I_{nom} = 0.43 \text{ mA}$
- closed:
 $I_{nom} = 4.5 \text{ mA}$
- X designates the connection terminals B or D, depending on the version of the signal converter.

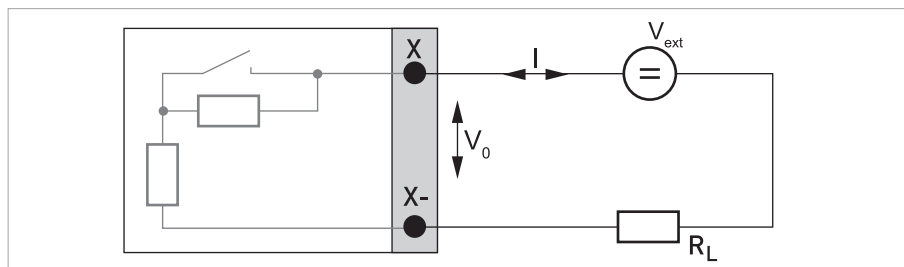


Figure 4-49: Pulse output / frequency output passive P_N according to IEC 60947-5-6 (NAMUR) Ex i

**INFORMATION!**

- Any connection polarity.

Status output / limit switch S_N NAMUR, Ex i I/O

- Connection according to IEC 60947-5-6.
- open:
 $I_{nom} = 0.43 \text{ mA}$
- closed:
 $I_{nom} = 4.5 \text{ mA}$
- The output is closed when the device is de-energised.
- X designates the connection terminals B or D, depending on the version of the signal converter.

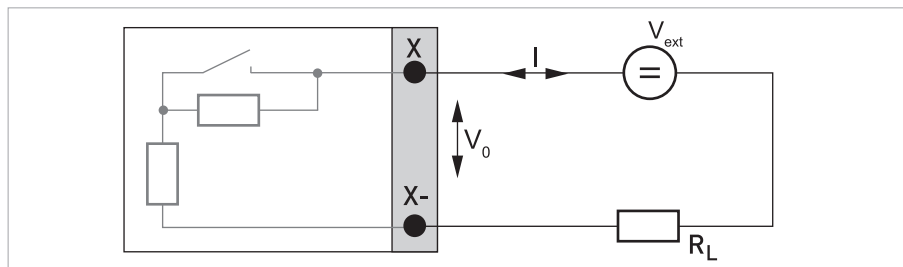


Figure 4-50: Status output / limit switch S_N according to IEC 60947-5-6 (NAMUR) Ex i

**DANGER!**

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

**INFORMATION!**

- Any connection polarity.

Control input passive, Ex i I/O

- $5.5 \text{ V} \leq V_{\text{ext}} \leq 32 \text{ VDC}$
- $I_{\text{max}} = 6 \text{ mA}$ at $V_{\text{ext}} \leq 24 \text{ V}$
 $I_{\text{max}} = 6.5 \text{ mA}$ at $V_{\text{ext}} \leq 32 \text{ V}$
- Switching point for identifying "contact open or closed":
 Contact open (off): $V_0 \leq 3.5 \text{ V}$ at $I \leq 0.5 \text{ mA}$
 Contact closed (on): $V_0 \geq 5.5 \text{ V}$ at $I \geq 4 \text{ mA}$
- X designates the connection terminals B, if available.

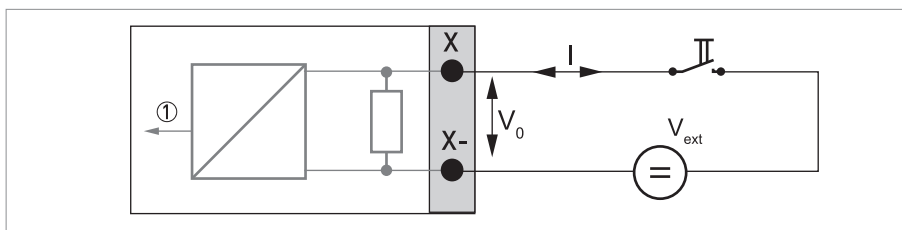


Figure 4-51: Control input passive C_p Ex i

① Signal

Current input active, Ex i I/O

- $V_{\text{int, nom}} = 20 \text{ VDC}$
- $I \leq 22 \text{ mA}$
- $V_{0, \text{min}} = 14 \text{ V}$ at $I \leq 22 \text{ mA}$
- In the event of a short circuit, the voltage is cut off.
- X designates the connection terminals A or B, depending on the version of the signal converter.

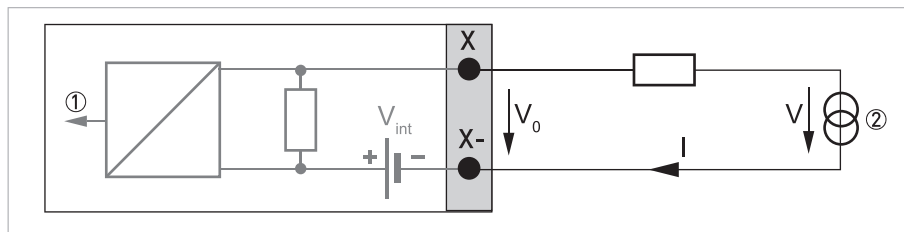


Figure 4-52: Current input active IIn_a

- ① Signal
- ② 2-wire transmitter (e.g. temperature)

Current input passive, Ex i I/O

- $V_{\text{ext}} \leq 32 \text{ VDC}$
- $I \leq 22 \text{ mA}$
- $V_{0, \text{max}} = 4 \text{ V}$ at $I \leq 22 \text{ mA}$
- X designates the connection terminals A or B, depending on the version of the signal converter.

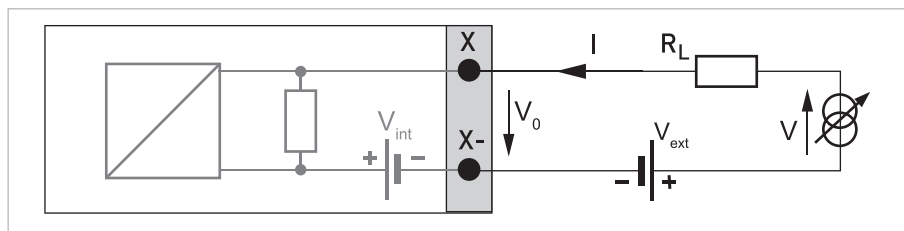


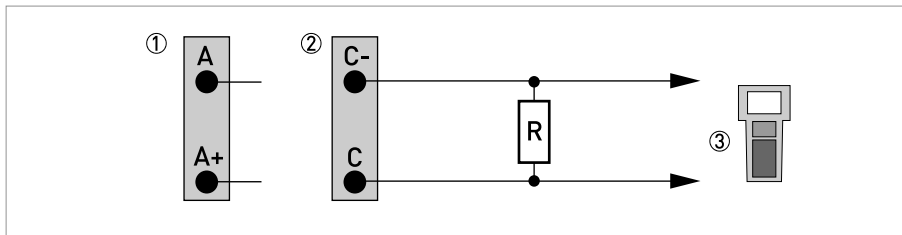
Figure 4-53: Current input passive IIn_p

- ① Signal
- ② 2-wire transmitter (e.g. temperature)

4.12.6 HART connection

**INFORMATION!**

- In the Basic I/O the current output at connection terminals A+/A-/A always has HART[®] capability.
- For Modular I/O and Ex i I/O, only the output module for the connection terminals C/C- has HART[®] capability.

HART[®] connection active (point-to-point)Figure 4-54: HART[®] connection active (I₂)

- ① Basic I/O: terminals A and A+
- ② Modular I/O: terminals C- and C
- ③ HART[®] communicator

The parallel resistance to the HART[®] communicator must be $R \geq 230 \Omega$.

HART® connection passive (Multi-drop mode)

- $I: I_{0\%} \geq 4 \text{ mA}$
- Multi-drop mode I: $I_{\text{fix}} \geq 4 \text{ mA} = I_{0\%}$
- $V_{\text{ext}} \leq 32 \text{ VDC}$
- $R \geq 230 \Omega$

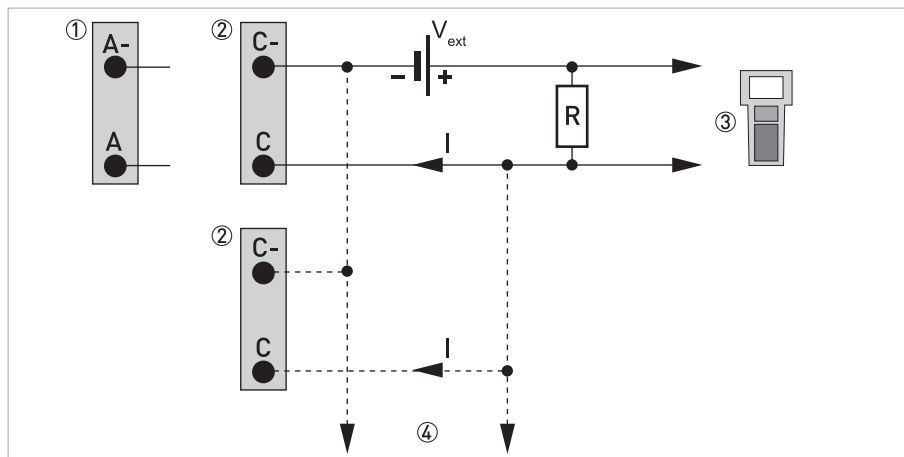


Figure 4-55: HART® connection passive (I_p)

- ① Basic I/O: terminals A- and A
- ② Modular I/O: terminals C- and C
- ③ HART® communicator
- ④ Other devices with HART® capability

5.1 Switching on the power

Before connecting to power, please check that the system has been correctly installed. This includes:

- The device must be mounted in compliance with the local regulations.
- The power connections must have been made in compliance with the local regulations for measuring devices.
- The electrical terminal compartments must be tightened and the cover has been screwed on.
- Check that the electrical operating data of the power supply are correct.



- Switching on the power.

5.2 Starting the signal converter

The measuring device, consisting of the flow sensor and the signal converter, is supplied ready for operation. All operating data have been set at the factory in accordance with your order specifications.

When the power is switched on, a self test is carried out. After that the device immediately begins measuring, and the current values are displayed.

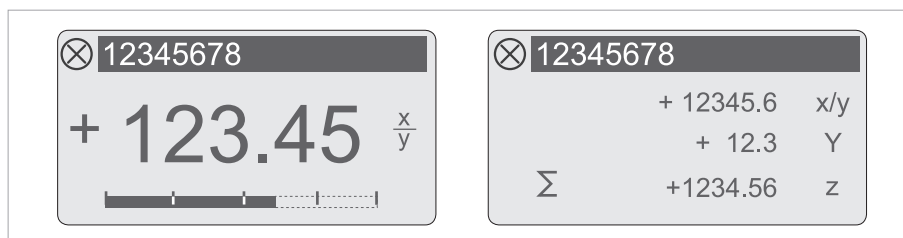


Figure 5-1: Displays in measuring mode (examples for 2 or 3 measured values)
x, y and z denote the units of the measured values displayed

It is possible to change between the two measured value windows, the trend display and the list with the status messages by pressing the keys \uparrow and \downarrow . For information about possible status messages, their meaning and cause refer to *Status messages and diagnostic information* on page 123.

6.1 Display and operating elements

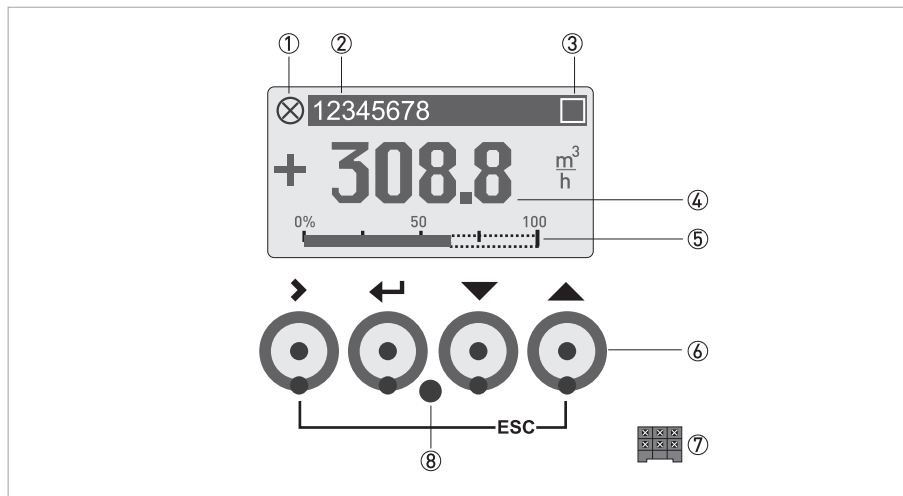


Figure 6-1: Display and operating elements (Example: flow indication with 2 measuring values)

- ① Indicates the device status
- ② Tag number (is only indicated if this number was entered previously by the operator)
- ③ Indicates the key and lock status
- ④ First measured variable in large representation
- ⑤ Bargraph indication
- ⑥ Operating keys, optical and mechanical (see table below for function and representation in text)
- ⑦ Interface to the GDC bus (not present in all signal converter versions)
- ⑧ Infrared sensor (not present in all signal converter versions)



CAUTION!

The use of a jumper is only permitted for custody transfer devices to lock the access to custody transfer relevant parameters. For non custody transfer devices (i.e. process instruments) this jumper must not be used!



INFORMATION!

- The switching point for the 4 optical keys is located directly in front of the glass. It is recommended to activate the keys at right angles to the front. Touching them from the side can cause incorrect operation.
- After 5 minutes of inactivity, there is an automatic return to the measuring mode. Previously changed data is not saved.

The device user interface provides several display modes. In measuring mode the following display pages are available:

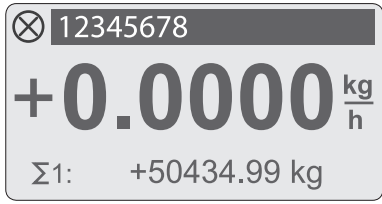

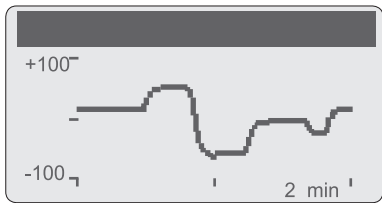
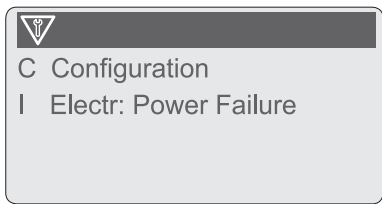
Display page in measuring mode	Screen
1st measuring page	
2nd measuring page	
Graphic page	
Status page	

Table 6-1: Indication of display pages

The following display modes are available:

Display modes and functionality	> key	↵ key	↓ or ↑ key	Esc (> + ↑) key
Measuring mode Display of measurement values	Press key for 2.5 s At measuring pages or graphic page enters device menu for configuration. At status page enters menu for status messages and details	Reset display	Switch between display pages: 1st and 2nd measuring page, graphic page and status page	-
Menu mode Navigation through device menu or active status messages	Access to displayed menu, then 1st submenu is displayed	Either return to menu level above or to measuring mode but prompt whether the data should be saved	Select menu item	-
Parameter and data mode Changing parameter values or starting function	For numerical values, move cursor (highlighted in black) one position to the right	Return to menu mode	Use cursor (highlighted in black) to change number, unit, property and to move the decimal point	Return to menu mode without acceptance of data

Table 6-2: Description of display modes and operating keys

The following status levels with the related symbols are available:





Symbol	Symbol background colour	Letter	Status signal	Description and consequence
	white	F (bold)	Error in device	No measurement possible.
	blue	F	Application error	No measurement possible due to process/application conditions. The device is still OK.
	blue	S	Out of specification	Measurements are available but are no longer sufficiently accurate and should be checked.
	blue	M	Maintenance required	Measurements are still accurate but this could soon change
	blue	C	Checks in progress	A test function is active. The displayed or transferred measured value does not correspond to the actual measured value.
-	-	I	Information	No direct influence on the measurements.
-	-	-	No message	-

Table 6-3: Description of the icons for the status level

For further information refer to *Status messages and diagnostic information* on page 123.

6.1.1 Display in measuring mode with 2 or 3 measured values

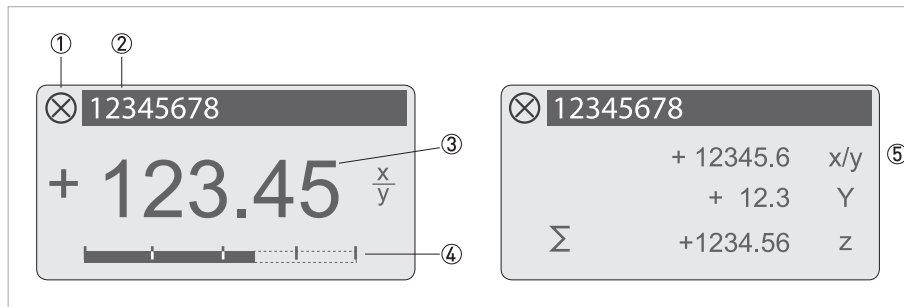


Figure 6-2: Example for display in measuring mode with 2 or 3 measured values

- ① Indicates a possible status message in the status list
- ② Tag number (is only indicated if this number was entered previously by the operator)
- ③ 1st measured variable in large representation
- ④ Bargraph indication
- ⑤ Depiction with 3 measured values

6.1.2 Display for selection of submenu and functions, 3 lines

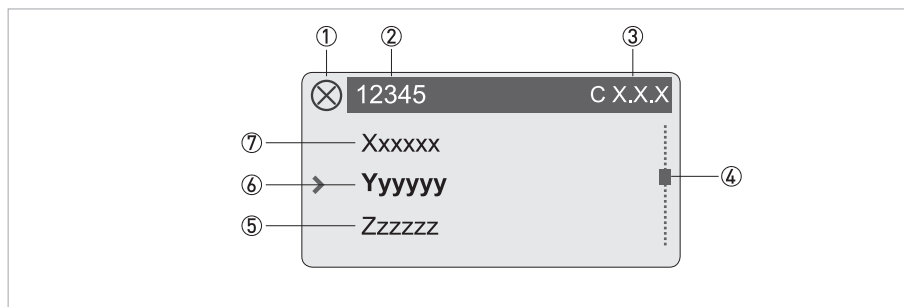


Figure 6-3: Display for selection of submenu and functions, 3 lines

- ① Indicates a possible status message in the status list
- ② Menu, submenu or function name
- ③ Number relating to ⑥
- ④ Indicates position within menu, submenu or function list
- ⑤ Next menu(s), submenu or function
[___ signalise in this line the end of the list]
- ⑥ Current menu(s), submenu or function
- ⑦ Previous menu(s), submenu or function
[___ signalise in this line the beginning of the list]

6.1.3 Display when setting parameters, 4 lines

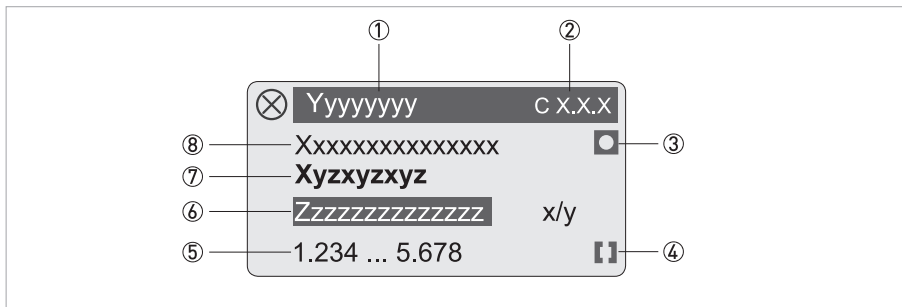


Figure 6-4: Display when setting parameters, 4 lines

- ① Current menu(s), submenu or function
- ② Number relating to ⑦
- ③ Denotes factory setting
- ④ Denotes permissible value range
- ⑤ Permissible value range for numeric values
- ⑥ Currently set value, unit or function (when selected, appears with white text, blue background)
This is where the data is changed.
- ⑦ Current parameter
- ⑧ Factory setting of parameter

6.1.4 Display when previewing parameters, 4 lines

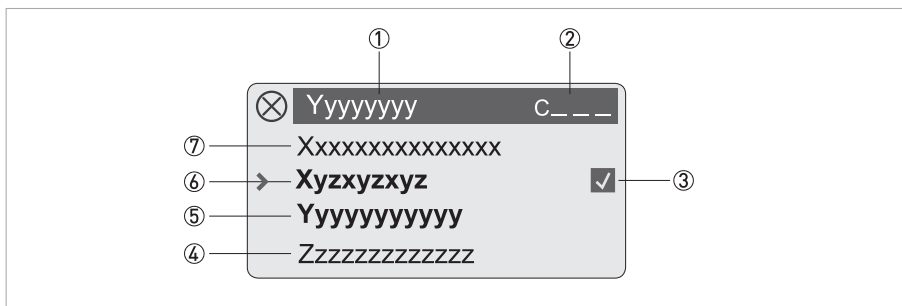


Figure 6-5: Display when previewing parameters, 4 lines

- ① Current menu(s), submenu or function
- ② Number relating to ⑥
- ③ Denotes a changed parameter (simple check of changed data when browsing through lists)
- ④ Next parameter
- ⑤ Currently set data from ⑥
- ⑥ Current parameter (for selection press key >; then see previous chapter)
- ⑦ Factory setting of parameter

6.1.5 Using an IR interface (option)

The optical IR interface serves as an adapter for PC-based communication with the signal converter without opening the housing.



INFORMATION!

- This device is not part of the scope of delivery.
- For more information about activation with the functions A6 or C5.6.6 refer to Function tables on page 100.

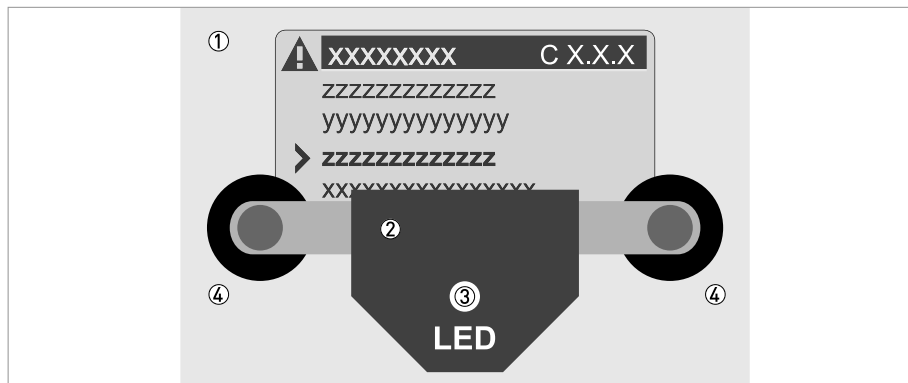


Figure 6-6: IR interface

- ① Glass panel in front of the control and display panel
- ② IR interface
- ③ LED lights up when IR interface is activated.
- ④ Suction cups

Timeout function

Following activation of the IR interface in A6 or C5.6.6 the interface must be properly positioned and attached to the housing with the suction cups within 60 seconds. If this does not happen within the specified time period, the device can be operated using the optical keys again. Upon activation, the LED ③ lights up and the optical keys no longer function.

6.2 Menu structure



INFORMATION!

Note the key function within and between the columns.

Measuring mode	Select menu	Select menu and/or sub-menu	Select function and set data
		↓ ↑	↓ ↑ >
↵	Press > 2.5 s		
	A quick setup	> A1 language	>
		↵ A2 Tag	↵
		A3 reset	
		> A3.1 reset errors	
		↵ A3.2 counter 1	
		A3.3 counter 2	
		A3.4 counter 3	
		A4 analogue outputs	
		A4.1 measurement	
		A4.2 unit	
		A4.3 range	
		A4.4 low flow cutoff	
		A4.5 time constant	
		A5 digital outputs	
		A5.1 measurement	
		A5.2 pulse value unit	
		A5.3 value p. pulse	
		A5.4 low flow cutoff	
		A6 GDC IR interface	
		A7 process input	
		> A7.1 device serial no.	
		↵ A7.2 zero calibration	
		A7.3 size	
		A7.4 GK	
		A7.5 GKL	
		A7.6 coil resistance Rsp	
		A7.7 calib. coil temp.	
		A7.8 target conduct.	
		A7.9 EF electr. factor	
		A7.10 field frequency	
		A7.11 flow direction	
	↓ ↑	↓ ↑	↓ ↑ >

Table 6-4: Menu structure "A quick setup"

Measuring mode		Select menu	Select menu and/or sub-menu	Select function and set data
			↓ ↑	↓ ↑ >
↵	Press > 2.5 s			
	C setup	> ↵	C1 process input	> ↵
				C1.1 calibration
				C1.2 filter
				C1.3 self test
				C1.4 information
				C1.5 simulation
↵		> ↵	C2 I/O (Input/Output)	> ↵
				C2.1 hardware
				C2._ current out X
				C2._ frequency out X
				C2._ pulse output X
				C2._ status output X
				C2._ limit switch X
				C2._ control input X
				C2._ current input X
↵		> ↵	C3 I/O counter	> ↵
				C3.1 counter 1
				C3.2 counter 2
				C3.3 counter 3
↵		> ↵	C4 I/O HART	> ↵
				C4.1 PV is
				C4.2 SV is
				C4.3 TV is
				C4.4 4V is
				C4.5 HART units
↵		> ↵	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
				C5.8 HART
				C5.9 quick setup
		↓ ↑	↓ ↑	↓ ↑ >

Table 6-6: Menu structure "C setup"

6.3 Function tables



INFORMATION!

- The following tables describe the functions of the standard device with HART[®] connection. The functions for Modbus, Foundation Fieldbus, Profibus and PROFINET IO are described in detail in the corresponding supplementary instructions.
- Depending on the device version, not all functions are available.
- The description "PF option" used in the tables only refers to the TIDALFLUX 2000 flow sensor / "CAP option" only refers to the OPTIFLUX 7000 flow sensor.

6.3.1 Menu "A quick setup"

Function	Setting / Description
----------	-----------------------

A1 language

A1 language	Language selection depends on the device version.
-------------	---

A2 Tag

A2 Tag	Measuring point identifier (Tag no.) appears in the LC display header (up to 8 digits).
--------	---

A3 reset

A3 reset	-
A3.1 reset errors	Query: reset errors? Select: no / yes
A3.2 reset counter 1	Query: reset counter? Select: no / yes (available if activated in C5.9.1)
A3.3 reset counter 2	Query: reset counter? Select: no / yes (available if activated in C5.9.2)
A3.4 reset counter 3	Query: reset counter? Select: no / yes (available if activated in C5.9.3)

A4 analogue outputs (only for HART[®])

A4 analogue outputs	Applicable to all current outputs (terminals A, B and C), frequency outputs (terminals A, B and D), limit switches (terminals A, B, C, and/or D) and the 1st display page / line 1.
A4.1 measurement	Select: volume flow / mass flow (not valid for PF (partly filled)) / diagnosis value / flow speed / coil temperature / conductivity (not valid for CAP (capacitive)) / level (only valid for PF (partly filled)) Query: use at all outputs? (also use this setting for A4.2...A4.5!) Select: no (applies only to the main current output) / yes (applies to all analogue outputs)
A4.2 unit	Selection of the unit from a list, depending on the "measurement".
A4.3 range	Setting for main current output (range: 0...100%). Setting: 0...x.xx (format and unit, depending on "measurement", see A4.1 and A4.2 above) Query: Use for all outputs? Make setting, see A4.1 above!
A4.4 low flow cutoff	Setting for main current output (sets output value to "0"). Setting: x.xxx ± x.xxx% (range: 0.0...20%) (1st value = switching point / 2nd value = hysteresis), condition: 2nd value ≤ 1st value Query: Use for all outputs? Make setting, see A4.1 above!

Function	Setting / Description
A4.5 time constant	Setting for main current output (applicable to all flow measurements). Setting: xxx.x s (range: 000.1...100 s)
	Query: Use for all outputs? Make setting, see A4.1 above!

A4 station address (only for PROFIBUS)

A4 station address	Setting of device address. The functions are described in detail in the supplementary instructions.
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A4 slave address (only for MODBUS)

A4 slave address	Setting of device address. The functions are described in detail in the supplementary instructions.
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A4 PROFINET (only for PROFINET IO)

A4 MAC Address	Shows the device "MAC Address".
A4 MAC Address 1	Shows the "MAC Address" of port 1.
A4 MAC Address 2	Shows the "MAC Address" of port 2.
A4 IP-Address: 000.000.000.000	Read or change "IP Address".
A4 Subnet Mask: 000.000.000.000	Read or change "Subnet Mask".
A4 Default Gateway: 000.000.000.000	Read or change "Default Gateway".
A4 information	Shows information about PROFINET option (e.g. software version)

A5 digital outputs (only for HART®)

A5 digital outputs	Valid for all pulse outputs (terminals A, B and/or D) and counter 1.
A5.1 measurement	Select: volume flow / mass flow (not valid for PF (partly filled))
	Query: Use for all outputs? (also use this setting for A5.2...A5.4!) Select: no (only for pulse output D) / yes (for all digital outputs)
A5.2 pulse value unit	Selection of the unit from a list, depending on the "measurement".
A5.3 value p. pulse	Setting for pulse output D (volume or mass value per pulse). Setting: xxx.xxx in L/s or kg/s
	Query: Use for all outputs? Make setting, see A5.1 above!
A5.4 low flow cutoff	Setting for pulse output D (sets output value to "0"). (1st value = switching point / 2nd value = hysteresis), condition: 2nd value ≤ 1st value
	Query: Use for all outputs? Make setting, see A5.1 above!

A6 GDC IR interface

A6 GDC IR interface	After this function has been activated an optical GDC adapter can be connected to the LC display. If approximately 60 seconds pass without a connection being established or after the adapter is removed, then the function is exited and the optical keys are active once again.
	Select: break (exit function without connection) / activate (the IR interface (adapter) and interrupt the optical keys)

Function	Setting / Description
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A7 process input

A7.1 device serial no.	Shows the serial number of the system.
The following process input parameters are only available, if the quick access has been activated in the menu "setup / device / quick setup".	
A7.2 zero calibration	Display of actual zero calibration value.
	Query: calibrate zero?
	Select: break (return with ↵ key) / standard (factory setting) / manual (display last value, set new value, range: -1.00...+1 m/s) / automatic (shows the current value as the new zero calibration value)
A7.3 size	Select from the size table.
A7.4 GK	Depending on the selection in A7.4 / A7.5, the function C1.1.0, 5 or 6 appears. Set value according to information on nameplate; range: 0.5...20
A7.5 GKL	
A7.6 coil resistance Rsp	Field coil resistance at +20°C / +68°F; range: 10.00...220 Ω
A7.7 calib. coil temp.	The coil temperature is derived from the coil resistance at the reference temperature.
	Set coil temperature.
	Select: break (return with ↵ key) / standard (=+20°C / +68°F) / automatic (set current temperature) Range: -40.0...+200°C
	Set coil resistance.
A7.8 target conduct.	Not valid for CAP (capacitive)!
	Reference value for on-site calibration; range: 1.000...50000 µS/cm
	With the PF option (partly filled) this measurement is only used for empty pipe detection (C1.1.10).
A7.9 EF electr. factor	For calculation of the conductivity based on the electrode impedance (C1.1.11).
	Select: break (return with ↵ key) / standard (with factory setting) / manual (set desired value) / automatic (determines EF according to the setting in A7.8 or C1.1.10)
	With the CAP option (capacitive) and the PF option (partly filled) this measurement is only used for empty pipe detection (C1.1.10).
A7.10 field frequency	Setting as on flow sensor nameplate = line frequency x value (from the following list): 2; 4/3; 2/3; 1/2; 1/4; 1/6; 1/8; 1/12; 1/18; 1/36; 1/50
A7.11 flow direction	Define the polarity of the flow direction.
	Select: normal direction (according to the arrow on the flow sensor) / reverse direction (in the opposite direction to the arrow)

Table 6-7: Menu "A quick setup"

6.3.2 Menu "B test"

Function	Setting / Description
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B1 simulation

B1 simulation	The displayed values are simulated.
B1.1 flow speed	Simulation of the flow speed Select: break (exit function without simulation) / set value (range: -12...+12 m/s; unit selection in C5.7.7) Query: start simulation? Select: no (exit function without simulation) / yes (start simulation)
B1.2 volume flow	Simulation of volume flow, sequence and settings similar to B1.1, see above!
B1._ current out X	_ stands for B1.3...1.6
B1._ pulse output X	
B1._ frequency out X	Simulation X
B1._ control input X	X stands for one of the connection terminals A, B, C or D
B1._ limit switch X	Sequence and settings similar to B1.1, see above!
B1._ status output X	For the pulse output the set number of pulses are displayed once in a second!
B1._ current input X	
B1.7 flow fraction	Only valid for PF option (partly filled)! Simulation of the flow fraction for partly filled pipes. This value is multiplied with the normal flow measurement. 100% relates to fully filled pipes. Sequence and settings similar to B1.1, see above!
B1.8 level	Only valid for PF option (partly filled)! Simulation of the level for partly filled pipes. Sequence and settings similar to B1.1, see above!

B2 actual values

B2 actual values	Display the actual values. Exit the displayed function with the ↵ key.
B2.1 operating hours	Display the actual operating hours. Exit the displayed function with the ↵ key.
B2.2 act. flow speed	Display the actual flow speed. Exit the displayed function with the ↵ key.
B2.3 act. coil temp.	Refer also to C1.1.7...C1.1.8.
B2.4 electr. temperature	Display the actual electronics temperature. Exit the displayed function with the ↵ key.
B2.5 act. conductivity	Refer also to C1.3.1...C1.3.2. With the CAP option (capacitive) and the PF option (partly filled) this measurement is only used for empty pipe detection (C1.1.10).
B2.6 act. electr. noise	Refer also to C1.3.13...C1.3.15.
B2.7 act. flow profile	Not valid for PF option (partly filled)! Refer also to C1.1.10...C1.1.12.
B2.8 act. coil resistance	Display the actual resistance of the field coils depending on the current coil temperature.
B2.9 current input A	Displays the active current value.
B2.10 current input B	

Function	Setting / Description
B2.11 flow fraction	Only valid for PF option (partly filled)!
	Display of the actual flow fraction for partly filled pipes. This value is multiplied with the normal flow measurement. 100% relates to fully filled pipes.
B2.12 level	Only valid for PF option (partly filled)!
	Display of the actual level for partly filled pipes.

B3 information

B3 information	LC display (this format description is only valid for B3.2....3.5) 1st line: ID number of the circuit board 2nd line: software version 3rd line: production date
B3.1 C number	CG number, cannot be changed (input/output version).
B3.2 process input	Process input part of the electronics.
B3.3 SW.REV.MS	Information about the main software.
B3.4 SW.REV.UIS	Information about the user interface software of the measuring device.
B3.5 "bus interface"	Only appears with Profibus, Modbus and FF and shows the information about the corresponding interface software.
B3.6 Electronic Revision ER	Reference identification number, electronic revision and production date of the device; includes all hardware and software changes
B3.7 CRC	Information about the CRC's for the legally relevant software components.

Table 6-8: Menu "B test"

6.3.3 Menu "C setup"

Function	Setting / Description
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C1 process input

C1.1 calibration

C1.1 calibration	Grouping of all functions related to flow sensor calibration.
C1.1.1 zero calibration	Display of actual zero calibration value.
	Query: calibrate zero? Select: break (return with ↵ key) / standard (factory setting) / manual (display last value, set new value, range: -1.00...+1 m/s) / automatic (shows the current value as the new zero calibration value)
C1.1.2 size	Select from the size table.
C1.1.3 GK selection	Not valid for PF option (partly filled)!
	Select the field current and the active GKx values; select GK value (refer to nameplate of the flow sensor). Select: GK & GKL (both values possible / linearity test) / GK (250 mApp) (only GK values possible) / GKL (125 mApp) (only GKL values possible) / GKH (250 mApp) (only GKH values possible)
C1.1.4 GK	Only available if selected in C1.1.3. Set value according to the information on the nameplate. Range: 0.5...12 (20)
C1.1.5 GKL	Not valid for PF option (partly filled)!
	Only available if selected in C1.1.3. Set value according to the information on the nameplate. Range: 0.5...12 (20)

Function	Setting / Description
C1.1.6 GKH	Not valid for PF option (partly filled)!
	Only available if selected in C1.1.3. Set value according to the information on the nameplate. Range: 0.5...12 [20]
C1.1.7 coil resistance Rsp	Field coil resistance at +20°C / +68°F.
	Range: 10.00...220 Ω
C1.1.8 calib. coil temp.	The coil temperature is derived from the coil resistance at the reference temperature.
	Set coil temperature.
	Select: break (return with ↵ key) / standard (=+20°C / +68°F) / automatic (set current temperature) Range: -40.0...+200°C
	Set coil resistance. Select: break (return with ↵ key) / standard (= setting of C1.1.7) / automatic (= calibration with the current resistance)
C1.1.9 density	Not valid for PF option (partly filled)!
	Calculation of the mass flow with constant product density. Range: 0.1...5 kg/L
C1.1.10 target conduct.	Reference value for on-site calibration. Range: 1.000...50000 µS/cm
	With the CAP option (capacitive) and the PF option (partly filled) this measurement is only used for empty pipe detection (C1.1.10).
C1.1.11 EF electr. factor	For calculation of the conductivity based on the electrode impedance.
	Query: calibrate EF? Select: break (return with ↵ key) / standard (with factory setting) / manual (set desired value) / automatic (determines EF according to the setting in C1.1.10)
	With the CAP option (capacitive) and the PF option (partly filled) this measurement is only used for empty pipe detection (C1.1.10).
C1.1.12 num. of electrodes	Setting as on flow sensor nameplate. Select: 2 electrodes (no full pipe electrode available) / 3 electrodes (with full pipe electrode but no grounding electrode available) / 4 electrodes (with full pipe and grounding electrode available)
	Not valid for CAP option (capacitive) and PF option (partly filled)!
C1.1.13 field frequency	Setting as on flow sensor nameplate = line frequency x value (from the following list): 2; 4/3; 2/3; 1/2; 1/4; 1/6; 1/8; 1/12; 1/18; 1/36; 1/50
C1.1.14 select settling	Mode of the settling time (special function).
	Select: standard (fixed allocation) / manual (manual time setting for the settling time for the field current)
C1.1.15 settling time	Only available if "manual" is selected in C1.1.14. Range: 1.0...250 ms
C1.1.16 line frequency	Setting the line frequency to one value.
	Select: automatic / 60 Hz / 50 Hz
	Select: For DC powered system, automatic = 50 Hz
C1.1.17 act. coil resistance	Display of the actual resistance of the field coil.

Function	Setting / Description
C1.2 filter	
C1.2 filter	Grouping of all functions related to filter of flow sensor electronics.
C1.2.1 limitation	Limitation of all flow values, before smoothing by time constant; affects all outputs. Settings: -xxx.x / +xxx.x m/s; condition: 1st value < 2nd value
	Range 1st value: -100.0 m/s ≤ value ≤ -0.001 m/s
	Range 2nd value: +0.001 m/s ≤ value ≤ +100 m/s
C1.2.2 flow direction	Define the polarity of the flow direction.
	Select: normal direction (according to the arrow on the flow sensor) / reverse direction (in the opposite direction to the arrow)
C1.2.3 time constant	For all flow measurements and outputs.
	xxx.x s; range: 0.0...100 s
C1.2.4 pulse filter	Suppresses noise due to solids, air/gas bubbles and sudden changes in pH.
	Select: off (without pulse filter) / on (with old pulse filter) / automatic (with new pulse filter)
	Pulse filter "on" : The change from one measurement value to the next one is limited to the value "pulse limitation" for the total time "pulse width". This filter allows a faster signal tracking for slowly changing flow values.
	Pulse filter "automatic" : The raw flow values are collected into a buffer, covering two times the "pulse width" values. This filter is called "median" filter. This filter allows a better suppression of pulse shaped disturbances (particles or air bubbles in very noisy environment).
C1.2.5 pulse width	Length of interference and delays to be suppressed on sudden changes in flow.
	Only available, if pulse filter (C1.2.4) is "on" or "automatic".
	xx.x s; range: 0.01...10 s
C1.2.6 pulse limitation	Dynamic limitation from one measured value to the next; only if pulse filter (C1.2.4) is "on".
	xx.x s; range: 0.01...100 m/s
C1.2.7 noise filter	Suppresses noise at low conductivity, high solids content, air and gas bubbles, and chemically inhomogeneous media.
	Select: off (without noise filter) / on (with noise filter)
C1.2.8 noise level	Range within which changes are evaluated as noise, and outside of which changes are evaluated as flow (only if the noise filter is set to "on" in C1.2.7).
	xx.xx m/s; range: 0.01...10 m/s
C1.2.9 noise suppression	Set noise suppression (only if the noise filter is set to "on" in C1.2.7).
	Range: 1...10, noise suppression factor [min = 1...max = 10]
C1.2.10 low flow cutoff	Sets low flow values to "0"; affects all outputs.
	x.xxx ± x.xxx L/h; range: 0.0...10 L/h
	(1st value = switching point / 2nd value = hysteresis), condition: 2nd value ≤ 1st value

Function	Setting / Description
C1.3 self test	Grouping of all functions related to self test of flow sensor electronics.
C1.3.1 empty pipe	<p>Not valid for CAP option (capacitive)!</p> <p>Switch conductivity measurement off and on (measurement of the electrode resistance).</p> <p>Select: off (no electrode resistance measurement, conductivity measurement or empty pipe indication) / conductivity (only conductivity measurement) / cond.+empty pipe (F) (conductivity measurement and empty pipe indication, error category [F] application) / cond.+empty pipe (S) (conductivity measurement and empty pipe indication, error category [S] measurement out of specification) / cond.+empty pipe (I) (conductivity measurement and empty pipe indication, error category [I] information)</p> <p>Flow indication "= 0" when "empty pipe"</p>
C1.3.1 empty pipe	<p>Only valid for CAP option (capacitive)!</p> <p>Select: off (no electrode resistance measurement or empty pipe indication) / empty pipe (F) (empty pipe indication, error category [F] application) / empty pipe (S) (empty pipe indication, error category [S] measurement out of specification) / empty pipe (I) (empty pipe indication, error category [I] information)</p> <p>Flow indication "= 0" when "empty pipe"</p>
C1.3.2 limit empty pipe	<p>Only available if "empty pipe [...]" is activated in C1.3.1.</p> <p>Range: 0.0...9999 μS (set about 50% of the lowest occurring conductivity in operation. Conductivity below this value means a signal as "empty pipe".</p> <p>For the CAP option (capacitive) this value does not indicate fluid conductivity!</p>
C1.3.3 act. conductivity	<p>Only available if "empty pipe [...]" is activated in C1.3.1.</p> <p>Actual conductivity is indicated. Activation takes place only after setting mode is exited!</p> <p>For the CAP option (capacitive) a value for empty pipe detection is displayed which does not refer to the fluid conductivity!</p>
C1.3.4 full pipe	<p>Only for flow sensors with 3 (4) electrodes.</p> <p>Select: off (no full pipe measurement) / on (full pipe measurement by 3rd electrode)</p>
C1.3.5 limit full pipe	<p>Only available if full pipe detection is activated in C1.3.4.</p> <p>Range: 0.0...9999 μS Conductivity above this value means a signal as "full pipe".</p>
C1.3.6 linearity	<p>Not valid for CAP option (capacitive) and PF option (partly filled)!</p> <p>Only if GK values "GK+GKL" are activated with C1.1.3 (check carried out with 2 field currents).</p> <p>Select: off (no linearity check) / on (linearity check activated)</p>
C1.3.7 act. linearity	<p>Not valid for CAP option (capacitive) and PF option (partly filled)!</p> <p>Only available if linearity test is activated in C1.3.6. The conductivity measurement must also be activated (C1.3.1).</p> <p>Activation takes place only after setting mode is exited!</p>
C1.3.8 gain	Automatic test switched off / on.
C1.3.9 coil current	Select: off / on
C1.3.10 flow profile	<p>Not valid for CAP option (capacitive) and PF option (partly filled)!</p> <p>Automatic test switched off / on. Select: off / on</p>

Function	Setting / Description
C1.3.11 limit flow profile	Not valid for CAP option (capacitive) and PF option (partly filled)!
	Only available if flow profile is activated in C1.3.10.
	Range: 0.000...10 [absolute values above this threshold generate an error of category [S]]
C1.3.12 act. flow profile	Not valid for CAP option (capacitive) and PF option (partly filled)!
	Only available if flow profile is activated in C1.3.10. Activation takes place only after setting mode is exited!
C1.3.13 electrode noise	Automatic test switched off / on. Select: off / on
C1.3.14 limit electr. noise	Only available if electrode noise is activated in C1.3.13.
	Range: 0.000...12 m/s [noise above this threshold generates an error of category [S]]
C1.3.15 act. electr. noise	Only available if electrode noise is activated in C1.3.13. Activation takes place only after setting mode is exited!
C1.3.16 settling of field	Automatic test switched off / on. Select: off / on
C1.3.17 diagnosis value	Not valid for CAP option (capacitive) and PF option (partly filled)!
	Select diagnosis value for testing the various analogue outputs.
	Select: off (no diagnosis) / electrode noise (activate in C1.3.13) / flow profile [activate in C1.3.10] / linearity [activate in C1.3.6] / terminal 2 DC [electrode DC voltage at electrode terminal 2] / terminal 3 DC [electrode DC voltage at electrode terminal 3]
C1.3.17 diagnosis value	Only valid for CAP option (capacitive)!
	Select diagnosis value for testing the various analogue outputs.
	Select: off (no diagnosis) / electrode noise (activate in C1.3.13)
C1.3.17 diagnosis value	Only valid for PF option (partly filled)!
	Select diagnosis value for testing the various analogue outputs.
	Select: off (no diagnosis) / electrode noise (activate in C1.3.13) / terminal 2 DC [electrode DC voltage at electrode terminal 2] / terminal 3 DC [electrode DC voltage at electrode terminal 3]

C1.4 information

C1.4 information	Grouping of all functions related to information with respect to flow sensor and sensor electronics.
C1.4.1 liner	Shows the material of the liner.
C1.4.2 electr. material	Shows the material of the electrodes.
C1.4.3 calibration date	Shows the calibration date.
C1.4.4 serial no. sensor	Shows the serial number of the flow sensor.
C1.4.5 V no. sensor	Shows the order number of the flow sensor.
C1.4.6 sensor electr. info	Shows the serial number of the circuit board, the software version number and the calibration date of the circuit board.
C1.4.7 option PF info	Only valid for PF option (partly filled)!
	Shows the serial number of circuit board, the software version number and the calibration date of the circuit board for partly filled pipes.

C1.5 simulation

C1.5 simulation	Grouping of all functions for simulating flow sensor values.
	These simulations have effect on all outputs, including counters and display.
C1.5.1 flow speed	For sequence refer to B1.1.

Function	Setting / Description
C1.5.2 volume flow	For sequence refer to B1.2.
C1.5.3 flow fraction	Only valid for PF option (partly filled)!
	For sequence refer to B1.3.
C1.5.4 level	Only valid for PF option (partly filled)!
	For sequence refer to B1.4.

Table 6-9: Menu C1

Function	Setting / Description
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C2 I/O (Inputs/Outputs)

C2.1 hardware

C2.1 hardware	Assignment of connection terminals dependent on signal converter version: active / passive / NAMUR
C2.1.1 terminals A	Select: off (switched off) / current output / frequency output / pulse output / status output / limit switch / control input / current input
C2.1.2 terminals B	Select: off (switched off) / current output / frequency output / pulse output / status output / limit switch / control input / current input
C2.1.3 terminals C	Select: off (switched off) / current output / status output / limit switch
C2.1.4 terminals D	Select: off (switched off) / frequency output / pulse output / status output / limit switch

Function	Setting / Description
C2._ current out X	
C2._ current out X	X stands for one of the connection terminals A, B or C _ stands for C2.2 (A) / C2.3 (B) / C2.4 (C)
C2._1 range 0%...100%	Current range for the selected "measurement", e.g. 4...20 mA, corresponds to 0...100% xx.x ... xx.x mA; range: 0.00...20 mA Condition: 0 mA ≤ 1st value ≤ 2nd value ≤ 20 mA
C2._2 extended range	Min. and max. limits of current values. If the current range is exceeded, the current is set to these limits. xx.x ... xx.x mA; range: 03.5...21.5 mA Condition: 0 mA ≤ 1st value ≤ 2nd value ≤ 21.5 mA
C2._3 error current	Specify error current. xx.x mA; range: 3...22 mA Condition: outside of extended range
C2._4 error condition	Set the error conditions. Select: error in device (error category [F]) / application error (error category [F]) / out of specification (error category [S])
C2._5 measurement	Measurements for activating the output. Select: volume flow / mass flow (not valid for PF (partly filled)) / diagnosis value / flow speed / coil temperature / conductivity (not valid for CAP (capacitive)) / level (only valid for PF (partly filled))
C2._6 range	0...100% of the "measurement" set in C2._5. x.xx...xx.xx _ _ _ (format and unit depend on the "measurement", see above)
C2._7 polarity	Set polarity, please note flow direction in C1.2.2! Select: both polarities (plus and minus values are displayed) / positive polarity (display for negative values = 0) / negative polarity (display for positive values = 0) / absolute value (always displays positive, with both negative and positive values)
C2._8 limitation	Limitation before applying the time constant. ±xxx ... ±xxx%; range: -150...+150%
C2._9 low flow cutoff	Sets the measurement to "0" for low values. x.xxx ± x.xxx L/h; range: 0.0...20 L/h (1st value = switching point / 2nd value = hysteresis); condition: 2nd value ≤ 1st value
C2._10 time constant	Range: 000.1...100 s
C2._11 special function	Select: off (switched off) / automatic range (range is changed automatically, extended lower range, only makes sense together with a status output) / external range (change by control input, extended lower range, control input must also be activated)
C2._12 threshold	Appears only if "C2._11 special function" is activated between extended and normal range. The automatic range function always changes from the extended to the normal range when the 100% current is reached. The upper 100% value of the hysteresis is then = 0. The threshold is then the hysteresis value, instead of "threshold ± hysteresis" as shown in the display. Range: 5.0...80% (1st value = switching point / 2nd value = hysteresis); condition: 2nd value ≤ 1st value
C2._13 information	Serial number of the I/O board, software version number and production date of the circuit board.

Function	Setting / Description
C2._14 simulation	For sequence refer to "B1._ current output X".
C2._15 4mA trimming	Trimming of the current at 4 mA.
	Reset to 4 mA restores the factory calibration.
	Used for HART® setting.
C2._16 20mA trimming	Trimming of the current at 20 mA.
	Reset to 20 mA restores the factory calibration.
	Used for HART® setting.

C2._ frequency out X

C2._ frequency out X	X stands for one of the connection terminals A, B or D _ stands for C2.2 (A) / C2.3 (B) / C2.5 (D)
C2._1 pulse shape	Specify the pulse shape.
	Select: symmetric (about 50% on and 50% off) / automatic (constant pulse with about 50% on and 50% off at 100% pulse rate) / fixed (fixed pulse rate; for setting refer to "C2._3 100% pulse rate")
C2._2 pulse width	Only available if set to "fixed" in C2._1.
	Range: 0.05...2000 ms
	Note: max. setting value T_p [ms] \leq 500 / max. pulse rate [1/s], gives the pulse width = time where the output is activated
C2._3 100% pulse rate	Pulse rate for 100% of the measuring range.
	Range: 0.0...10000 1/s
	Limitation 100% pulse rate \leq 100/s: $I_{max} \leq$ 100 mA Limitation 100% pulse rate $>$ 100/s: $I_{max} \leq$ 20 mA
C2._4 measurement	Measurements for activating the output.
	Select: volume flow / mass flow (not valid for PF (partly filled)) / diagnosis value / flow speed / coil temperature / conductivity (not valid for CAP (capacitive)) / level (only valid for PF (partly filled))
C2._5 range	0...100% of the "measurement" set in C2._4
	x.xx...xx.xx _ _ _ (format and unit depend on the "measurement", see above)
C2._6 polarity	Set polarity, please note flow direction in C1.2.2!
	Select: both polarities (plus and minus values are displayed) / positive polarity (display for negative values = 0) / negative polarity (display for positive values = 0) / absolute value (always displays positive, with both negative and positive values)
C2._7 limitation	Limitation before applying the time constant.
	\pm xxx ... \pm xxx%; range: -150...+150%
C2._8 low flow cutoff	Sets the measurement to "0" for low values.
	x.xxx \pm x.xxx L/h; range: 0.0...20 L/h
	(1st value = switching point / 2nd value = hysteresis); condition: 2nd value \leq 1st value
C2._9 time constant	Range: 000.1...100 s
C2._10 invert signal	Select: off (activated output: switch closed) / on (activated output: switch open)
C2._11 phase shift w.r.t. B	Only available when configuring the A or D terminal and only if output B is a pulse or frequency output. If setting in C2.5.6 is "both polarities", the phase shift is prefixed by a symbol, e.g. -90° and +90°.
	Select: off (no phase shift) / 0° phase shift (between outputs A or D and B, inversion possible) / 90° phase shift (between outputs A or D and B, inversion possible) / 180° phase shift (between outputs A or D and B, inversion possible)

Function	Setting / Description
C2.3.11 special functions	This function is only available at the terminal B "frequency output". At the same time, 2 frequency outputs must be available. Setting: 1st output at terminal A or D / 2nd output at terminal B The B output is operated as a slave output, controlled and set using master output A or D Select: off (no phase shift) / phase shift w.r.t. D or A (slave output is B and master output is D or A)
C2._12 information	Serial number of the I/O board, software version number and production date of the circuit board.
C2._13 simulation	For sequence refer to "B1._ frequency out X".

C2._ pulse output X

C2._ pulse output X	X stands for one of the connection terminals A, B or D _ stands for C2.2 (A) / C2.3 (B) / C2.5 (D)
C2._1 pulse shape	Specify the pulse shape. Select: symmetric (about 50% on and 50% off) / automatic (constant pulse with about 50% on and 50% off at 100% pulse rate) / fixed (fixed pulse rate, for setting refer to "C2._3 100% pulse rate")
C2._2 pulse width	Only available if set to "fixed" in C2._1. Range: 0.05...2000 ms Note: max. setting value T_p [ms] \leq 500 / max. pulse rate [1/s], gives the pulse width = time where the output is activated
C2._3 max. pulse rate	Pulse rate for 100% of the measuring range. Range: 0.01...10000 1/s Limitation 100% pulse rate \leq 100/s: $I_{max} \leq$ 100 mA Limitation 100% pulse rate $>$ 100/s: $I_{max} \leq$ 20 mA
C2._4 measurement	Measurements for activating the output. Select: volume flow / mass flow (not valid for PF (partly filled))
C2._5 pulse value unit	Selection of the unit from a list, depending on the "measurement".
C2._6 value p. pulse	Set value for volume or mass per pulse. xxx.xxx; measured value in L or kg depending on setting in C2._6
C2._7 polarity	Set polarity, please note flow direction in C1.2.2! Select: both polarities (plus and minus values are displayed) / positive polarity (display for negative values = 0) / negative polarity (display for positive values = 0) / absolute value (use for the output)
C2._8 low flow cutoff	Sets the measurement to "0" for low values. (1st value = switching point / 2nd value = hysteresis); condition: 2nd value \leq 1st value
C2._9 time constant	Range: 000.1...100 s
C2._10 invert signal	Select: off (activated output generates a high current at the output, switch closed) / on (activated output generates a low current at the output, switch open)
C2._11 phase shift w.r.t. B	Only available when configuring the A or D terminal and only if output B is a pulse or frequency output. If setting in C2.5.6 is "both polarities", the phase shift is prefixed by a symbol, e.g. -90° and +90°. Select: off (no phase shift) / 0° phase shift (between outputs A or D and B, inversion possible) / 90° phase shift (between outputs A or D and B, inversion possible) / 180° phase shift (between outputs A or D and B, inversion possible)

Function	Setting / Description
C2.3.11 special functions	This function is only available at the pulse output of terminal B. At the same time, 2 pulse outputs must be available. Setting: 1st output at terminal A or D / 2nd output at terminal B The B output is operated as a slave output, controlled and set using master output A or D Select: off (no phase shift) / phase shift w.r.t. D or A (slave output is B and master output is D or A)
C2._12 information	Serial number of the I/O board, software version number and production date of the circuit board.
C2._13 simulation	For sequence refer to "B1._ pulse output X".

C2._ status output X

C2._ status output X	X (Y) stands for one of the connection terminals A, B, C or D _ stands for C2.2 (A) / C2.3 (B) / C2.4 (C) / C2.5 (D)
C2._1 mode	The output shows the following measuring conditions: Select: out of specification (output set, signals status of category "error in device" or "application error" or "out of specification" refer to <i>Status messages and diagnostic information</i> on page 123) / application error (output set, signals status of the category "error in device" or "application error" refer to <i>Status messages and diagnostic information</i> on page 123) / polarity flow (polarity of the current flow) / over range flow (over range of the flow) / counter 1 preset (activates when counter X preset value is reached) / counter 2 preset (activates when counter X preset value is reached) / counter 3 preset (activates when counter X preset value is reached) / output A (activated by the status of output Y, additional output data see below) / output B (activated by the status of output Y, additional output data see below) / output C (activated by the status of output Y, additional output data see below) / output D (activated by the status of output Y, additional output data see below) / off (switched off) / empty pipe (when pipe empty, output activated) (contains the low-level detection for PF option (partly filled)) / error in device (when error, output activated)
C2._2 current out Y	Only appears if output A...C is set under "mode (see above)", and this output is a "current output". Select: polarity (is signaled) / over range (is signaled) / automatic range (signals lower range)
C2._2 frequency out Y and pulse output Y	Only appears if output A, B or D is set under "mode (see above)", and this output is a "frequency/pulse output". Select: polarity (is signaled) / over range (is signaled)
C2._2 status output Y	Only appears if output A...D is set under "mode (see above)", and this output is a "status output". Select: same signal (like other connected status output, signal can be inverted, see below)
C2._2 limit switch Y and control input Y	Only appears if output A...D / input A or B is set under "mode (see above)", and this output / input is a "limit switch / control input". Select: status off (is always selected here if status output X is connected with a limit switch / control input Y)
C2._2 off	Only appears if output A...D is set under "mode (see above)" and this output is switched off.
C2._3 invert signal	Select: off (activated output: switch closed) / on (activated output: switch open)
C2._4 information	Serial number of the I/O board, software version number and production date of the circuit board.
C2._5 simulation	For sequence refer to "B1._ status output X".

Function	Setting / Description
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C2._ limit switch X

C2._ limit switch X	X stands for one of the connection terminals A, B, C or D _ stands for C2.2 (A) / C2.3 (B) / C2.4 (C) / C2.5 (D)
C2._1 measurement	Select: volume flow / mass flow (not valid for PF (partly filled)) / diagnosis value / flow speed / coil temperature / conductivity (not valid for CAP (capacitive)) / level (only valid for PF (partly filled))
C2._2 threshold	Switching level, set threshold with hysteresis xxx.x ±x.xxx (format and unit depending on the "measurement", see above) (1st value = threshold / 2nd value = hysteresis), condition: 2nd value ≤ 1st value
C2._3 polarity	Set polarity, please note flow direction in C1.2.2! Select: both polarities (plus and minus values are displayed) / positive polarity (display for negative values = 0) / negative polarity (display for positive values = 0) / absolute value (always displays positive, with both negative and positive values)
C2._4 time constant	Range: 000.1...100 s
C2._5 invert signal	Select: off (activated output: switch closed) / on (activated output: switch open)
C2._6 information	Serial number of the I/O board, software version number and production date of the circuit board.
C2._7 simulation	For sequence refer to "B1._ limit switch X".

C2._ control input X

C2._ control input X	X stands for connection terminal A or B _ stands for C2.2 (A) / C2.3 (B)
C2._1 mode	Select: off (control input switched off) / hold all outputs (hold current values, not display and counters) / output Y (hold current values) / all outputs to zero (current values = 0%, not display and counters) / output Y to zero (current value = 0%) / all counters (reset all counters to "0") / counter "Z" reset (set counter 1, (2 or 3) to "0") / stop all counters / stop counter "Z" (stops counter 1, (2 or 3) / zero outp.+stop Cnt. (all outputs 0%, stop all counters, not the display) / external range Y (control input for external range of current output Y) - also make this setting on current output Y (no check if current output Y is available) / error reset (all resettable errors are deleted)
C2._2 invert signal	Select: off (control input is activated when a current is applied at the input by voltage to passive inputs or a low-value resistor to active inputs) / on (control input is activated when no current is applied at the input, low voltage to passive inputs or a high-value resistor to active inputs)
C2._3 information	Serial number of the I/O board, software version number and production date of the circuit board.
C2._4 simulation	For sequence refer to "B1._ control input X".

Function	Setting / Description
C2._ current input X	
C2._ current input X	X stands for connection terminal A or B _ stands for C2.2 (A) / C2.3 (B)
C2._1 range 0%...100%	Fixed current range (4...20 mA) for the assigned value range; The range indicated cannot be changed.
C2._2 extended range	Adjustable, extended, linear range goes from 3.6...21.0 mA. Error ranges: 0.5...<3.6 mA / >21.0...23.0 mA / <0.5 mA open circuit / >23.0 closed circuit
C2._3 measurement	The connected sensor delivers the values to the current input; possible values: temperature, pressure or current
C2._4 range	Measuring range from 0...100% in the corresponding unit.
C2._5 time constant	Range: 000.1...100 s
C2._6 information	Serial number of the I/O board, software version number and production date of the circuit board.
C2._7 simulation	For sequence refer to "B1._ current input X".
C2._8 4mA trimming	Trimming of the current at 4 mA
	Reset to 4 mA restores the factory calibration.
C2._9 20mA trimming	Trimming of the current at 20 mA
	Reset to 20 mA restores the factory calibration.

Table 6-10: Menu C2

Function	Setting / Description
C3 I/O counter	
C3.1 counter 1	Set function of counter.
C3.2 counter 2	_ stands for 1, 2, 3 (= counter 1, 2, 3) The basic version (standard) has only 2 counters!
C3.3 counter 3	These functions are only available for HART® devices.
C3._1 function	Select: sum counter (counts positive + negative values) / + counter (counts only the positive values) / - counter (counts only the negative values) / off (counter is switched off)
C3._2 measurement	Selection of the "measurement" for counter _.
	Select: volume flow / mass flow (not valid for PF (partly filled))
C3._3 low flow cutoff	Sets low flow values to "0".
	(1st value = switching point / 2nd value = hysteresis); condition: 2nd value ≤ 1st value
C3._4 time constant	Range: 000.1...100 s
C3._5 preset value	If this value is reached, positive or negative, a signal is generated that can be used for a status output at which "preset counter X" has to be set.
	Preset value (max. 8 digits) x.xxxxx in selected unit, refer to C5.7.10 + 13
C3._6 reset counter	For sequence refer to A3.2, A3.3 and A3.4.
C3._7 set counter	Set counter _ to the desired value.
	Select: break (exit function) / set value (opens the editor to make the entry)
	Query: set counter?
	Select: no (exit function without setting the value) / yes (sets the counter and exits the function)
C3._8 stop counter	Counter _ stops and holds the current value.
	Select: no (exits the function without stopping the counter) / yes (stop the counter and exits the function)
C3._9 start counter	Start counter _ after that counter is stopped.
	Select: no (exits the function without starting the counter) / yes (starts the counter and exits the function)
C3._10 information	Serial number of the I/O board, software version number and production date of the circuit board.

Table 6-11: Menu C3

Function	Setting / Description
C4 I/O HART	
C4 I/O HART	<p>Selection / display of the 4 dynamic variables (DV) for HART®.</p> <p>The HART® current output (terminal A basic I/Os or terminal C modular I/Os) always has a fixed link to the primary variables (PV). Fixed links of the other DVs (1-3) are only possible if additional analogue outputs (current and frequency) are available; if not, the "measurement" can be freely selected from the list in "A4.1 measurement".</p> <p>_ stands for 1, 2, 3 or 4 X stands for connection terminals A...D</p>
C4.1 PV is	Current output (primary variable)
C4.2 SV is	(secondary variable)
C4.3 TV is	(tertiary variable)
C4.4 4V is	(quaternary variable)
C4.5 HART units	<p>Function to make the change of the units for the DVs (dynamic variables) possible.</p> <p>Select: break (return with ↵ key) / HART® display (copies the settings for the display units to the settings for the DVs) / load defaults (resets the DVs to the factory defaults)</p>
C4._.1 current out X	Shows the current analogue measured value of the linked current output. The "measurement" cannot be changed!
C4._.1 frequency out X	Shows the current analogue measured value of the linked frequency output. If present, the "measurement" cannot be changed!
C4._.1 HART dynamic var.	<p>Measurements of the dynamic variables for HART®.</p> <p>Select (linear): volume flow / mass flow (not valid for PF (partly filled)) / diagnosis value / flow speed / coil temperature / conductivity (not valid for CAP (capacitive)) / level (only valid for PF (partly filled))</p> <p>Select (digital): counter 1 / counter 2 / counter 3 / operating hours</p>

Table 6-12: Menu C4

Function	Setting / Description
C5 device	
C5.1 device info	
C5.1 device info	Grouping of all functions that have no direct effect on the measurement or any output.
C5.1.1 Tag	Settable characters (max. 8 digits): A...Z; a...z; 0...9; / - , .
C5.1.2 C number	CG number, cannot be changed; describes the signal converter version.
C5.1.3 device serial no.	Serial number of the system; cannot be changed.
C5.1.4 electronic serial no.	Serial number of the electronic assembly; cannot be changed.
C5.1.5 SW.REV.MS	Serial number of the circuit board, version number of the main software, production date of the circuit board.
C5.1.6 Electronic Revision ER	Reference identification number, electronic revision and production date of the device; includes all hardware and software changes.
C5.1.7 CRC	Information about the CRC's for the legally relevant software components.

Function	Setting / Description
C5.2 display	
C5.2 display	-
C5.2.1 language	Language selection depends on the device version.
C5.2.2 contrast	At extreme temperatures the contrast on the display can be adjusted. Setting: -9...0...+9 This change takes place immediately, not just when setting mode is exited!
C5.2.3 default display	Specification of the default display page that is returned to after a short delay period. Select: none (current page is always active) / 1. meas. page (shows this page) / 2. meas. page (shows this page) / status page (shows only status messages) / graphic page (trend of the 1st measurement)
C5.2.4 self test	Not available at this time.
C5.2.5 SW.REV.UIS	Serial number of the circuit board, version number of user interface software, production date of the circuit board.

C5.3 1. meas. page & C5.4 2. meas. page

C5.3 1. meas. page	_ stands for 3 = 1. meas. page and 4 = 2. meas. page
C5.4 2. meas. page	
C5._1 function	Specify the number of measured value lines (font size). Select: one line / two lines / three lines
C5._2 measurement 1.line	Specify measurement for 1st line. Select: volume flow / mass flow (not valid for PF (partly filled)) / diagnosis value / flow speed / coil temperature / conductivity (not valid for CAP (capacitive)) / level (only valid for PF (partly filled))
C5._3 range	0...100% of the "measurement" set in C5._2. x.xx...xx.xx _ _ _ (format and unit depending on the "measurement")
C5._4 limitation	Limitation before applying the time constant. ±xxx...±xxx%; range: -120...+120%
C5._5 low flow cutoff	Sets low flow values to "0". (1st value = switching point / 2nd value = hysteresis); condition: 2nd value ≤ 1st value
C5._6 time constant	Range: 0.1...100 s
C5._7 format 1.line	Specify decimal places. Select: automatic (adaptation is automatic) / X (= none) ...X.XXXXXXXXX (max. 8 digits)
C5._8 measurement 2.line	Specify "measurement 2.line" (only available if this 2nd line is activated) Select: bargraph (for the measurement selected in 1st line) / volume flow / mass flow (not valid for PF (partly filled)) / diagnosis value / flow speed / counter 1 / counter 2 / counter 3 / conductivity (not valid for CAP (capacitive)) / coil temperature / operating hours / level (only valid for PF (partly filled))
C5._9 format 2.line	Specify decimal places. Select: automatic (adaptation is automatic) / X (= none) ...X.XXXXXXXXX (max. 8 digits)
C5._10 measurement 3.line	Specify "measurement 3.line" (only available if this 3rd line is activated). Select: volume flow / mass flow (not valid for PF (partly filled)) / diagnosis value / flow speed / coil temperature / conductivity (not valid for CAP (capacitive)) / counter 1 / counter 2 / counter 3 / operating hours / level (only valid for PF (partly filled)) / current input A / current input B

Function	Setting / Description
C5._.11 format 3.line	Specify decimal places. Select: automatic (adaptation is automatic) / X (= none) ...X.XXXXXXXXXX (max. 8 digits)

C5.5 graphic page

C5.5 graphic page	This page always shows trend curve of the "measurement" of the 1. meas. page / 1.line (refer to C5.3.2).
C5.5.1 select range	Select: manual (set range in C5.5.2) / automatic (automatic depiction based on the measured values) Reset only after parameter change or after switching off and on.
C5.5.2 range	Set the scaling for the Y axis. Only available if "manual" is set in C5.5.1. ±xx...±xx%; range: -100...+100% (1st value = lower limit / 2nd value = upper limit); condition: 1st value ≤ 2nd value
C5.5.3 time scale	Set the time scaling for the X axis (trend curve). xxx min; range: 0...100 min

C5.6 special functions

C5.6 special functions	-
C5.6.1 reset errors	Query: reset errors? Select: no / yes
C5.6.2 save settings	Save current settings. Select: break (exit function without saving) / backup 1 (saves the settings in the backup 1 storage place) / backup 2 (saves the settings in the backup 2 storage place) Query: go on with copy? (cannot be undone) Select: no (exit function without saving) / yes (copy current settings to storage backup 1 or backup 2)
C5.6.3 load settings	Load saved settings. Select: break (exit function without loading) / factory settings (reload factory settings) / backup 1 (loads the settings from the backup 1 storage place) / backup 2 (loads the settings from the backup 2 storage place) / load sensor data (restore factory setting of the values for the flow sensor. Display and I/O settings are retained!) Query: go on with copy? (cannot be undone) Select: no (exit the function without saving) / yes (load data from the selected storage place)
C5.6.4 password quick set	Password required to change data in the menu "quick setup". 0000 (= to this menu without password) xxxx (password required); range (4 digits): 0001...9999
C5.6.5 password setup	Password required to change data in the menu "setup". 0000 (= to this menu without password) xxxx (password required); range (4 digits): 0001...9999
C5.6.6 GDC IR interface	After this function has been activated an optical GDC adapter can be connected to the LC display. If approximately 60 seconds pass without a connection being established or after the adapter is removed, then the function is exited and the optical keys are active once again. Select: break (exit function without connection) / activate (the IR interface (adapter) and interrupt the optical keys)

Function	Setting / Description
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C5.7 units

C5.7 units	-
C5.7.1 volume flow	m ³ /h; m ³ /min; m ³ /s; L/h; L/min; L/s (L = litres); ft ³ /h; ft ³ /min; ft ³ /s; gal/h; gal/min; gal/s; IG/h; IG/min; IG/s; cf/h; cf/min; cf/s; free unit (set factor and text in the next two functions, sequence see below)
C5.7.2 Text free unit	For text to be specified refer to <i>Set free units</i> on page 122:
C5.7.3 [m ³ /s]*factor	Specification of the conversion factor, based on m ³ /s: xxx.xxx refer to <i>Set free units</i> on page 122
C5.7.4 mass flow	kg/s; kg/min; kg/h; t/min; t/h; g/s; g/min; g/h; lb/s; lb/min; lb/h; ST/min; ST/h (ST = Short Ton); LT/h (LT = Long Ton); free unit (set factor and text in the next two functions, sequence see below)
C5.7.5 Text free unit	For text to be specified refer to <i>Set free units</i> on page 122:
C5.7.6 [kg/s]*factor	Specification of the conversion factor, based on kg/s: xxx.xxx refer to <i>Set free units</i> on page 122
C5.7.7 flow speed	m/s; ft/s
C5.7.8 conductivity	μS/cm; S/m
C5.7.9 temperature	°C; °F; K
C5.7.10 volume	m ³ ; L (Liter); hL; mL; gal; IG; in ³ ; ft ³ ; yd ³ ; cf; free unit (set factor and text in the next two functions, sequence see below)
C5.7.11 Text free unit	For text to be specified refer to <i>Set free units</i> on page 122:
C5.7.12 [m ³]*factor	Specification of the conversion factor, based on m ³ : xxx.xxx refer to <i>Set free units</i> on page 122
C5.7.13 mass	kg; t; mg; g; lb; ST; LT; oz; free unit (set factor and text in the next two functions, sequence see below)
C5.7.14 Text free unit	For text to be specified refer to <i>Set free units</i> on page 122:
C5.7.15 [kg]*factor	Specification of the conversion factor, based on kg: xxx.xxx refer to <i>Set free units</i> on page 122
C5.7.16 density	kg/L; kg/m ³ ; lb/cf; lb/gal; free unit (set factor and text in the next two functions, sequence see below)
C5.7.17 Text free unit	For text to be specified refer to <i>Set free units</i> on page 122:
C5.7.18 [kg/m ³]*factor	Specification of the conversion factor, based on kg/m ³ : xxx.xxx refer to <i>Set free units</i> on page 122
C5.7.19 pressure	Pa; kPa; bar; mbar; psi (no free units possible); only if current input available.

Function	Setting / Description
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C5.8 HART

C5.8 HART	This function is only available for devices with a HART® interface!
C5.8.1 HART	Switch the HART® communication on or off. Select: on (HART® activated); possible current range for current output 4...20 mA / off (HART® not activated); possible current range for current output 0...20 mA
C5.8.2 address	Set address for HART® operation. Select: 00 (point-to-point operation, current output has normal function, current = 4...20 mA) / 01...15 (Multi-Drop operation, current output has a constant setting of 4 mA)
C5.8.3 message	Set required text: A...Z ; a...z ; 0...9 ; / - + , . *
C5.8.4 description	Set required text: A...Z ; a...z ; 0...9 ; / - + , . *

C5.8 PROFINET (only for PROFINET IO)

C5.8.1 MAC Address	Shows the device "MAC Address".
C5.8.2 MAC Address 1	Shows the "MAC Address" of port 1.
C5.8.3 MAC Address 2	Shows the "MAC Address" of port 2.
C5.8.4 IP-Address: 000.000.000.000	Read or change "IP Address".
C5.8.5 Subnet Mask: 000.000.000.000	Read or change "Subnet Mask".
C5.8.6 Default Gateway: 000.000.000.000	Read or change "Default Gateway".
C5.8.7 information	Shows information about PROFINET option (e.g. software version)

C5.9 quick setup

C5.9 quick setup	Activate quick access in the menu "quick setup". Default: "quick setup" is active (yes) Select: yes (activated) / no (not activated)
C5.9.1 reset counter 1	Reset of counter 1 can be activated or deactivated. Select: yes (activated) / no (not activated)
C5.9.2 reset counter 2	Reset of counter 2 can be activated or deactivated. Select: yes (activated) / no (not activated)
C5.9.3 reset counter 3	Reset of counter 3 can be activated or deactivated. Select: yes (activated) / no (not activated)
C5.9.4 process input	Activate quick access to the important process input parameters Select: yes (activated) / no (not activated)

Table 6-13: Menu C5

6.3.4 Set free units

Free units	Sequences to set texts and factors
Texts	
Volume flow, mass flow, mass, volume, density and pressure	3 digits before and after the slash xxx/xxx (max. 6 characters plus a "/")
Permissible characters	A...Z; a...z; 0...9; / - + , . * ; @ \$ % ~ () [] _
Conversion factors	
Desired unit	= base unit * conversion factor
Conversion factor	Max. 9 digits
Shift decimal point	↑ to the left and ↓ to the right

Table 6-14: Sequences to set texts and factors

6.4 Description of functions

6.4.1 Reset counter in the menu "quick setup"



INFORMATION!

It may be necessary to activate resetting of the counter in the menu "quick setup".

Key	Function	Description and setting
>	A quick setup	Press and hold for 2.5 s, then release the key.
>	A1 language	-
2 x ↓	A3 reset	-
>	A3.1 reset errors	-
↓	A3.2 counter 1	Select desired counter. (Counter 3 is optional)
↓	A3.3 counter 2	
↓	A3.4 counter 3	
>	Query: reset counter? Select: no	-
↓ or ↑	Query: reset counter? Select: yes	-
↵	A3.2 counter 1, A3.3 counter 2 (or A3.4 counter 3)	Counter has been reset.
3 x ↵	Measuring mode	-

Table 6-15: Reset counter in the menu "quick setup"

6.4.2 Deleting error messages in the menu "quick setup"



INFORMATION!

For the detailed list of the possible error messages refer to Status messages and diagnostic information on page 123.

Key	Function	Description
>	A quick setup	Press and hold for 2.5 s, then release the key.
>	A1 language	-
2 x ↓	A3 reset	-
>	A3.1 reset errors	-
>	Query: reset errors? Select: no	-
↓ or ↑	Query: reset errors? Select: yes	-
↵	A3.1 reset errors	Error has been reset.
3 x ↵	Measuring mode	-

Table 6-16: Deleting error messages in the menu "quick setup"

6.5 Status messages and diagnostic information

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

Each status message (= status signal) has a specific symbol, determined by NAMUR, which is displayed with the message. The length of each message is limited to one line. The symbols are shown in the top left corner of the display on every screen.

Symbol	Symbol background colour	Letter	Status signal	Description and consequence
	white	F (bold)	Error in device	No measurement possible.
	blue	F	Application error	No measurement possible due to process/application conditions. The device is still OK.
	blue	S	Out of specification	Measurements are available but are no longer sufficiently accurate and should be checked.
	blue	M	Maintenance required	Measurements are still accurate but this could soon change
	blue	C	Checks in progress	A test function is active. The displayed or transferred measured value does not correspond to the actual measured value.
-	-	I	Information	No direct influence on the measurements.
-	-	-	No message	-

Table 6-17: Description of the icons for the status level

Messages on the display	Description	Actions
Status: F _ _ _ _ _	Operational fault in device, mA output \leq 3.6 mA or set fault current (depending on the seriousness of the fault), status output open, pulse / frequency output: no pulses	Repair necessary.
F error in device	Fault or failure of device. Parameter or hardware error. No measurement possible.	Group message, when one of the following or some other severe error occurs.
F IO 1	Error, operational fault in IO 1. Parameter or hardware error. No measurement possible.	Load settings (C4.6.3) (backup 1, backup 2 or factory settings). If status message still does not disappear, replace electronic unit.
F parameter	Error, operational fault of data manager, electronic unit, parameter or hardware error. Parameters no longer usable.	
F IO 2	Error, operational fault in IO 2. Parameter or hardware error. No measurement possible.	
F configuration (also when changing modules)	Invalid configuration: display software, bus parameter or main software do not match existing configuration. This error also occurs when a module has been added or removed without confirming the configuration change.	After module change, confirm query for changed configuration. If device configuration unchanged: defective, replace electronic unit.
F display	Error, operational fault in display. Parameter or hardware error. No measurement possible.	Defective, replace electronic unit.
F sensor electronic	Error, operational fault in flow sensor electronics. Parameter or hardware error. No measurement possible.	Defective, replace electronic unit.
F sensor global	Data error in the global data of the flow sensor electronic equipment.	Load settings (C5.6.3) (backup 1, backup 2 or factory settings). If status message still does not disappear, replace electronic unit.
F sensor local	Data error in the local data of the flow sensor electronic equipment.	Defective, replace electronic unit.
F field current local	Data error in the local data of the field current supply	Defective, replace electronic unit.
F current in-/output A	Error, operational fault in current output or output for terminals A/B. Parameter or hardware error. No measurement possible.	Defective, replace electronic unit or input/output module (I/O module).
F current in-/output B		
F current output C	Error, operational fault in current output for terminal C. Parameter or hardware error. No measurement possible.	Defective, replace electronic unit or output module (I/O module).
F software user interface	Fault revealed by CRC check of operation software.	Replace electronic unit.
F hardware settings (also when changing modules)	The set hardware parameters do not match the identified hardware. A dialogue appears in the display.	Answer queries in dialogue mode, follow directions. After module change, confirm query for changed configuration. If device configuration unchanged: defective, replace electronic unit.
F hardware detection	Existing hardware cannot be identified. Defective or unknown modules.	Replace electronic unit.
F RAM/ROM error I01	A RAM or ROM error is detected during the CRC check.	Defective, replace electronic unit or input/output module (I/O module).
F RAM/ROM error I02		

Messages on the display	Description	Actions
Status: F _ _ _ _ _	Operational fault in device, mA output \leq 3.6 mA or set fault current (depending on the seriousness of the fault), status output open, pulse / frequency output: no pulses	Repair necessary.
F Fieldbus	Malfunction of the Fieldbus, Profibus or FF interface.	-
	Modbus or Ethernet interface malfunction (can also appear with some Profibus or FF errors).	-
F PF sensor error	Malfunction reported by the level sensor.	-
F PF sens. communication	Communication error to the level sensor. Either the connection is interrupted or the flow sensor is not powered up.	-
F Ethernet	Malfunction of the Ethernet interface	-

Table 6-18: Operational faults in device

Messages on the display	Description	Actions
Status: F _ _ _ _ _	Application fault, device OK, but measured values affected.	Application test or operator action necessary.
F application error	Application-dependent fault, but device is OK.	Group message, when errors as described below or other application errors occur.
F empty pipe	1 or 2 measuring electrodes are not in contact with the medium; measured value is set to zero. No measurement possible.	Measuring pipe not filled; function dependent on C1.3.2. Check installation. Or electrodes completely insulated e.g. by oil film. Clean!
	The two empty pipe messages cannot appear at the same time. The difference lies in whether the measured value is also set to zero upon the detection of an empty pipe. The flow sensor electronics will use one or the other function (setting to zero or further measurement) depending on a selection made by the user.	
F flow exceeding limit	Measuring range exceeded, filter setting limits measured values. No message if empty pipe.	Limitation C1.2.1, increase values.
	If this limit occurs sporadically in processes with air pockets, solid contents or low conductivity, then either the limit has to be increased or a pulse filter used so as to quell the error messages and also reduce the measurement errors.	
F field frequency too high	Field frequency is not reaching steady state, a measured flow value is still being supplied but may have errors. Measured values are still supplied, but they are always too low. No message if coil broken or bridged.	If "C1.1.14 settling time" is set to "manual", increase value in C1.1.15. If "standard" is set, set field frequency in C1.1.13 according to signal converter nameplate.
F DC offset	ADC over-ranged by DC offsets. No measurement can be performed, the flow is set to zero. No message if empty pipe.	For remote signal converters, check the connection of the signal cable.
F open circuit A	Load on current output A/B/C too high, effective current too low.	Current not correct, mA output cable has open circuit or load too high. Check cable, reduce load (set < 1000 Ω).
F open circuit B		
F open circuit C		

Messages on the display	Description	Actions
Status: F _ _ _ _ _	Application fault, device OK, but measured values affected.	Application test or operator action necessary.
F over range A	The current or the corresponding measured value is limited by a filter setting.	Check with "C2.1 hardware" or sticker in terminal compartment, which output is connected to the terminal. If current output: extend "C2.x.6 range" and "C2.x.8 limitation". If frequency output: extend values in "C2.x.5" and "C2.x.7".
F over range B		
F over range C		
F over range A	The pulse rate or the corresponding measured value is limited by a filter setting. Or the demanded pulse rate is too high.	
F over range B		
F over range C		
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	Error during the CRC check of the backup 1 or 2 settings.	Save active settings in backup 1 or 2.
F backup 2 settings		
F wiring A	Open or short circuit of control input A/B. Only available if used as an active NAMUR input.	-
F wiring B		
F wiring A	The current at the current input is less than 0.5 mA or greater than the limit switch of 23 mA.	-
F wiring B		

Table 6-19: Application error

Messages on the display	Description	Actions
Status: S _ _ _ _ _	Out of specification, measurement continues, accuracy possibly less.	Maintenance required.
S uncertain measurement	Device maintenance necessary; measured values only conditionally usable.	Group message, when errors as described below or other influences occur.
S pipe not full	Only for flow sensors with 3 or 4 electrodes. Full pipe electrode has no contact with medium. Measured values are still supplied, but they are too high.	Measuring pipe not filled; function dependent on C1.3.5. Check installation. Or electrodes completely insulated e.g. by oil film. Clean!
S empty pipe	1 or 2 measuring electrodes are not in contact with the medium; measured value is set to zero. Measurement continues.	Filling level of EMF less than 50% or electrodes completely insulated. If "0" to be indicated when pipe is empty, activate in "C1.3.1 cond.+empty pipe (F)".
	The two empty pipe messages cannot appear at the same time. The difference lies in whether the measured value is also set to zero upon the detection of an empty pipe. The sensor electronics will use one or the other function (setting to zero or further measurement) depending on a selection made by the user.	
S linearity	Measured values at both field current levels are not equal. Measured values are still supplied.	Very strong external magnetic fields, or defect in sensor's magnetic circuit or in signal processing.
S flow profile	Measured value is not zero in the case of a non-homogenous magnetic field. Measured values are still supplied.	Unimpeded inlet and outlet runs of the measuring sensor are too short, pipe not full, measuring tube liner damaged.

Messages on the display	Description	Actions
Status: S _ _ _ _ _	Out of specification, measurement continues, accuracy possibly less.	Maintenance required.
S electrode noise	Noise on the electrodes too high. Measured values are still supplied. No message if empty pipe.	a) Electrodes extremely soiled; b) Conductivity too low: activate noise or pulse filter C1.2.4, C1.2.7; c) Gas bubbles, solids or chem. reactions in medium: activate noise or pulse filter C1.2.4, C1.2.7; d) Electrode corrosion (if message also appears when flow is zero): use flow sensor with suitable electrode material.
S gain error	Preamplifier not equal to the calibrated value; check calibration. Measured values are still supplied.	Defective, replace electronic unit.
S electrode symmetry	Impedance of the two measuring electrodes not equal. Measured values are still supplied.	Deposits in measuring tube or electrode short-circuit to ground. Clean and check measuring tube!
S field coil broken	Field coil resistance too high.	Check field coil connections to the electronic module (for remote versions: field current cable) for open circuit / short circuit
S field coil bridged	Field coil resistance too low.	
S field current deviation	Measured field current not equal to the calibrated value. Check calibration. Measured values are still supplied. No message if coil broken or bridged.	Check field current connections. If OK: defective, replace electronic unit.
S field frequency too high	The ratio of the two measuring windows is not equal to 1, the magnetic field is not properly in steady state. Measured values are still supplied.	If "C1.1.14 settling time" is set to "manual", increase value in C1.1.15. If "standard" is set, set field frequency in C1.1.13 according to flow sensor nameplate.
S electronic temperature	Upper limit for the permissible electronic temperature has been exceeded.	Ambient temperature too high, direct solar radiation or, for C version, process temperature too high.
S coil temperature	Upper limit for the permissible coil temperature has been exceeded. No message if coil broken/bridged.	Process and ambient temperature too high.
S overflow counter 1	This is counter 1 or FB2 (with Profibus). Counter has overrun and started again at zero.	-
S overflow counter 2	This is counter 2 or FB3 (with Profibus). Counter has overrun and started again at zero.	-
S overflow counter 3	This is counter 3 or FB4 (with Profibus). Not available without IO2. Counter has overrun and started again at zero.	-
S backplane invalid	The data record on the backplane is invalid. The CRC check has revealed a fault.	No data can be loaded from the backplane when replacing electronics. Save the data to the backplane again (Service).
S error current A	Error current at current input	-
S error current B		
S less 10% level	The level sensor reports a low level inside the pipe.	-

Table 6-20: Measurements out of specification

Messages on the display	Description	Actions
Status: I _ _ _ _ _	Information (current measurement OK)	
I counter 1 stopped	This is counter 1 or FB2 (with Profibus). The counter has stopped.	If counter to continue counting, activate "yes" in "C2.y.9 start counter".
I counter 2 stopped	This is counter 2 or FB3 (with Profibus). The counter has stopped.	
I counter 3 stopped	This is counter 3 or FB4 (with Profibus). The counter has stopped.	
I power fail	The device was not in operation for an unknown period of time, because the power was switched off. This message is for information only.	Temporary power failure. Counters did not run during it.
I control input A act.	This message appears when the control input is active. This message is for information only.	-
I control input B act.		
I over range display 1	1st line on page 1 (2) of display limited by filter setting.	Menu display C4.3 and/or C4.4, select 1st or 2nd meas. page and increase values in "C4.z.3 range" and/or "C4.z.4 limitation".
I over range display 2		
I backplane sensor	The data on the backplane are not usable because they have been generated with an incompatible version.	-
I backplane settings	The global settings on the backplane are not usable because they have been generated with an incompatible version.	-
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.	-
I optical interface	The optical interface is being used. The keys on the local display are not in operation.	The keys are ready for operation again approx. 60 seconds after the end of the data transfer/removal of the optical interface.
I write cycles overfl.	The maximum number of write cycles of the EEPROM or FRAMS on the Profibus DP PCB has been exceeded.	-
I baudrate search	The baudrate of the Profibus DP interface is searched for.	-
I no data exchange	There is no data exchange between the signal converter and the Profibus.	-
I conductivity off	Conductivity measurement switched off.	Changing of settings in C1.3.1.
I diagnosis channel off	Diagnosis value switched off.	Changing of settings in C1.3.17.
I empty pipe	1 or 2 measuring electrodes are not in contact with the medium; measured value is set to zero. No measurement possible.	Measuring pipe not filled; function dependent on C1.3.2. Check installation. Or electrodes completely insulated e.g. by oil film. Clean!
I PROFINET DCP signal	Detected a PROFINET DCP signal (blink) addressed to this device. DCP signal is used for identification of a single PROFINET device on the bus.	-
I PROFINET Communication	Active PROFINET communication (application relation) with cyclic data exchange.	-
I Port 1 linked	Ethernet link on port 1 is up. There is an active network device attached to port 1 and the bus is ready for communication.	-
I Port 2 linked	Ethernet link on port 2 is up. There is an active network device attached to port 2 and the bus is ready for communication.	-

Table 6-21: Information

Messages on the display	Description	Actions
Status: C _ _ _ _ _	Output values partially simulated or fixed	Maintenance required.
C checks in progress	Test mode of the device. Measured values are possibly simulated values or values with fixed settings.	Message depending on the situation via HART® or FDT. Depiction via display if outputs are held by control input or set to zero.
C test sensor	Test function of the flow sensor electronics is active.	-
C simulation fieldbus	Values on the Foundation Fieldbus interface are simulated.	-
C sensor option PF	Test function of the flow sensor for partly filled pipes is active.	-

Table 6-22: Simulation of the measured values

7.1 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.

7.2 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.

7.3 Repairs

Repairs must be carried out exclusively by the manufacturer or the manufacturer authorised specialist companies.

7.4 Returning the device to the manufacturer

7.4.1 General information

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



WARNING!

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

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



WARNING!

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

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

7.4.2 Form (for copying) to accompany a returned device



CAUTION!

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

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

7.5 Disposal



LEGAL NOTICE!

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

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



According to the directive 2012/19/EU or UK Regulation 2013 No. 3113, the monitoring and control instruments marked with the WEEE symbol and reaching their end-of-life **must not be disposed of with other waste.**

The user must dispose of the WEEE to a designated collection point for the recycling of WEEE or send them back to our local organisation or authorised representative.

7.6 Disassembling the signal converter

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

Detailed information needed by WEEE collection and/or dismantling centre and recycling operators (and companies) is available on request at the support centre.

The signal converter is available in different versions and variants. The housing of the device and its components inside are broadly used. Therefore this handbook describes the standard versions. Where available, additional data will be mentioned. For specific data concerning versions, please contact the support centre.

Product description and data/info:

Measuring device: Electromagnetic signal converter for flow measurement

Depending on version: (values \pm 5%)		Type			
L x W x H:		Field version		Compact version	
		[mm]	[inch]	[mm]	[inch]
		205 x 300 x 277	8.1 x 11.8 x 10.9	205 x 260 x 155	8.1 x 10.2 x 6.1
Volume:		0.006 m ³	370 inch ³	0.0053 m ³	325 inch ³
Total weight:	Aluminium version	6.1 kg	13.5 lb	4.3 kg	9.48 lb
	Stainless steel version	13.5 kg	29.8 lb	9.8 kg	21.6 lb
Weight%; metal parts:		78%		82%	
Weight%; plastic parts:		9%		7%	
Weight%; electronics; PC boards		14%		11%	

Table 7-1: Field and compact version

Depending on version: (values \pm 5%)		Type			
L x W x H:		Rack version (21 TE)		Wall version	
		[mm]	[inch]	[mm]	[inch]
		190 x 129 x 107	7.5 x 5.1 x 4.2	198 x 138 x 299	7.8 x 5.4 x 11.8
Volume:		0.003 m ³	183 inch ³	0.008 m ³	489 inch ³
Total weight:	Aluminium version	1.05 kg	2.32 lb	-	-
	Polyamide carbonate version	-	-	2.4 kg	5.3 lb
Weight%; metal parts:		35%		17%	
Weight%; plastic parts:		6%		57%	
Weight%; electronics; PC boards		59%		26%	

Table 7-2: Rack and wall version

**INFORMATION!**

The device has to be de-installed from the piping-circuit and cleaned properly before disassembling is possible. The device does not have a battery (or circuit board cell) inside and the printed circuit board material used, contains a minimal weight percentage of brominated flame retardants. The device is RoHS compliant.

**DANGER!**

The device **MUST** be disconnected from power before disassembling.

**CAUTION!**

- Wear personal protective equipment.
- Make sure that you use a stable workplace/bench to do the disassembly actions.

**INFORMATION!**

Before disassembling the device, make sure you have the proper tools needed:

- Torx screwdriver set
- Pozidriv screwdriver set
- Adjustable wrench or wrench set (e.g. 10-27 mm)

There are no special guidance or actions necessary to disassemble the device.

7.6.1 Aluminum or stainless steel C (compact) version



Disassembling the device

- Remove the covers (③ - ⑤) from the housing ① by unscrewing them.
Non-standard versions can have interlocking heads screws which then have to be unscrewed first with 4 mm Allen key.
 - Disconnect all electric cables from connection terminals (if still attached).
 - Remove all the cable glands, (stopping) plug and plastic insert(s) of the housing.
 - Remove the electronics insert and display.
 - Unscrew the backplane PC board inside the housing, together with the terminal block (T20) and disconnect all the wiring from the terminal block.
 - Remove both the plastic cable covers and backplane and push the cabling (cable gland) inside the housing ① and remove it then completely.
- ➡ All main parts are now disassembled and can be shipped separately for reuse and/or recycling.

Exploded view

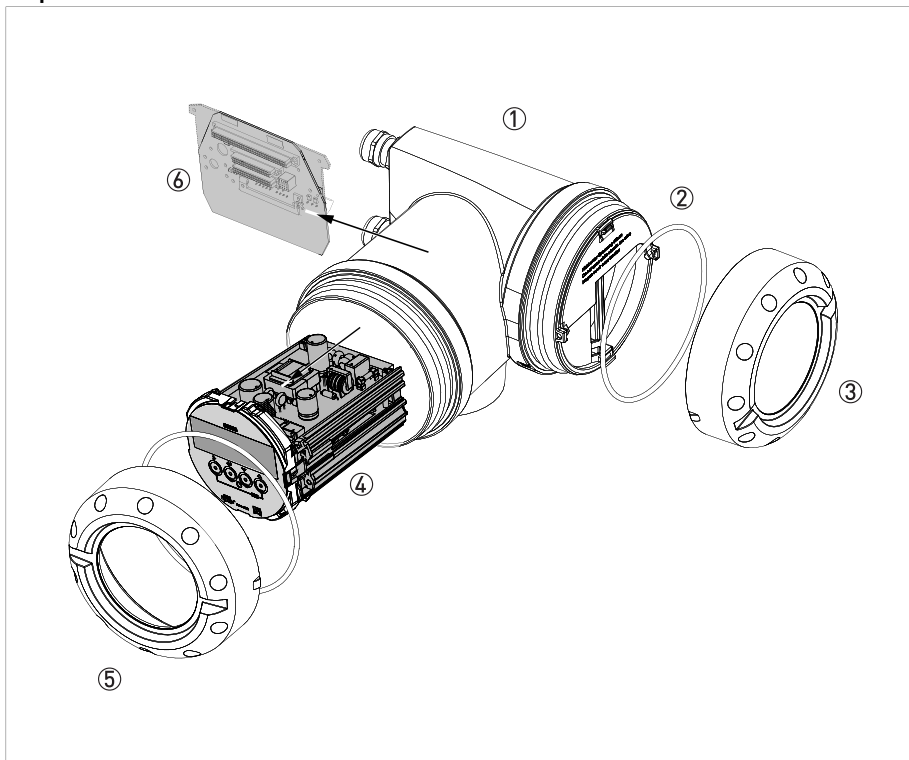


Figure 7-1: Disassembled compact device

- ① Signal converter housing
- ② Plastic housing insert with rubber ring
- ③ Cover of electric and I/O connections compartment
- ④ Electronic insert with display unit
- ⑤ Cover of electronic insert/display compartment and rubber ring (depending on version; glass window)
- ⑥ Backplane PC board for connection inside the housing (varies per version ordered)

7.6.2 Aluminium or stainless steel F (remote) version



Disassembling the device

- Remove the covers (② - ③ - ⑤) of the housing by unscrewing them.
Non-standard versions can have interlocking heads screws which then have to be unscrewed first with 4 mm Allen key.
- Disconnect all electric cables from connection terminals (if still attached).
- Remove all the cable glands, (stopping) plug and plastic insert(s) of the housing.
- Remove the electronics insert and display ⑥ .
- Unscrew the cable terminal in the console ④ and remove the terminal and cable.
- Unscrew the backplane PC board ⑦ inside the housing, together with the terminal block (T20) and disconnect all the wiring from the terminal block.
- Remove both the plastic cable covers and backplane and push the cabling (cable gland) inside the housing and remove it completely.
- By unscrewing of the four M10 bolts, the housing ① and console ④ can also be separated.
- ➡ All main parts are now disassembled and can be shipped separately for reuse and/or recycling.

Exploded view

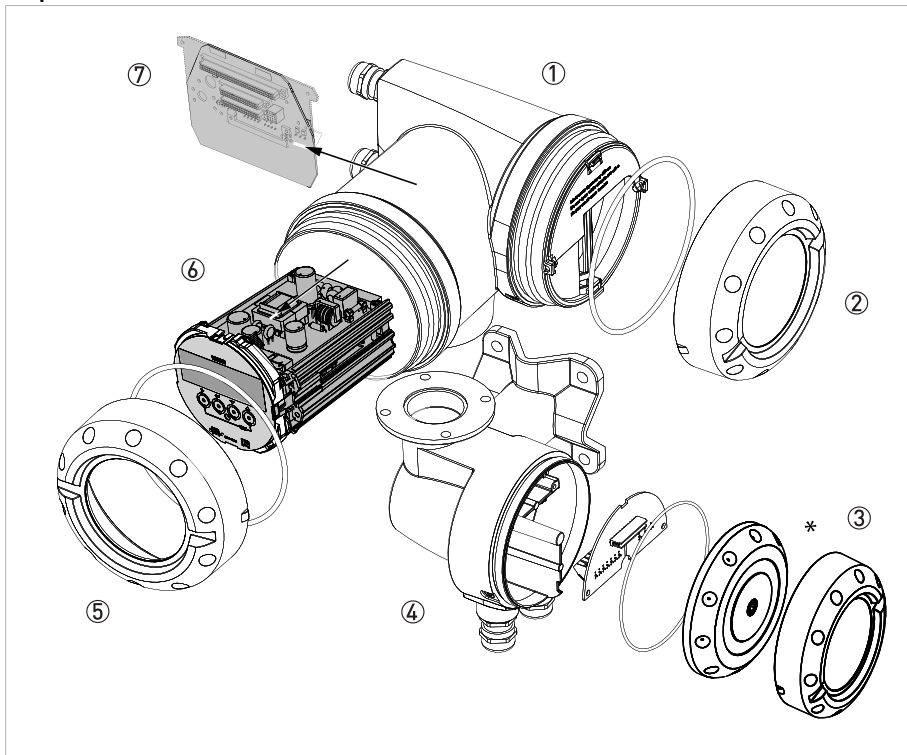


Figure 7-2: Disassembled field device

- ① Signal converter housing
- ② Cover of electric and I/O connections compartment
- ③ Cover of sensor connections compartment (* "old" version with Allen bolt mount)
- ④ Console sensor connection part
- ⑤ Cover of electronic insert/display compartment (depending on version; glass window)
- ⑥ Electronic insert with display unit
- ⑦ Backplane PC board for connection inside the housing (varies per version ordered)

7.6.3 Polyamide W (wall) version



Disassembling the device

- Open the bottom and top door of the wall housing ① , open and pull out the compartment covers of the sensor and power connection terminals.
- Disconnect all electric cables from connection terminals (if still attached) and remove the cable glands and stop plug ② .
- Remove the metal plate and locking mechanism from the inside of the bottom door
You have to break-out by force to remove the knob ② and the M10 stud bolts ⑤ on the backside of housing.
- Remove the housing locking mechanism on the left side of the rear housing part and pull out the rubber seal ④ .
- Remove the display unit and separate from electronic insert unit ⑥ , pull off all electric cable/wire(s)
(sensor connection cables and display wire connected to the circuit board).
- Unscrew both screws from electronic insert unit and lift the unit out of the backplane connector ⑦ .
Depending on the version, cut off the small PC board / connectors from the cable.
- Unscrew the four M3 bolts of the sensor connection terminal and pull it out with the leftover wire.
- Unscrew the M4 bolt of the earthing connector (mains terminal) and remove the complete PC board.
- Remove the small sealing ring and pull out the terminal block from the mains connector.
- ➡ All main parts are now disassembled and can be shipped separately for reuse and/or recycling.

Exploded view

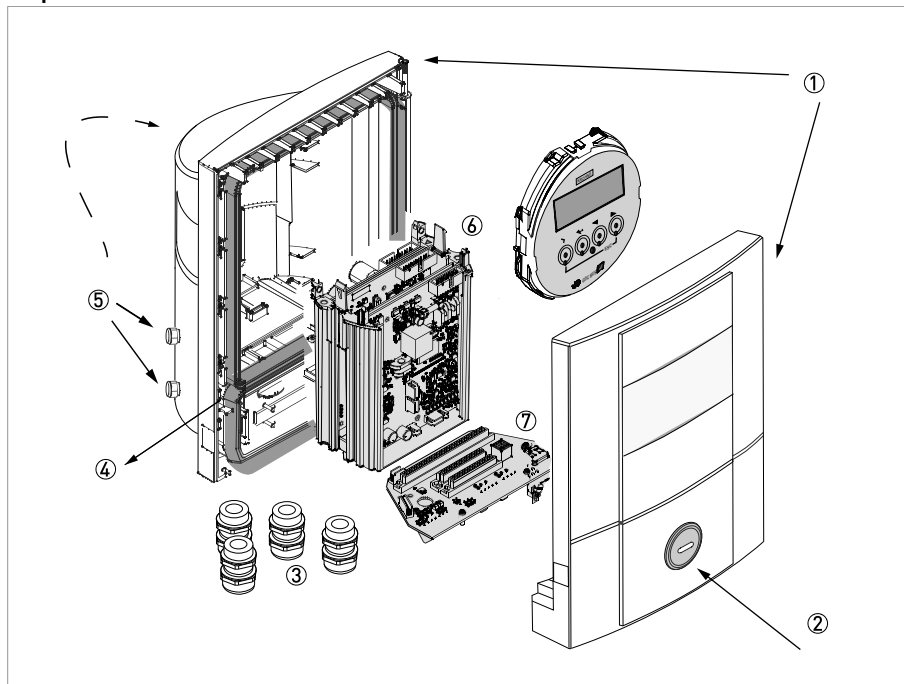


Figure 7-3: Disassembled (W) wall device

- ① Plastic parts of the front and back of the housing
- ② Integral (metal) lock for the bottom door
- ③ Cable glands
- ④ Rubber compartment seal
- ⑤ Four M10 stud bolts, cast in the back panel of the housing
- ⑥ Electronic insert with display unit
- ⑦ Backplane PCB to connect the electronic insert unit

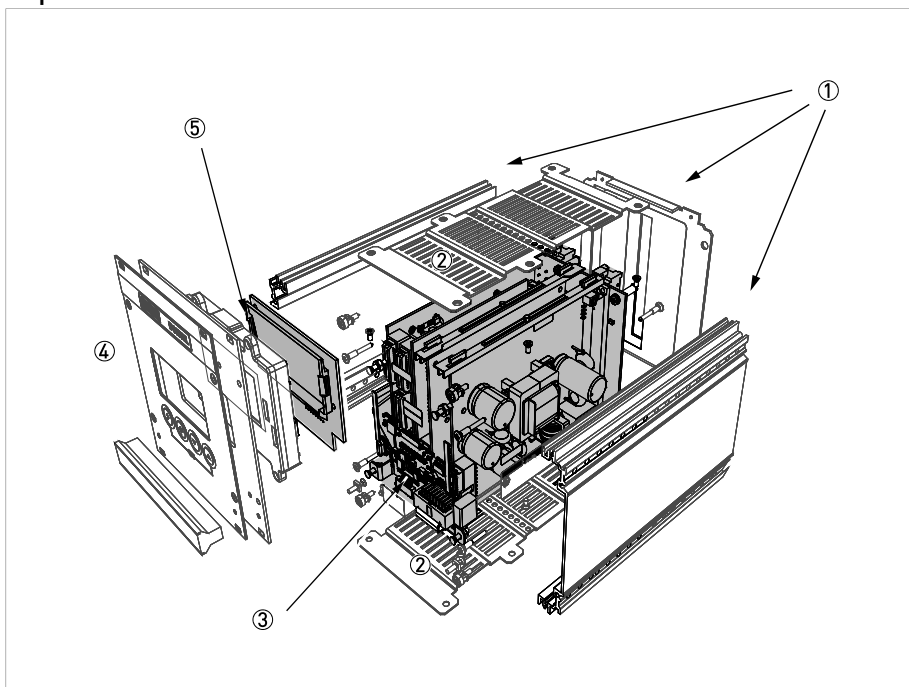
**INFORMATION!**

Because of modifications on the device, it is possible that certain parts are deviating as from what is mentioned in this manual (e.g. the integral lock from the bottom door can also be delivered in polyamide).

7.6.4 Rack version

**Disassembling the device**

- Disconnect all sensor, I/O and mains power cables if these are still attached to the device.
 - Remove the front panel by unscrewing the 4 panel screws and disconnect the display cable.
 - Unscrew the 4 panel screws of the rear panel and pull out the electronic insert unit.
 - Separate the electronic unit from the backplane and rear panel (pull out from connectors).
 - The backplane PCB can be removed from the rearpanel by unscrewing the 4 screws.
 - The different PCB's can be separated by removing all connectors / connector cables.
 - Detach the grip on the front panel, the LCD in its plastic bracket and the parts of the housing.
- ➡ All main parts are now disassembled and can be shipped separately for reuse and/or recycling.

Exploded view**Figure 7-4: Disassembled rack device (RL)**

- ① Aluminum housing parts (e.g. side and back plate)
- ② Aluminum housing parts (e.g. top and bottom plate)
- ③ Electronics insert unit
- ④ Front plate with top foil and instrument grip
- ⑤ Liquid Crystal Display with plastic bracket

7.7 Overview of the signal converter materials and components

The items mentioned in the listing below are the main parts of the device.

The signal converter can be ordered in different versions. The next tables show the data of the normal (standard) versions in compact, F (field), W (wall) and R (rack) housing. Please contact our Support Service for details of special versions with additional features on I/O and/or Ex.

Materials/components, which must be removed and treated separately

Material (or material code)	Weight		Additional information
	[kg]	[lb]	
Printed circuit boards	0.6	1.32	Average size: 600 cm ² / 9.8 inch ² (± 5%)
Electrolyte capacitor	*	*	* The PC boards of the electronic insert contains totally 20 cm ³ of electrolytic capacitors (depending on I/O configuration)
Battery	**	**	** xFC 300/400 devices with HART7 button cell for real time clock, weight ~1 gram
LCD screen/glass	0.09	0.2	Screen size < 25 cm ² The cover contains a glass screen 70 g / 0.16 lb
Plastics with brominated flame retardants	-	-	-
Noble/precious metal	-	-	-

Table 7-3: Signal converter in compact version

Material (or material code)	Weight		Additional information
	[kg]	[lb]	
Printed circuit boards	0.6	1.32	Average size: 600 cm ² / 9.8 inch ² (± 5%)
Electrolyte capacitor	*	*	* The PC boards of the electronic insert contains totally 20 cm ³ of electrolytic capacitors (depending on I/O configuration)
Battery	**	**	** xFC 300/400 devices with HART7 button cell for real time clock, weight ~1 gram
LCD screen/glass	0.09	0.2	Screen size < 25 cm ² The cover contains a glass screen 70 g / 0.16 lb Note: for Ex versions ~300 g / 0.66 lb
Plastics with brominated flame retardants	-	-	-
Noble/precious metal	-	-	-

Table 7-4: Signal converter in field version

Material (or material code)	Weight		Additional information
	[kg]	[lb]	
Printed circuit boards	0.56	1.22	Average size: 600 cm ² / 9.8 inch ² (± 5%)
Electrolyte capacitor	*	*	* The PC boards of the electronic insert contains totally 20 cm ³ of electrolytic capacitors (depending on I/O configuration)
Battery	-	-	-
LCD screen/glass	0.02	0.04	Screen size < 25 cm ²
Plastics with brominated flame retardance	-	-	
Noble/precious metal	-	-	-

Table 7-5: Signal converter in wall-mount version

Material (or material code)	Weight		Additional information
	[kg]	[lb]	
Printed circuit boards	0.60	1.32	Average size: ~600 cm ² / 9.8 inch ² (± 5%)
Electrolyte capacitor	*	*	* The PC boards of the electronic insert contains totally ± 20 cm ³ of electrolytic capacitors (depending on I/O configuration)
Battery	-	-	-
LCD screen	0.018	0.04	Screen size < 25 cm ²
Noble/precious metal	-	-	-

Table 7-6: Signal converter in rack version

Material/components, which can disturb recycling processes

Material (or material code)	Weight		Additional information
	[kg]	[lb]	
Mixture ABS / steel	-	-	-
Metal mixture	0.09	0.20	e.g. bolts, washers, screws, cable clamp
Plastics mixture	-	-	-
Silicon / rubber	0.02	0.04	O-rings
PVC & connector parts	0.01	0.02	e.g. cabling and foils (display)
Copper, brass	0.024	0.053	Gold-plated connector, copper wire

Table 7-7: Signal converter in compact version

Material (or material code)	Weight		Additional information
	[kg]	[lb]	
Mixture ABS / steel	-	-	-
Metal mixture	0.111	0.244	e.g. bolts, washers, screws, cable clamp, terminal plate
Plastics mixture	-	-	-
Silicon / rubber	0.030	0.07	O-rings
PVC & connector parts	0.013	0.03	e.g. cabling and foils (display)
Copper, brass and other	0.024	0.053	Gold-plated connector, copper wire

Table 7-8: Signal converter in field version

Material (or material code)	Weight		Additional information
	[kg]	[lb]	
Mixture ABS / steel	-	-	-
Metal mixture	0.18	0.4	e.g. bolts, washers, screws, cable clamp
Plastics mixture	-	-	-
Silicon / rubber	0.15	0.32	O-rings (seal ring)
PVC & connector parts	0.05	0.12	e.g. cabling and foils (display)
Copper, brass and other	0.01	0.02	Gold-plated connector, copper wire

Table 7-9: Signal converter in wall-mount version

Material (or material code)	Weight		Additional information
	[kg]	[lb]	
Mixture ABS / steel	-	-	-
Metal mixture	0.018	0.04	e.g. bolts, washers, screws
Plastics mixture	-	-	-
Silicon / rubber	-	-	-
PVC & connector parts	0.007	0.015	e.g. cabling and foils (display)
Copper, brass	-	-	Gold-plated connector, copper wire

Table 7-10: Signal converter in rack version

Beneficial material/components, useful for recycling

Material (or material code)	Weight		Additional information
	[kg]	[lb]	
Stainless steel	10.94 ①	24.12 ①	① Data only applicable for stainless steel housing (incl. covers)
Aluminium	3.4 ②	7.5 ②	② Data only applicable for aluminum housing (incl. covers)
Polyamide	0.36	0.79	Plastic screens and sections inside housing
Printed circuit boards	0.6	1.32	Separate electronic units
Cabling	*	*	All cables are detachable from the device
Ferrite	negligible		-
Copper, brass	negligible		-

Table 7-11: Signal converter in compact version

Material (or material code)	Weight		Additional information
	[kg]	[lb]	
Stainless steel	12.24 ①	27.0 ①	① Data only applicable for stainless steel housing (incl. covers)
Aluminium	4.8 ②	10.6 ②	② Data only applicable for aluminum housing (incl. covers)
Polyamide	0.36	0.79	Plastic screens and sections inside housing
Printed circuit boards	0.6	1.32	Separate electronic units
Cabling	*	*	All cables are detachable from the device
Ferrite	negligible		-
Copper, brass	negligible		-

Table 7-12: Signal converter in field version

Material (or material code)	Weight		Additional information
	[kg]	[lb]	
Stainless steel	0.2	0.44	-
Aluminium	negligible		-
Polyamide	1.1	2.4	Housing
Printed circuit boards	0.55	1.2	-
Cabling	*	*	All cables are detachable from the device
Ferrite	negligible		-
Copper, brass	negligible		-

Table 7-13: Signal converter in wall-mount version

Material (or material code)	Weight		Additional information
	[kg]	[lb]	
Stainless steel	negligible		-
Aluminum	0.40	0.88	Housing
Polyamide	0.05	0.11	Strap
Printed circuit boards	0.60	1.32	-
Cabling	*	*	All cables are detachable from the device
Ferrite	negligible		-
Copper, brass	negligible		-

Table 7-14: Signal converter in rack version

Total (average) *	[kg] *	[lb] *	* depending on version (\pm 5%)
Compact version (aluminum)	4.3	9.5	Aluminum content 80%
Compact version (stainless steel)	12.3	27.0	Stainless steel content 90%
Field version (aluminum)	6.1	13.5	Aluminum content 80%
Field version (stainless steel)	13.5	29.8	Stainless steel content 90%
Wall version	2.3	5.1	Polyamide content 55%
Rack version	1.1	2.4	Aluminum content 35%

8.1 Measuring principle

An electrically conductive fluid flows inside an electrically insulated pipe through a magnetic field. This magnetic field is generated by a current, flowing through a pair of field coils.

Inside of the fluid, a voltage U is generated:

$$U = v * k * B * D$$

in which:

v = mean flow velocity

k = factor correcting for geometry

B = magnetic field strength

D = inner diameter of flowmeter

The signal voltage U is picked off by electrodes and is proportional to the mean flow velocity v and thus the flow rate Q . A signal converter is used to amplify the signal voltage, filter it and convert it into signals for totalizing, recording and output processing.

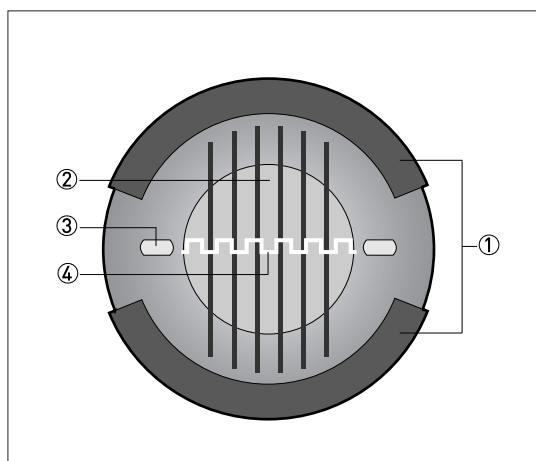


Figure 8-1: Measuring principle

- ① Field coils
- ② Magnetic field
- ③ Electrodes
- ④ Induced voltage (proportional to flow velocity)

8.2 Technical data



INFORMATION!

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

Measuring system

Measuring principle	Faraday's law of induction
Application range	Continuous measurement of current volume flow, flow velocity, conductivity, mass flow (at constant density), coil temperature of the flow sensor

Design

Modular design	The measuring system consists of a flow sensor and a signal converter.
Flow sensor	
OPTIFLUX 1000	DN10...150 / NPS3/8...6
OPTIFLUX 2000	DN25...3000 / NPS1...120
OPTIFLUX 4000	DN2.5...3000 / NPS1/10...120
OPTIFLUX 5000	Flange: DN15...300 / NPS1/2...12 Sandwich: DN2.5...100 / NPS1/10...4
OPTIFLUX 6000	DN2.5...150 / NPS1/10...6
OPTIFLUX 7000	Flange: DN25...100 / NPS1...4 Sandwich: DN25...100 / NPS1...4
	This capacitive flowmeter is only available as compact version (OPTIFLUX 7300 C).
WATERFLUX 3000	DN25...600 / NPS1...24
TIDALFLUX 2000	DN200...1600 / NPS8...64
	This flow sensor for measurements in partly filled pipelines is only available as a remote field housing version (TIDALFLUX 2300 F).
OPTIPROBE	DN80...3200 / NPS3...128
	This insertion type flow sensor is available in two models. Model A has a fixed insertion length of 25 mm / 1". Model B has a varying insertion length of 25...400 mm / 1...15.7".
	With the exception of the OPTIFLUX 1000 and WATERFLUX 3000 all flow sensors are also available as Ex versions.
Signal converter	
Compact version (C)	OPTIFLUX x300 C (x = 1, 2, 4, 5, 6, 7) or WATERFLUX 3300 C or OPTIPROBE 300 C
Field housing (F) - remote version	IFC 300 F
	Compact and field housing versions are also available as Ex versions.
Wall-mounted housing (W) - remote version	IFC 300 W
Rack-mounted housing (RL) - remote version	IFC 300 RL

Options	
Outputs / inputs	Current output (including HART®), pulse output, frequency output and/or status output, limit switch and/or control input or current input (depending on the I/O version)
Totaliser	2 (optional 3) internal counters with a max. of 10 counter places (e.g. for counting volume and/or mass units)
Verification	Integrated verification, diagnostic functions: measuring device, process, measured value, empty pipe detection, stabilisation
Communication interfaces	HART®, Foundation Fieldbus, Profibus PA and DP, PROFINET IO, Modbus
Display and user interface	
Graphic display	LC display, backlit white.
	Size: 128 x 64 pixels, corresponds to 59 x 31 mm = 2.32" x 1.22"
	Display module can be positioned/rotated in 90° increments.
	Ambient temperatures below -25°C / -13°F, may affect the readability of the display.
Operating elements	4 push buttons or 4 optical keys for operator control of the signal converter without opening the housing.
	Infrared interface for reading and writing all parameters with IR interface (option) without opening the housing.
Remote control	PACTware™ (including Device Type Manager (DTM))
	HART® Hand Held Communicator from Emerson Process
	AMS® from Emerson Process
	PDM® from Siemens
	All DTMs and drivers are available free of charge from the manufacturer's website.
Display functions	
Operating menu	Setting the parameters using 2 measured value pages, 1 status page, 1 graphics page (measured values and graphics are freely adjustable)
Language of display texts (as language package)	Standard: English, French, German, Dutch, Portuguese, Swedish, Spanish, Italian
	Eastern Europe: English, Slovenian, Czech, Hungarian
	Southern Europe: English, Turkish
	Northern Europe: English, Danish, Polish, Finnish, Norwegian
	China: English, German, Chinese
Russia: English, German, Russian	
Units	Metric, British and US units selectable as required from lists for volume/mass flow and counting, flow velocity, electrical conductivity, temperature, pressure

Measuring accuracy

Reference conditions	Depending on the flow sensor version.
	Refer to the technical data of the flow sensor.
Maximum measuring error	±0.15% of the measured value ±1 mm/s, depending on the flow sensor.
	For further information refer to the technical data of the respective flow sensor.
	Current output electronics: ±5 µA
Repeatability	±0.06% according to OIML R117 Not valid for WATERFLUX 3000, OPTIFLUX 7000, TIDALFLUX 2000 and OPTIPROBE

Operating conditions

Temperature	
Process temperature	Refer to the technical data of the flow sensor.
Ambient temperature	Depending on the version and combination of outputs.
	It is advised to protect the signal converter from external heat sources such as direct sunlight as higher temperatures reduce the life cycle of electronic components.
	-40...+65°C / -40...+149°F
	Ambient temperatures below -25°C / -13°F, may affect the readability of the display.
Storage temperature	-50...+70°C / -58...+158°F
Pressure	
Medium	Refer to the technical data of the flow sensor.
Ambient pressure	Atmosphere: height up to 2000 m / 6561.7 ft above sea level
Chemical properties	
Electrical conductivity	Standard Electrical conductive liquids in general: $\geq 1 \mu\text{S}/\text{cm}$ Demineralised water: $\geq 20 \mu\text{S}/\text{cm}$
	TIDALFLUX 2000 All media: $\geq 50 \mu\text{S}/\text{cm}$ (also refer to the technical data of the flow sensor)
	OPTIFLUX 7000 All media except for water: $\geq 0.05 \mu\text{S}/\text{cm}$ (also refer to the technical data of the flow sensor) Demineralised water: $\geq 1 \mu\text{S}/\text{cm}$
Type of measurement	Electrical conductive liquids
Solid content (volume)	Up to 70% for OPTIFLUX flow sensors and up to 20% for TIDALFLUX 2000 flow sensors
	The greater the solid content, the less accurate the measurements!
Gas content (volume)	Up to 5% for OPTIFLUX and TIDALFLUX 2000 flow sensors
	The greater the gas content, the less accurate the measurements!
Flow	For detailed information, refer to chapter "Flow tables".
Other conditions	
Ingress protection according to IEC 60529	C (compact version) & F (field housing): IP66/67 (according to NEMA 4/4X/6)
	W (wall-mounted housing): IP65/66 (according to NEMA 4/4X)
	RL (rack-mounted housing (21 TE)): IP20 (according to NEMA 1); Use: Indoor only, level of pollution 2 and relative humidity < 75%

Installation conditions

Installation	For detailed information, refer to chapter "Installation".
Inlet / outlet sections	Refer to the technical data of the flow sensor.
Dimensions and weight	For detailed information refer to chapter "Dimensions and weight".

Materials

Signal converter housing	Standard
	Version C and F: die-cast aluminium powder coated (Epoxy primer and Polyester topcoat)
	Version W: polyamide
	Version RL (21 TE): aluminium and aluminium sheet, partially polyester-coated
	Option
	Versions C and F: stainless steel 1.4408 / 316
Flow sensor	For housing materials, process connections, liners, grounding electrodes and gaskets, refer to the technical data of the flow sensor.

Electrical connection

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	Standard: 100...230 VAC (-15%), 50/60 Hz 240 VAC + 5% is included in the tolerance range.
	Option 1: 12...24 VDC (-55% / +30%) 12 VDC - 10% is included in the tolerance range.
	Option 2: 24 VAC/DC (AC: -15% / +10%, 50/60 Hz; DC: -25% / +30%) 12 V is not included in the tolerance range.
Power consumption	AC: 22 VA
	DC: 12 W
Signal cable	Only for remote versions.
	DS 300 (type A) Max. length: 600 m / 1968 ft (depending on electrical conductivity and flow sensor version)
	BTS 300 (type B) Max. length: 600 m / 1968 ft (depending on electrical conductivity and flow sensor version)
	Type LiYCY (only FM, Class 1 Div. 2) Max. length: 100 m / 328 ft (depending on electrical conductivity and flow sensor version)
Interface cable (only TIDALFLUX 2000)	Type LiYCY Max. length: 600 m / 1968 ft (3 x 0.75 mm ² shielded cable)
Cable entries (except TIDALFLUX 2000)	Standard: M20 x 1.5 (8...12 mm) for C, F and W version; Terminal strip for R version
	Option: 1/2 NPT, PF 1/2 for C, F and W version
Cable entries (only TIDALFLUX 2000)	Standard: 2x M20 x 1.5 + 2x M16 x 1.5 EMC type
	Option: 1/2 NPT

Inputs and outputs

General	All 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	V_{ext} = external voltage; R_L = load + resistance; V_0 = terminal voltage; I_{nom} = nominal current Safety limit values (Ex i): V_i = max. input voltage; I_i = max. input current; P_i = max. input power rating; C_i = max. input capacity; L_i = max. input inductivity		
Current output			
Output data	Volume flow, mass flow, diagnostic value, flow velocity, coil temperature, conductivity		
Settings	Without HART®		
	Q = 0%: 0...15 mA; Q = 100%: 10...20 mA		
	Error identification: 3...22 mA		
	With HART®		
	Q = 0%: 4...15 mA; Q = 100%: 10...20 mA		
	Error identification: 3.5...22 mA		
Operating data	Basic I/O	Modular I/O	Ex i I/O
Active	$V_{int, nom} = 24 \text{ VDC}$ $I \leq 22 \text{ mA}$ $R_L \leq 1 \text{ k}\Omega$		$V_{int, nom} = 20 \text{ VDC}$ $I \leq 22 \text{ mA}$ $R_L \leq 450 \Omega$ $V_0 = 21 \text{ V}$ $I_0 = 90 \text{ mA}$ $P_0 = 0.5 \text{ W}$ $C_0 = 90 \text{ nF} / L_0 = 2 \text{ mH}$ $C_0 = 110 \text{ nF} / L_0 = 0.5 \text{ mH}$ Linear characteristics
	Observe connection polarity.		
Passive	$V_{ext} \leq 32 \text{ VDC}$ $I \leq 22 \text{ mA}$ $V_0 \geq 1.8 \text{ V}$ $R_L \leq (V_{ext} - V_0) / I_{max}$		$V_{ext} \leq 32 \text{ VDC}$ $I \leq 22 \text{ mA}$ $V_0 \geq 4 \text{ V}$ $R_L \leq (V_{ext} - V_0) / I_{max}$ $V_i = 30 \text{ V}$ $I_i = 100 \text{ mA}$ $P_i = 1 \text{ W}$ $C_i = 10 \text{ nF}$ $L_i \sim 0 \text{ mH}$
	Observe connection polarity.		Any connection polarity.

HART®			
Description	HART® protocol via active and passive current output		
	HART® version: 5		
	Universal HART® parameter: completely integrated		
Load	≥ 230 Ω at HART® test point; Note maximum load for current output!		
Multi-Drop operation	Yes, current output = 4 mA		
	Multi-Drop address adjustable in operation menu 1...15		
Device drivers	Available for FC 375/475, AMS, PDM, FDT/DTM		
Registration (HART Communication Foundation)	Yes		
Pulse output or frequency output			
Output data	Pulse output: volume flow, mass flow		
	Frequency output: volume flow, mass flow, diagnostic value, flow velocity, coil temperature, conductivity		
Function	Adjustable as pulse or frequency output		
Pulse rate/frequency	Adjustable final value: 0.01...10000 pulse/s or Hz		
Settings	Pulses per volume or mass unit or max. frequency for 100% flow		
	Pulse width: setting automatic, symmetric or fixed (0.05...2000 ms)		
Operating data	Basic I/O	Modular I/O	Ex i I/O
Active	-	$V_{nom} = 24 \text{ VDC}$	-
		f_{max} in operating menu set to $f_{max} \leq 100 \text{ Hz}$: $I \leq 20 \text{ mA}$ open: $I \leq 0.05 \text{ mA}$ closed: $V_{0, nom} = 24 \text{ V}$ at $I = 20 \text{ mA}$	
		f_{max} in operating menu set to $100 \text{ Hz} < f_{max} \leq 10 \text{ kHz}$: $I \leq 20 \text{ mA}$ open: $I \leq 0.05 \text{ mA}$ closed: $V_{0, nom} = 22.5 \text{ V}$ at $I = 1 \text{ mA}$ $V_{0, nom} = 21.5 \text{ V}$ at $I = 10 \text{ mA}$ $V_{0, nom} = 19 \text{ V}$ at $I = 20 \text{ mA}$	
		Observe connection polarity.	

Operating data	Basic I/O	Modular I/O	Ex i I/O
Passive	$V_{\text{ext}} \leq 32 \text{ VDC}$		-
	f_{max} in operating menu set to $f_{\text{max}} \leq 100 \text{ Hz}$: $I \leq 100 \text{ mA}$ $R_{L, \text{max}} = 47 \text{ k}\Omega$ $R_{L, \text{min}} = (V_{\text{ext}} - V_0) / I_{\text{max}}$ open: $I \leq 0.05 \text{ mA}$ at $V_{\text{ext}} = 32 \text{ VDC}$ closed: $V_{0, \text{max}} = 0.2 \text{ V}$ at $I \leq 10 \text{ mA}$ $V_{0, \text{max}} = 2 \text{ V}$ at $I \leq 100 \text{ mA}$		
	f_{max} in operating menu set to $100 \text{ Hz} < f_{\text{max}} \leq 10 \text{ kHz}$: $I \leq 20 \text{ mA}$ $R_{L, \text{max}} = 47 \text{ k}\Omega$ $R_{L, \text{min}} = (V_{\text{ext}} - V_0) / I_{\text{max}}$ open: $I \leq 0.05 \text{ mA}$ at $V_{\text{ext}} = 32 \text{ VDC}$ closed: $V_{0, \text{max}} = 1.5 \text{ V}$ at $I \leq 1 \text{ mA}$ $V_{0, \text{max}} = 2.5 \text{ V}$ at $I \leq 10 \text{ mA}$ $V_{0, \text{max}} = 5.0 \text{ V}$ at $I \leq 20 \text{ mA}$		
	Any connection polarity.		
NAMUR	-	Passive to IEC 60947-5-6	Passive to IEC 60947-5-6
		open: $I_{\text{nom}} = 0.6 \text{ mA}$ closed: $I_{\text{nom}} = 3.8 \text{ mA}$	open: $I_{\text{nom}} = 0.43 \text{ mA}$ closed: $I_{\text{nom}} = 4.5 \text{ mA}$
		$V_i = 30 \text{ V}$ $I_i = 100 \text{ mA}$ $P_i = 1 \text{ W}$ $C_i = 10 \text{ nF}$ $L_i \sim 0 \text{ mH}$	
Any connection polarity.			
Low flow cut-off			
Function	Switching point and hysteresis separately adjustable for each output, counter and the display		
Switching point	Current output, frequency output: 0...20%; set in increments of 0.1		
Hysteresis	Pulse output: Unit is volume flow or mass flow and not limited		
Time constant			
Function	The time constant corresponds to the elapsed time until 63% of the end value has been reached according to a step function.		
Settings	Set in increments of 0.1 seconds.		
	0...100 seconds		

Status output / limit switch			
Function and settings	Adjustable as automatic measuring range conversion, display of flow direction, counter overflow, error, switching point or empty pipe detection		
	Valve control with activated dosing function		
	Status and/or control: ON or OFF		
Operating data	Basic I/O	Modular I/O	Ex i I/O
Active	-	$V_{int} = 24 \text{ VDC}$ $I \leq 20 \text{ mA}$ open: $I \leq 0.05 \text{ mA}$ closed: $V_{0, nom} = 24 \text{ V}$ at $I = 20 \text{ mA}$	-
Passive	$V_{ext} \leq 32 \text{ VDC}$ $I \leq 100 \text{ mA}$ $R_{L, max} = 47 \text{ k}\Omega$ $R_{L, min} = (V_{ext} - V_0) / I_{max}$ open: $I \leq 0.05 \text{ mA}$ at $V_{ext} = 32 \text{ VDC}$ closed: $V_{0, max} = 0.2 \text{ V}$ at $I \leq 10 \text{ mA}$ $V_{0, max} = 2 \text{ V}$ at $I \leq 100 \text{ mA}$	$V_{ext} = 32 \text{ VDC}$ $I \leq 100 \text{ mA}$ $R_{L, max} = 47 \text{ k}\Omega$ $R_{L, min} = (V_{ext} - V_0) / I_{max}$ open: $I \leq 0.05 \text{ mA}$ at $V_{ext} = 32 \text{ VDC}$ closed: $V_{0, max} = 0.2 \text{ V}$ at $I \leq 10 \text{ mA}$ $V_{0, max} = 2 \text{ V}$ at $I \leq 100 \text{ mA}$	-
		Observe connection polarity.	
NAMUR	-	Passive to IEC 60947-5-6 open: $I_{nom} = 0.6 \text{ mA}$ closed: $I_{nom} = 3.8 \text{ mA}$	Passive to IEC 60947-5-6 open: $I_{nom} = 0.43 \text{ mA}$ closed: $I_{nom} = 4.5 \text{ mA}$
		Any connection polarity.	$V_i = 30 \text{ V}$ $I_i = 100 \text{ mA}$ $P_i = 1 \text{ W}$ $C_i = 10 \text{ nF}$ $L_i = 0 \text{ mH}$

Control input			
Function	Hold value of the outputs (e.g. for cleaning work), set value of the outputs to "zero", counter and error reset, range change.		
	Start of dosing when dosing function is activated.		
Operating data	Basic I/O	Modular I/O	Ex i I/O
Active	-	$V_{int} = 24 \text{ VDC}$ Ext. contact open: $V_{0, nom} = 22 \text{ V}$ Ext. contact closed: $I_{nom} = 4 \text{ mA}$ Contact closed (on): $V_0 \geq 12 \text{ V}$ at $I_{nom} = 1.9 \text{ mA}$ Contact open (off): $V_0 \leq 10 \text{ V}$ at $I_{nom} = 1.9 \text{ mA}$	-
		Observe connection polarity.	
Passive	$8 \text{ V} \leq V_{ext} \leq 32 \text{ VDC}$ $I_{max} = 6.5 \text{ mA}$ at $V_{ext} \leq 24 \text{ VDC}$ $I_{max} = 8.2 \text{ mA}$ at $V_{ext} \leq 32 \text{ VDC}$ Contact closed (on): $V_0 \geq 8 \text{ V}$ at $I_{nom} = 2.8 \text{ mA}$ Contact open (off): $V_0 \leq 2.5 \text{ V}$ at $I_{nom} = 0.4 \text{ mA}$	$3 \text{ V} \leq V_{ext} \leq 32 \text{ VDC}$ $I_{max} = 9.5 \text{ mA}$ at $V_{ext} \leq 24 \text{ V}$ $I_{max} = 9.5 \text{ mA}$ at $V_{ext} \leq 32 \text{ V}$ Contact closed (on): $V_0 \geq 3 \text{ V}$ at $I_{nom} = 1.9 \text{ mA}$ Contact open (off): $V_0 \leq 2.5 \text{ V}$ at $I_{nom} = 1.9 \text{ mA}$	$V_{ext} \leq 32 \text{ VDC}$ $I \leq 6 \text{ mA}$ at $V_{ext} = 24 \text{ V}$ $I \leq 6.6 \text{ mA}$ at $V_{ext} = 32 \text{ V}$ On: $V_0 \geq 5.5 \text{ V}$ at $I \geq 4 \text{ mA}$ Off: $V_0 \leq 3.5 \text{ V}$ at $I \leq 0.5 \text{ mA}$
	Any connection polarity.	Observe connection polarity.	Any connection polarity.
			$V_i = 30 \text{ V}$ $I_i = 100 \text{ mA}$ $P_i = 1 \text{ W}$ $C_i = 10 \text{ nF}$ $L_i = 0 \text{ mH}$
NAMUR	-	Active to IEC 60947-5-6 Terminals open: $V_{0, nom} = 8.7 \text{ V}$ Contact closed (on): $V_{0, nom} = 6.3 \text{ V}$ at $I_{nom} > 1.9 \text{ mA}$ Contact open (off): $V_{0, nom} = 6.3 \text{ V}$ at $I_{nom} < 1.9 \text{ mA}$ Detection of cable break: $V_0 \geq 8.1 \text{ V}$ at $I \leq 0.1 \text{ mA}$ Detection of cable short circuit: $V_0 \leq 1.2 \text{ V}$ at $I \geq 6.7 \text{ mA}$	-
		Observe connection polarity.	

Current input			
Function	A connected external sensor delivers the values (temperature, pressure or current) to the current input.		
Operating data	Basic I/O	Modular I/O	Ex i I/O
Active	-	$V_{int, nom} = 24 \text{ VDC}$ $I \leq 22 \text{ mA}$ $I_{max} \leq 26 \text{ mA}$ (electronically limited) $V_{0, min} = 19 \text{ V at } I \leq 22 \text{ mA}$ No HART®	$V_{int, nom} = 20 \text{ VDC}$ $I \leq 22 \text{ mA}$ $V_{0, min} = 14 \text{ V at } I \leq 22 \text{ mA}$ No HART®
		Observe connection polarity.	$V_0 = 24.5 \text{ V}$ $I_0 = 99 \text{ mA}$ $P_0 = 0.6 \text{ W}$ $C_0 = 75 \text{ nF} / L_0 = 0.5 \text{ mH}$ No HART®
Passive	-	$V_{ext} \leq 32 \text{ VDC}$ $I \leq 22 \text{ mA}$ $I_{max} \leq 26 \text{ mA}$ (electronically limited) $V_{0, max} = 5 \text{ V at } I \leq 22 \text{ mA}$ No HART®	$V_{ext} \leq 32 \text{ VDC}$ $I \leq 22 \text{ mA}$ $V_{0, max} = 4 \text{ V at } I \leq 22 \text{ mA}$ No HART®
		Observe connection polarity.	$V_i = 30 \text{ V}$ $I_i = 100 \text{ mA}$ $P_i = 1 \text{ W}$ $C_i = 10 \text{ nF}$ $L_i = 0 \text{ mH}$ No HART®

PROFIBUS DP	
Description	Galvanically isolated according to IEC 61158
	Profile version: 3.01
	Automatic data transmission rate recognition (max. 12 MBaud)
	Bus address adjustable via local display at the measuring device
Function blocks	5 x analogue input (AI), 3 x totaliser
Output data	Volume flow, mass flow, volume counter 1 + 2, mass counter, velocity, coil temperature, conductivity
PROFIBUS PA	
Description	Galvanically isolated according to IEC 61158
	Profile version: 3.01
	Current consumption: 10.5 mA
	Permissible bus voltage: 9...32 V; in Ex application: 9...24 V
	Bus interface with integrated reverse polarity protection
	Typical error current FDE (Fault Disconnection Electronic): 4.3 mA
	Bus address adjustable via local display at the measuring device
Function blocks	5 x analogue input (AI), 3 x totaliser
Output data	Volume flow, mass flow, volume counter 1 + 2, mass counter, velocity, coil temperature, conductivity
FOUNDATION Fieldbus	
Description	Galvanically isolated according to IEC 61158
	Current consumption: 10.5 mA
	Permissible bus voltage: 9...32 V; in Ex application: 9...24 V
	Bus interface with integrated reverse polarity protection
	Link Master function (LM) supported
	Tested with Interoperable Test Kit (ITK) version 5.1
Function blocks	3 x analogue input (AI), 2 x integrator, 1 x PID
Output data	Volume flow, mass flow, velocity, coil temperature, conductivity, electronics temperature
Modbus	
Description	Modbus RTU, Master / Slave, RS485
Address range	1...247
Supported function codes	03, 04, 16
Supported Baud rate	1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 Baud
PROFINET IO	
Description	PROFINET IO is an Ethernet based communications protocol.
	The device features two Ethernet ports with an integrated industrial Ethernet switch.
	The Ethernet standard 100BASE-TX is supported.
	Additionally, the PHYs support the following features: - Auto negotiation - Auto crossover - Auto polarity
Output data	Volume flow, mass flow, volume counter, mass counter, velocity, coil temperature, conductivity

Approvals and certificates

Declaration of conformity	This device fulfils the statutory requirements of the relevant directives and regulations. The manufacturer certifies successful testing of the product by applying the conformity mark.
	For more information on the directives, regulations, standards and certifications, please refer to the declaration of conformity supplied with the device or downloadable from the manufacturer's website.
Standard version	Non-Ex
Hazardous areas (Original and latest certificates are available on the manufacturer website for download)	
Option (only C version)	
ATEX	OPTIFLUX 2300 C, 4300 C (FTZU 13 ATEX 0093X): II 2(1)G Ex db eb [ia Ga] mb IIC T6...T3 Gb II 2(1)G Ex db eb [ia Ga] IIC T6...T3 Gb II 2(1)G Ex db eb [ia Ga] q IIC T5...T3 Gb II 2(1)G Ex db eb [ia Ga] q IIC T6...T3 Gb II 2(1)G Ex db eb [ia Ga] IIC T6...T3 Gb II 2D Ex tb IIC T85°C...T150°C Db
	OPTIFLUX 5300 C (KEMA 04 ATEX 2127 X): II 2 GD EEx dme [ia] IIC T6...T3 T85°C...T150°C II 2 GD EEx de [ia] IIC T6...T3 T85°C...T180°C II 2 GD EEx d [ia] IIC T6...T3 T85°C...T180°C II 2 (1) GD EEx dme [ia] IIC T6...T3 T85°C...T150°C II 2 (1) GD EEx de [ia] IIC T6...T3 T85°C...T180°C II 2 (1) GD EEx d [ia] IIC T6...T3 T85°C...T180°C
	OPTIFLUX 6300 C (KEMA 05 ATEX 2214 X): II 2 GD EEx d mb e [ia] IIC T6...T3 T150°C II 2(1) GD EEx d mb e [ia] IIC T6...T3 T150°C
	OPTIFLUX 7300 C (KEMA 10 ATEX 0105 X): II 2 G Ex d e mb IIC T6...T4 II 2 (1) G Ex d e mb [ia] IIC T6...T4 II 2 G Ex d mb IIC T6...T4 II 2(1) G Ex d mb [ia] IIC T6...T4
IECEx	OPTIFLUX 2300 C, 4300 C (IECEx FTZU 13.0003X): Ex db eb [ia Ga] mb IIC T6...T3 Gb Ex db eb [ia Ga] IIC T6...T3 Gb Ex db eb [ia Ga] q IIC T5...T3 Gb Ex db eb [ia Ga] q IIC T6...T3 Gb Ex db eb [ia Ga] IIC T6...T3 Gb Ex tb IIC T85°C...T150°C Db
NEPSI (China)	OPTIFLUX 2300 C, 4300 C (GYJ20.1341X): Ex d e ia mb IIC T3-T6 Gb Ex d e ia q IIC T3-T5 Gb Ex d e ia q IIC T3-T6 Gb Ex d e ia IIC T3-T6 Gb Ex tD A21 IP6X T85°C~T150°C
IA (South-Africa)	OPTIFLUX 2300 C, 4300 C (S-XPL/081085 X): Ex dme [ia] IIC T6...T3 Ex dqe [ia] IIC T6...T3 DIP A21 T80°C...T150°C
	OPTIFLUX 5300 C (S-XPL/090219 X): Ex d [ia] IIC T6...T3 Ex de [ia] IIC T6...T3 Ex dme [ia] IIC T6...T3 Ex de [ia] mb IIC T6...T3
	OPTIFLUX 6300 C (S-XPL/090221 X): Ex d mb e [ia] IIC T6...T3

DNV (Brazil)	OPTIFLUX 2300 C, 4300 C (DNV 12.0039 X): Ex db eb [ia Ga] IIC T6...T3 Gb Ex db eb [ia Ga] mb IIC T6...T3 Gb Ex db eb [ia Ga] q IIC T6...T6 Gb Ex db eb [ia Ga] q T5...T3 Gb
FM (USA)	OPTIFLUX 1300 C, 2300 C, 4300 C, 5300 C, 6300 C (FM 16 US 0329X): Class I, Division 2, Groups A,B,C,D Class II, Division 2, Groups F,G
CSA (Canada)	OPTIFLUX 1300 C, 2300 C, 4300 C, 5300 C, 6300 C (CSA 1665151): Class I, Division 2, Groups A,B,C,D Class II, Division 2, Groups F,G Class III, Division 2
QPS (USA & Canada)	OPTIFLUX 4300 C (QPS LR1338-10): Class I, Division 1, Groups BCD T6...T3 Class II, Division 1, Groups EGF T6...T3 Class III
KCS (Korea)	OPTIFLUX 2300 C (14-AV4BO-0737X): Ex de [ia] IIC T3..T6 (14-AV4BO-0739X): Ex dqe [ia] IIC T3..T6
	OPTIFLUX 4300 C (14-AV4BO-0734X): Ex de [ia] IIC T3..T6 (14-AV4BO-0735X): Ex dme [ia] IIC T3..T6 (14-AV4BO-0736X): Ex dqe [ia] IIC T3..T6
	OPTIFLUX 5300 C (14-AV4BO-0053X): Ex d [ia] IIC T6...T3
	OPTIFLUX 7300 SW/C (14-AV4BO-0054X): Ex d [ia] IIC T6...T3
PESO (India)	OPTIFLUX 2300 C, 4300 C (Approval no. A/P/HQ/MH/104/6207 (P444665)): Ex de eb [ia Ga] mb IIC T6...T3 Gb Ex db eb [ia Ga] IIC T6...T3 Gb Ex db eb [ia Ga] q IIC T5...T3 Gb Ex db eb [ia Ga] q IIC T6...T3 Gb
Option (only F version (except TIDALFLUX 2000))	
ATEX	IFC 300 F (FTZU 12 ATEX 0198X): II 2G Ex db eb [ia] IIC T6 Gb II 2(1)G Ex db eb [ia Ga] T6 Gb II 2D Ex tb IIIC T85°C Db
IECEX	IFC 300 F (IECEX FZTU 12.0023X): Ex db eb [ia] IIC T6 Gb Ex db eb [ia Ga] IIC T6 Gb Ex tb IIIC T85°C Db
NEPSI (China)	IFC 300 F (GYJ20.1343X): Ex d e [ia] IIC T6 Gb Ex d e [ia Ga] IIC T6 Gb Ex tD A21 [iaD] IP6X T85°C
IA (South-Africa)	IFC 300 F (S-XPL/090214): Ex de [ia] IIC T6
DNV (Brazil)	IFC 300 F (DNV 12.0044 X): Ex db eb [ia] IIC T6 Gb Ex db eb [ia Ga] IIC T6 Gb Ex tb IIIC T85°C Db, IP66/IP67, -40°C ≤ Ta ≤ +65°C (aluminum housing) -40°C ≤ Ta ≤ +60°C (stainless steel housing)
FM (USA)	IFC 300 F (FM 16 US 0329X): Class I, Division 2, Groups A,B,C,D Class II, Division 2, Groups E, F,G Class III, Division 2
CSA (Canada)	IFC 300 F (CSA 1665151): Class I, Division 2, Groups A,B,C,D Class II, Division 2, Groups F,G

KCS (Korea)	IFC 300 F (14-AV4BO-0748X): Ex de [ia] IIC T6
PESO (India)	IFC 300 F (Approval no. A/P/HQ/MH/104/5640 (P398966)): Ex db e [ia Ga] IIC T6 Gb
Option (only TIDALFLUX 2300 F)	
ATEX	TIDALFLUX 2300 F (DEKRA 12 ATEX 0235 X): IFC 300 F/PF: II 2G Ex d e [ia] IIC T6 Gb II 2[1]G Ex d e [ia] [ia Ga] IIC T6 Gb TIDALFLUX 2000: II 2G Ex d e ia q [ia] IIC T6 Gb II 2G Ex d e ia [ia] IIC T6 Gb
IECEX	TIDALFLUX 2300 F (IECEX DEK 12.0079X): IFC 300 F/PF: Ex d e [ia] IIC T6 Gb Ex d e [ia] [ia Ga] IIC T6 Gb TIDALFLUX 2000: Ex d e ia q [ia] IIC T6 Gb Ex d e ia [ia] IIC T6 Gb
NEPSI (China)	IFC 300 F/PF (GYJ16.1307X): Ex de [ia] IIC T6 Gb Ex de [ia Ga] IIC T6 Gb TIDALFLUX 2000 (GYJ16.1306X): Ex d e ia q IIC T6 Gb Ex d e ia IIC T6 Gb
QPS (USA & Canada)	TIDALFLUX 2300 F (QPS LR1338-8): IFC 300 F/PF: Class I, Zone 1, AEx db eb [ia Ga] IIC T6 Gb Class I, Division 2, Groups A,B,C,D T6 TIDALFLUX 2000: Class I, Zone 1, AEx db eb ia q [ia Ga] IIC T6 Gb Class I, Zone 1, AEx db eb ia [ia Ga] IIC T6 Gb Class I, Division 2, Groups A,B,C,D T6
Custody transfer (except TIDALFLUX 2000 & OPTIFLUX 7300 C)	
Standard version	Without
Option	Cold drinking water (OIML R49-1, KIWA K618, MI-001, UKCA); liquids other than water (OIML R117-1, MI-005)
Other standards and approvals	
Vibration and shock resistance	IEC 60068-2-34 Random vibration: f1 = 20 Hz, f2 = 2000 Hz; ASD = 0.01 g ² /Hz (rms a = 4.5 g), t = 90 minutes
	IEC 60068-2-27 Shock: peak acceleration a = 30 g, half sine wave; duration: 18 ms, number of shocks: 5
NAMUR	NE 21, NE 43, NE 53
CSA OL	CLASS 2252 86, CLASS 2252 06

Table 8-1: Technical data

8.3 Dimensions and weight

8.3.1 Housing

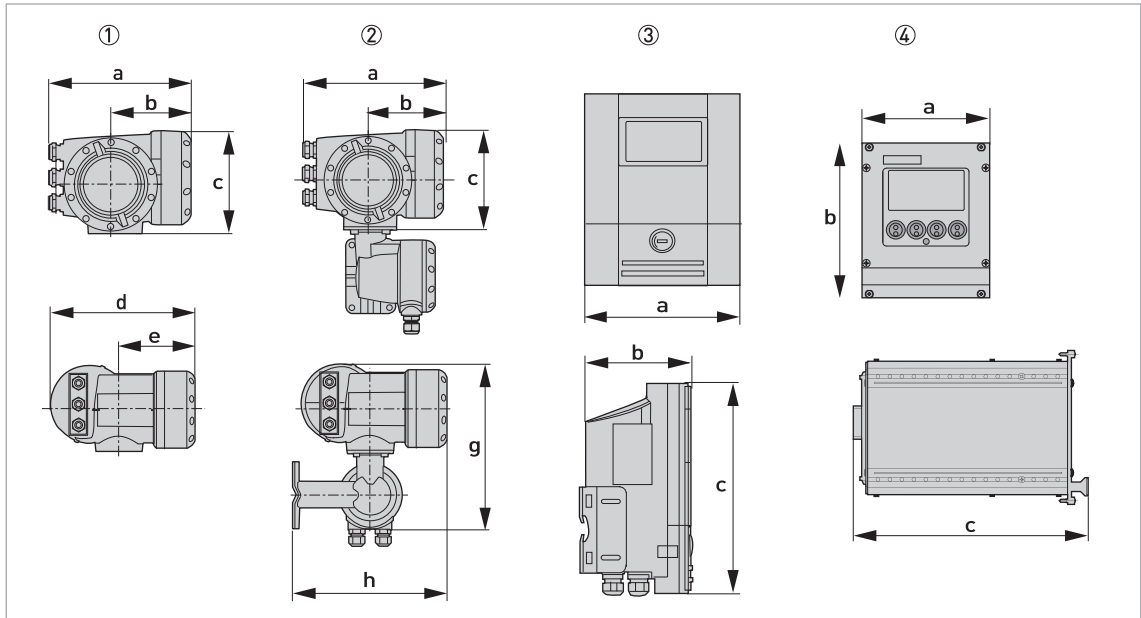


Figure 8-2: Dimensions of housing

- ① Compact version (C)
- ② Field housing (F) - remote version
- ③ Wall-mounted housing (W) - remote version
- ④ 19" rack-mounted housing 21 TE (RL) - remote version

Version	Dimensions [mm / inch]							Weight [kg / lb]
	a	b	c	d	e	g	h	
C ①	202 / 7.95	120 / 4.75	155 / 6.1	260 / 10.2	137 / 5.4	-	-	4.2 / 9.3
F ②	202 / 7.95	120 / 4.75	155 / 6.1	-	-	295.8 / 11.6	277 / 10.9	5.7 / 12.6
W ③	198 / 7.8	138 / 5.4	299 / 11.8	-	-	-	-	2.4 / 5.3
RL ④	107 / 4.21 (21 TE)	129 / 5.08 (3 HE)	190 / 7.48	-	-	-	-	0.98 / 2.16

Table 8-2: Dimensions and weight

The weight of the field housing version in stainless steel is 13.5 kg / 29.8 lb.



INFORMATION!

The total dimensions and weight of the compact device are depending on the nominal diameter and the material of the flow sensor.
For detailed information please refer to the relevant flow sensor documentation.

8.3.2 Mounting plate of field housing

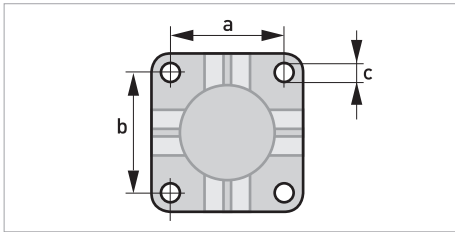


Figure 8-3: Dimensions for mounting plate of field housing

	[mm]	[inch]
a	72	2.8
b	72	2.8
c	Ø9	Ø0.4

Table 8-3: Dimensions in mm and inch

8.3.3 Mounting plate of wall-mounted housing

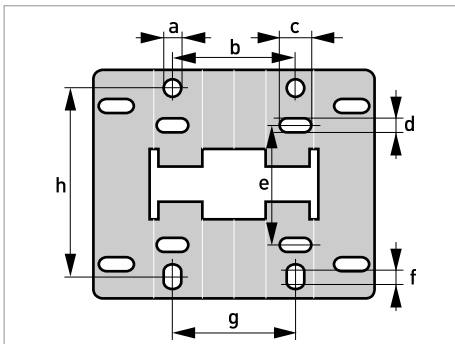


Figure 8-4: Dimensions of mounting plate of wall-mounted housing

	[mm]	[inch]
a	Ø9	Ø0.4
b	64	2.5
c	16	0.6
d	7	0.3
e	63	2.5
f	13	0.5
g	64	2.5
h	98	3.85

Table 8-4: Dimensions in mm and inch

8.4 Flow tables

v [m/s]	Q _{100 %} in m ³ /h			
	0.3	1	3	12
DN [mm]	Minimum flow	Nominal flow		Maximum flow
2.5	0.005	0.02	0.05	0.21
4	0.01	0.05	0.14	0.54
6	0.03	0.10	0.31	1.22
10	0.08	0.28	0.85	3.39
15	0.19	0.64	1.91	7.63
20	0.34	1.13	3.39	13.57
25	0.53	1.77	5.30	21.21
32	0.87	2.90	8.69	34.74
40	1.36	4.52	13.57	54.29
50	2.12	7.07	21.21	84.82
65	3.58	11.95	35.84	143.35
80	5.43	18.10	54.29	217.15
100	8.48	28.27	84.82	339.29
125	13.25	44.18	132.54	530.15
150	19.09	63.62	190.85	763.40
200	33.93	113.10	339.30	1357.20
250	53.01	176.71	530.13	2120.52
300	76.34	254.47	763.41	3053.64
350	103.91	346.36	1039.08	4156.32
400	135.72	452.39	1357.17	5428.68
450	171.77	572.51	1717.65	6870.60
500	212.06	706.86	2120.58	8482.32
600	305.37	1017.90	3053.70	12214.80
700	415.62	1385.40	4156.20	16624.80
800	542.88	1809.60	5428.80	21715.20
900	687.06	2290.20	6870.60	27482.40
1000	848.22	2827.40	8482.20	33928.80
1200	1221.45	3421.20	12214.50	48858.00
1400	1433.52	4778.40	14335.20	57340.80
1600	2171.46	7238.20	21714.60	86858.40
1800	2748.27	9160.9	27482.70	109930.80
2000	3393.00	11310.00	33930.00	135720.00
2200	4105.50	13685.00	41055.00	164220.00
2400	4885.80	16286.00	48858.00	195432.00
2600	5733.90	19113.00	57339.00	229356.00
2800	6650.10	22167.00	66501.00	266004.00
3000	7634.10	25447.00	76341.00	305364.00

Table 8-5: Flow rate in m/s and m³/h

v [ft/s]	Q ₁₀₀ % in US gallons/min			
	1	3.3	10	40
NPS [inch]	Minimum flow	Nominal flow		Maximum flow
1/10	0.02	0.09	0.23	0.93
1/6	0.06	0.22	0.60	2.39
1/4	0.13	0.44	1.34	5.38
3/8	0.37	1.23	3.73	14.94
1/2	0.84	2.82	8.40	33.61
3/4	1.49	4.98	14.94	59.76
1	2.33	7.79	23.34	93.36
1.25	3.82	12.77	38.24	152.97
1.5	5.98	19.90	59.75	239.02
2	9.34	31.13	93.37	373.47
2.5	15.78	52.61	159.79	631.16
3	23.90	79.69	239.02	956.09
4	37.35	124.47	373.46	1493.84
5	58.35	194.48	583.24	2334.17
6	84.03	279.97	840.29	3361.17
8	149.39	497.92	1493.29	5975.57
10	233.41	777.96	2334.09	9336.37
12	336.12	1120.29	3361.19	13444.77
14	457.59	1525.15	4574.93	18299.73
16	597.54	1991.60	5975.44	23901.76
18	756.26	2520.61	7562.58	30250.34
20	933.86	3112.56	9336.63	37346.53
24	1344.50	4481.22	13445.04	53780.15
28	1829.92	6099.12	18299.20	73196.79
32	2390.23	7966.64	23902.29	95609.15
36	3025.03	10082.42	30250.34	121001.37
40	3734.50	12447.09	37346.00	149384.01
48	5377.88	17924.47	53778.83	215115.30
56	6311.60	21038.46	63115.99	252463.94
64	9560.65	31868.51	95606.51	382426.03
72	12100.27	40333.83	121002.69	484010.75
80	14938.92	49795.90	149389.29	597557.18
88	18075.97	60252.63	180759.73	723038.90
96	21511.53	71704.38	215115.30	860461.20
104	25245.60	84151.16	252456.02	1009824.08
112	29279.51	97597.39	292795.09	1171180.37
120	33611.93	112038.64	336119.31	1344477.23

Table 8-6: Flow rate in ft/s and US gallons/min

9.1 General description

The open HART[®] protocol, which can be used freely, is integrated into the signal converter for communication.

Devices which support the HART[®] protocol are classified as either operating devices or field devices. When it comes to operating devices (Master), both manual control units (Secondary Master) and PC-supported workstations (Primary Master) are used in, for example, a control centre.

HART[®] field devices include flow sensors, signal converters and actuators. The field devices range from 2-wire to 4-wire to intrinsically safe versions for use in hazardous areas.

The HART[®] data are superimposed over the analogue 4...20 mA signal via FSK modem. This way, all of the connected devices can communicate digitally with one another via the HART[®] protocol while simultaneously transmitting the analogue signals.

When it comes to the field devices and secondary masters, the FSK or HART[®] modem is integrated, whereas with a PC communication takes place via an external modem which must be connected to the serial interface. There are, however, other connection variants which can be seen in the following connection diagrams.

9.2 Software history



INFORMATION!

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

Release date	Electronic revision (ER)	SW.REV.UIS	SW.REV.MS	HART [®] Device Revision
-	ER3.1.x	3.1.0	2.2.1	2
-	ER3.2.x	3.2.x	3.0.x	2
2010	ER3.3.x	3.3.x	3.0.x	3
2017	ER3.4.x	3.4.x	3.0.x	4

Table 9-1: Revision for device ID

HART [®] Device Revision	HART [®] DD Revision	FC 375/475 system SW.Rev.	AMS version	PDM version
2	2	≥ 1.8	≥ 7.0	≥ 6.0

Table 9-2: Revision for DD ID

Manufacturer ID	69 (0x45)
Device Type	227 (0xE3)

Table 9-3: HART[®] identification codes

9.3 Connection variants

The signal converter is a 4-wire device which is available in a variant with 4...20 mA current output and HART® interface.

Depending on the version, the settings and the wiring, the current output can operate as passive or active output.

- **Multi-drop mode is supported**

In a multi-drop communication system, more than 2 devices are connected to a common transmission cable.

- **Burst mode is not supported**

In the Burst mode a slave device transfers cyclic pre-defined response telegrams, to get a higher rate of data transfer.



INFORMATION!

For detailed information about the electrical connection of the signal converter for HART®, refer to the section "Electrical connection".

There are two ways of using the HART® communication:

- as Point-to-Point connection and
- as multi-drop connection, with 2-wire connection or as multi-drop connection, with 3-wire connection.

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

Point-to-Point connection between the signal converter and the HART® Master.

The current output of the device may be active or passive.

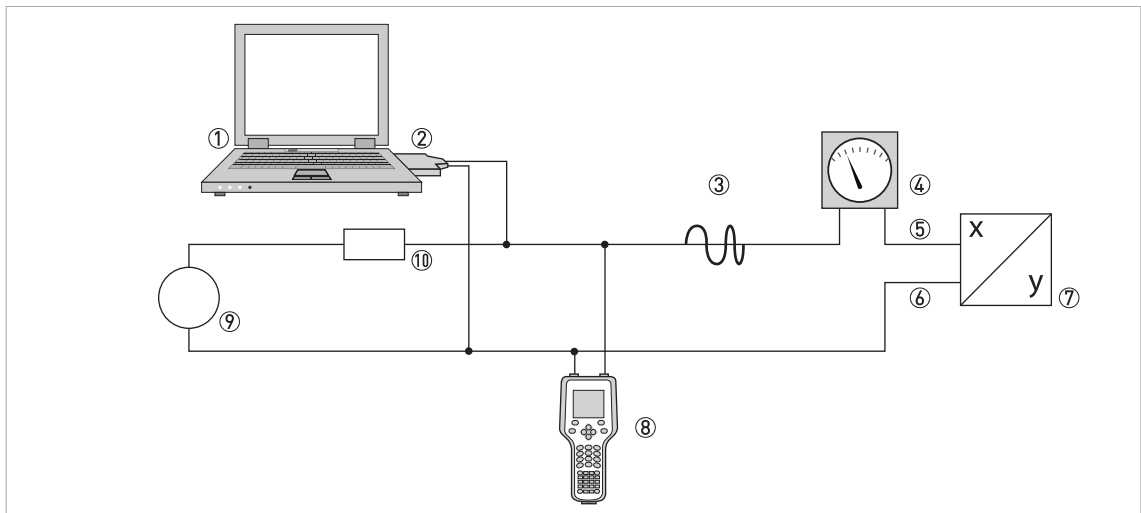


Figure 9-1: Point-to-Point connection

- ① Primary master
- ② FSK modem or HART® modem
- ③ HART® signal
- ④ Analog indication
- ⑤ Signal converter terminals A (C)
- ⑥ Signal converter terminals A- (C-)
- ⑦ Signal converter with address = 0 and passive or active current output
- ⑧ Secondary Master
- ⑨ Power supply for devices (slaves) with passive current output
- ⑩ Load $\geq 230 \Omega$

9.3.2 Multi-drop connection (2-wire connection)

In the case of a multi-drop connection, up to 15 devices may be installed in parallel (this signal converter and other HART® devices).

The current outputs of the devices must be passive!

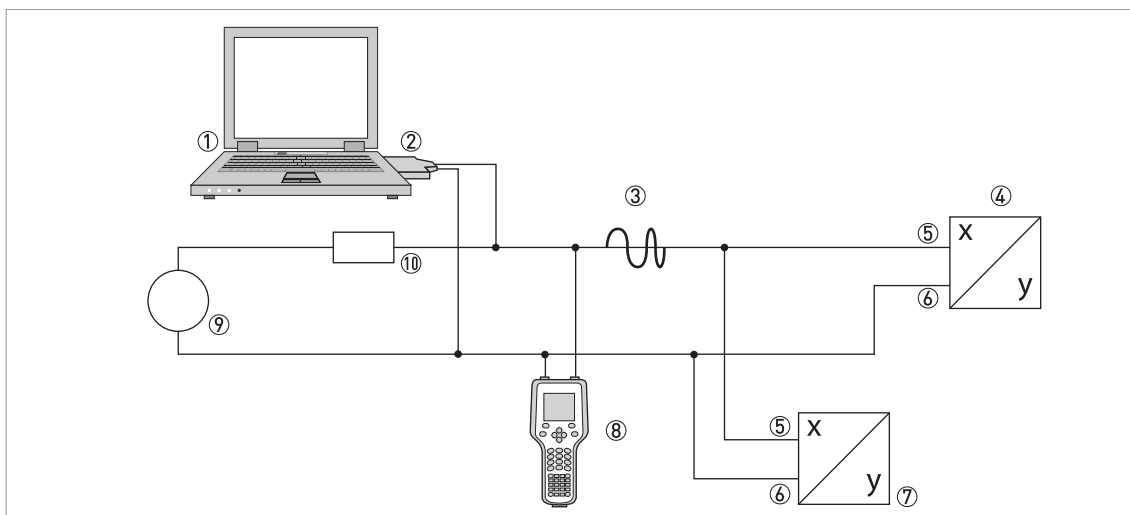


Figure 9-2: Multi-Drop connection (2-wire connection)

- ① Primary Master
- ② HART® modem
- ③ HART® signal
- ④ Other HART® devices or this signal converter (refer also to ⑦)
- ⑤ Signal converter terminals A (C)
- ⑥ Signal converter terminals A- (C-)
- ⑦ Signal converter with address ≥ 0 and passive current output, connection of max. 15 devices (slaves) with 4...20 mA
- ⑧ Secondary Master
- ⑨ Power supply
- ⑩ Load $\geq 230 \Omega$

9.3.3 Multi-drop connection (3-wire connection)

Connection of 2-wire and 4-wire devices in the same network. In order that the current output of the signal converter is working continuously active, an additional third wire must be connected to the devices in the same network. These devices must be powered via a 2-wire loop.

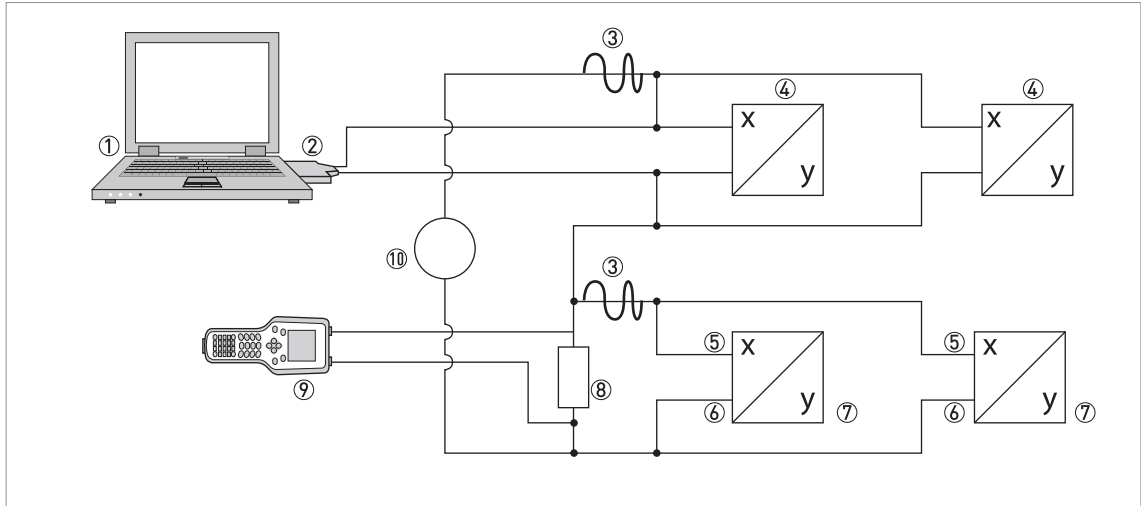


Figure 9-3: Multi-Drop connection (3-wire connection)

- ① Primary Master
- ② HART[®] modem
- ③ HART[®] signal
- ④ 2-wire external devices (slaves) with 4...20 mA, addresses > 0, powered by current loop
- ⑤ Signal converter terminals A (C)
- ⑥ Signal converter terminals A- (C-)
- ⑦ Connection of active or passive 4-wire devices (slaves) with 4...20 mA, addresses ≥ 0
- ⑧ Load ≥ 230 Ω
- ⑨ Secondary Master
- ⑩ Power supply

9.4 Inputs/outputs and HART dynamic variables and device variables

The signal converter is available with various input/output combinations.

The connection of the terminals A...D to the HART[®] dynamic variables PV, SV, TV and 4V depends on the device version.

PV = Primary Variable; SV = Secondary Variable; TV = Third Variable; 4V = Quaternary Variable

Signal converter version	HART [®] dynamic variable			
	PV	SV	TV	4V
Basic I/O, connection terminals	A	D	-	-
Modular I/O and Ex i I/O, connection terminals	C	D	A	B

Table 9-4: Connection of the terminals to the HART[®] dynamic variables

The signal converter can provide up to 10 measured values. The measured values are accessible as so-called HART[®] device variables and can be connected to the HART[®] dynamic variables. The availability of these variables depends on the device versions and the settings.

Code = device variable code

HART [®] device variable	Code	Type	Explanations
flow speed	20	linear	
volume flow	21	linear	
mass flow	22	linear	
conductivity	24	linear	
coil temperature	23	linear	
counter 1 (C)	6	totalizer	Valid for Basic I/O option only.
counter 1 (B)	13	totalizer	Valid for Modular I/O and Ex i I/O options only.
counter 2 (D)	14	totalizer	
counter 3 (A)	12	totalizer	Valid for Modular I/O and Ex i I/O options only.
diagnosis value	25	linear	Function and availability depends on diagnosis value setting.

Table 9-5: Description of the HART[®] device variables

For the dynamic variables connected to the linear analogue outputs for current and/or frequency, the assignment of the device variables takes place by selecting the linear measurement for these outputs under the appropriate function of the signal converter. It follows that the dynamic variables connected to current or frequency outputs can only be assigned to the linear HART® device variables.

The HART® dynamic variable PV is always connected to the HART® current output which is, for example, assigned to the volume flow.

A totalizer device variable can thus not be assigned to the dynamic variable PV because the PV is always connected to the HART® current output.

Such correlations do not exist for dynamic variables not connected to linear analogue outputs. Both linear and totalizer device variables can be assigned.

The totalizer device variables can only be assigned to the dynamic variables SV, TV and 4V if the connected output is not a current or frequency output.





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

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

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