



IFC 100 Handbook

Signal converter for electromagnetic flowmeters

Electronic revision:
ER 3.1.5_

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®
	X	all interfaces
3- _	Downwards compatible hardware and/or software change of inputs and outputs:	
	I	Current output
	F, P	Frequency / pulse output
	S	Status output
	C	Control input
	CI	Current input
	X	all inputs and outputs
4	Downwards compatible changes with new functions	
5	Incompatible changes, i.e. electronic equipment must be changed	

Table 1-1: Description of changes



INFORMATION!

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

Release date (ER)	Electronic revision (ER)	Changes and compatibility	Documentation
07/2010	ER 2.1.1 (SW.REV. 2.11 (3.00))	1	MA IFC 100 R04
12/2011	ER 3.0.0 (SW.REV. 3.00 (4.00))	1; 2-X; 3-X; 5-S ①	MA IFC 100 R05
04/2013	ER 3.0.1	1	MA IFC 100 R05
02/2014	ER 3.0.2	1	MA IFC 100 R05
08/2014	ER 3.1.0	1; 2-H; 2-M; 3-F; 3-P; 3-C	MA IFC 100 R05
09/2015	ER 3.1.2_	1; 2-F	MA IFC 100 R06
10/2016	ER 3.1.3_ ER 3.1.4_	1; 2-F	MA IFC 100 R06
08/2017	ER 3.1.5_	1; 3-F; 3-P; 5 ②	MA IFC 100 R07, R08, R09

Table 1-2: Changes and effect on compatibility

① Incompatible change on status output: de-energised status reversed

② Incompatible change for modular I/O and Ex i I/O module: removed from scope of supply

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.

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



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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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.

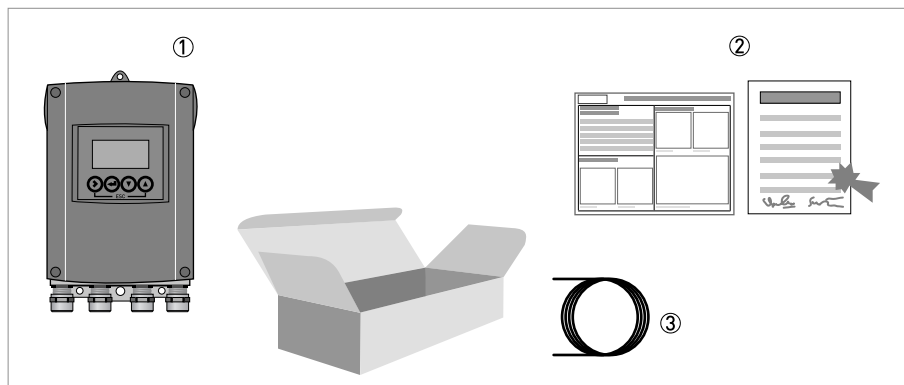


Figure 2-1: Scope of delivery

- ① Device in the version as ordered
- ② Product documentation
- ③ Signal cable (only for 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.

Flow sensor	Flow sensor + signal converter IFC 100	
	Compact (0°/45° version)	Remote wall-mounted housing
OPTIFLUX 1000	OPTIFLUX 1100 C	OPTIFLUX 1100 W
OPTIFLUX 2000	OPTIFLUX 2100 C	OPTIFLUX 2100 W
OPTIFLUX 4000	OPTIFLUX 4100 C	OPTIFLUX 4100 W
OPTIFLUX 5000	OPTIFLUX 5100 C	OPTIFLUX 5100 W
OPTIFLUX 6000	OPTIFLUX 6100 C	OPTIFLUX 6100 W
WATERFLUX 3000	WATERFLUX 3100 C	WATERFLUX 3100 W
OPTIPROBE	OPTIPROBE 100 C	OPTIPROBE 100 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.

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

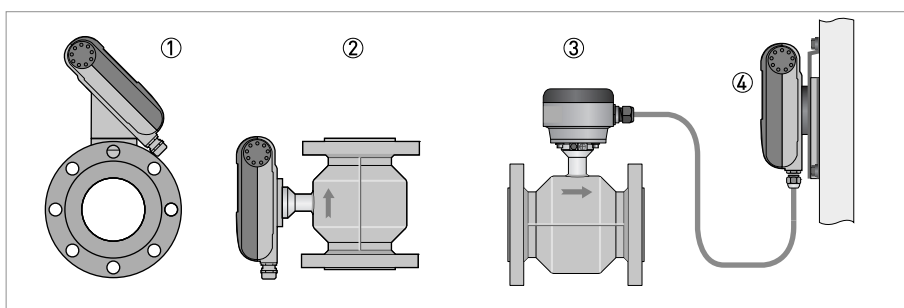


Figure 2-2: Device versions

- ① Compact version as 45° version
- ② Compact version as 0° version
- ③ Flow sensor with connection box
- ④ Wall version

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.

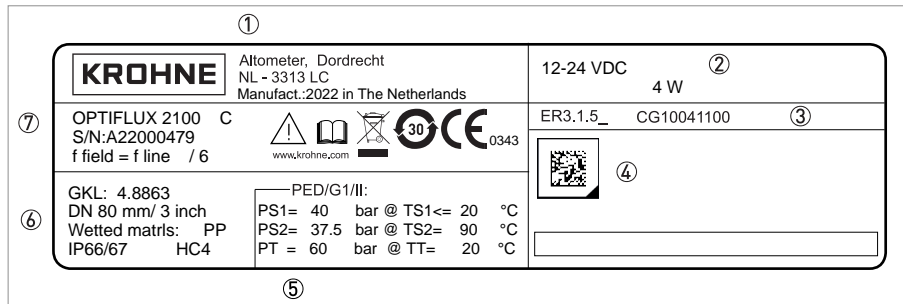


Figure 2-3: Example of a nameplate

- ① Name and address of the manufacturer, manufacturing date and country
- ② Data for power supply
- ③ Electronic revision (ER) and CG number
- ④ Data matrix
- ⑤ Approvals-related data (e.g. temperature thresholds and pressure thresholds)
- ⑥ GKL values (flow sensor constants), size (mm/inch), materials of wetted parts, ingress protection
- ⑦ Type designation, serial number, safety instructions, disposal, China RoHs marking 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

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: -40...+70°C / -40...+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 (e.g. exposure to the sun) 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.*

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 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.

3.6.1 Wall mounting

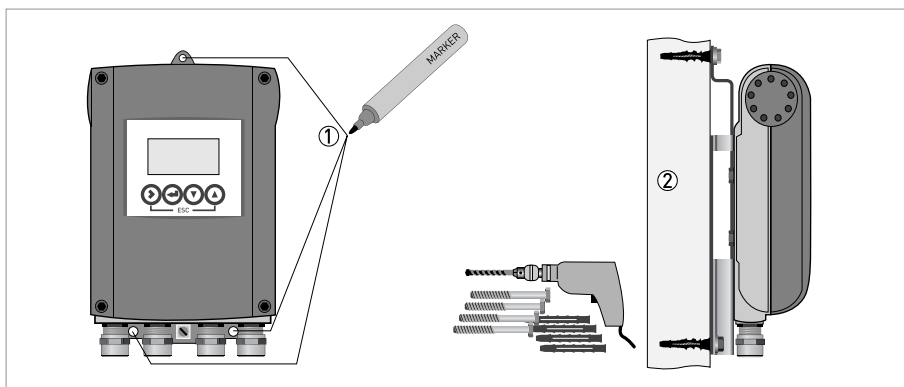


Figure 3-1: Mounting the wall-mounted housing



- ① Prepare the holes with the aid of the mounting plate. For further information refer to *Mounting plate of wall-mounted version, aluminium housing* on page 98.
- ② Fasten the device securely to the wall with the mounting plate.

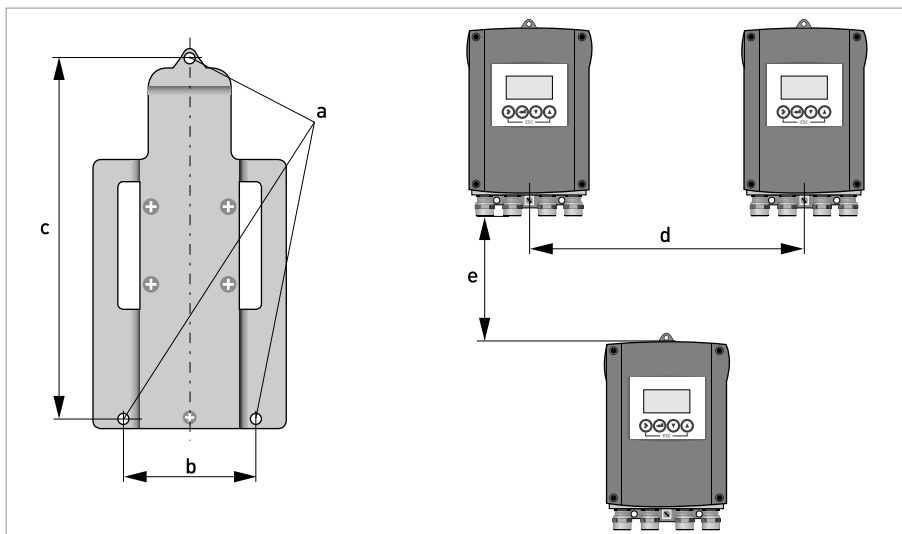


Figure 3-2: Wall mounting of multiple devices (aluminium housing)

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

Table 3-1: Dimensions in mm and inch

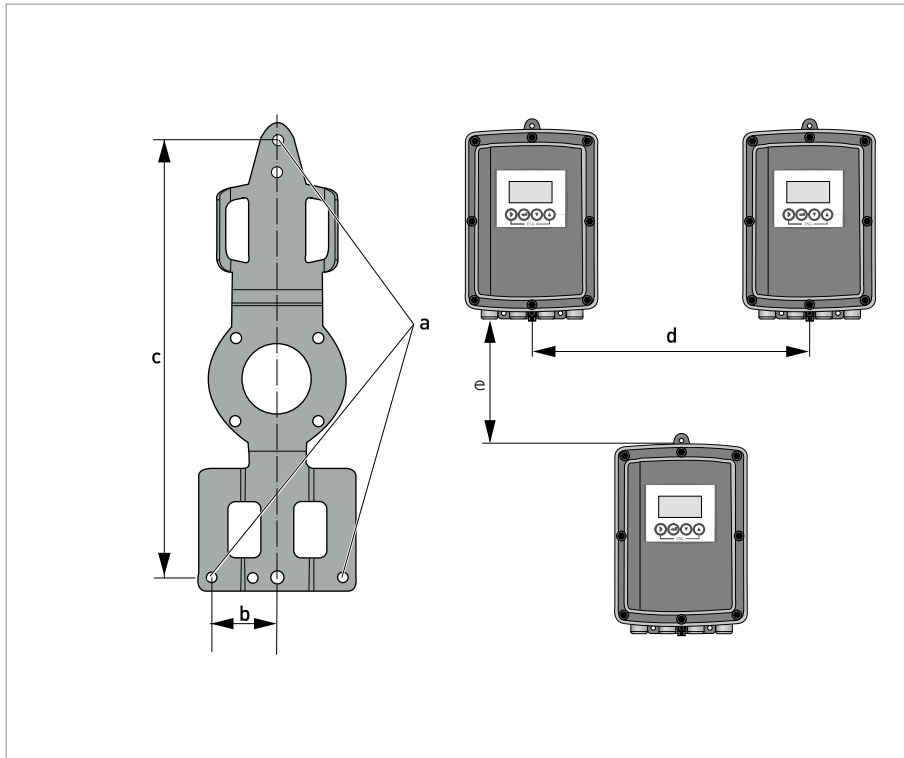


Figure 3-3: Wall mounting of multiple devices (stainless steel housing)

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

Table 3-2: Dimensions in mm and inch

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 58.

4.3 Electrical cables for remote device versions, notes

4.3.1 Notes on signal cable A



INFORMATION!

Signal cable A (type DS 300) with double shield ensures 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 (60) is carried out via the stranded drain wire (6).

4.3.2 Notes on field current cable C



DANGER!

*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

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

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



INFORMATION!

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

4.4.1 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: $\geq 50 \text{ mm} / 2''$

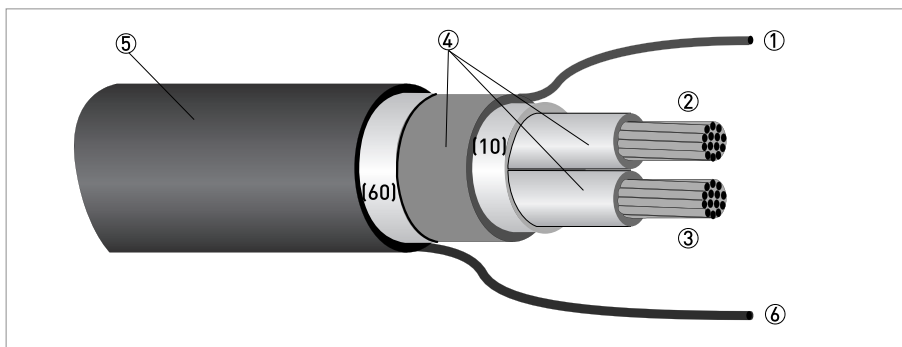


Figure 4-1: Construction of signal cable A (standard version)

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

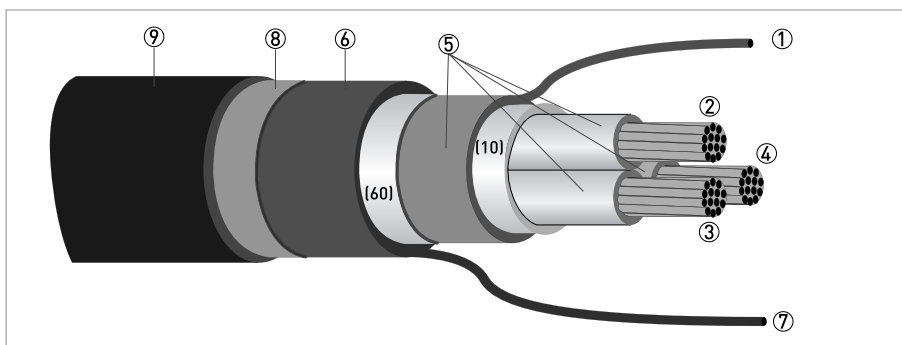


Figure 4-2: Construction of signal cable A (armoured version)

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

4.4.2 Preparing signal cable A, connection to 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.

- Connection of the two shields in the signal converter is carried out via the stranded drain wires.
- Bending radius: $\geq 50 \text{ mm} / 2''$

Required materials

- PVC insulating tube, $\varnothing 2.5 \text{ mm} / 0.1''$
- Heat-shrinkable tubing
- 2 wire end ferrules to DIN 46228: E 1.5-8 for the stranded drain wires (1), (6)
- 2 wire end ferrules to DIN 46228: E 0.5-8 for the insulated conductors 2, 3

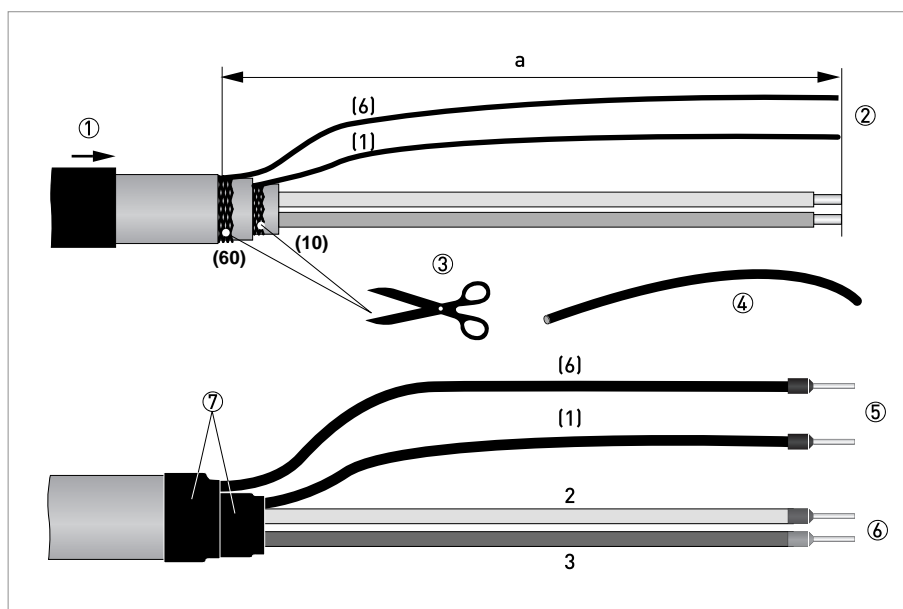


Figure 4-3: Preparation of signal cable A (standard version)

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



- 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 wire end ferrules onto the stranded drain wire.
- ⑥ Crimp the wire end ferrules onto the conductors 2, 3.
- ⑦ Shrink the heat-shrinkable tubing.

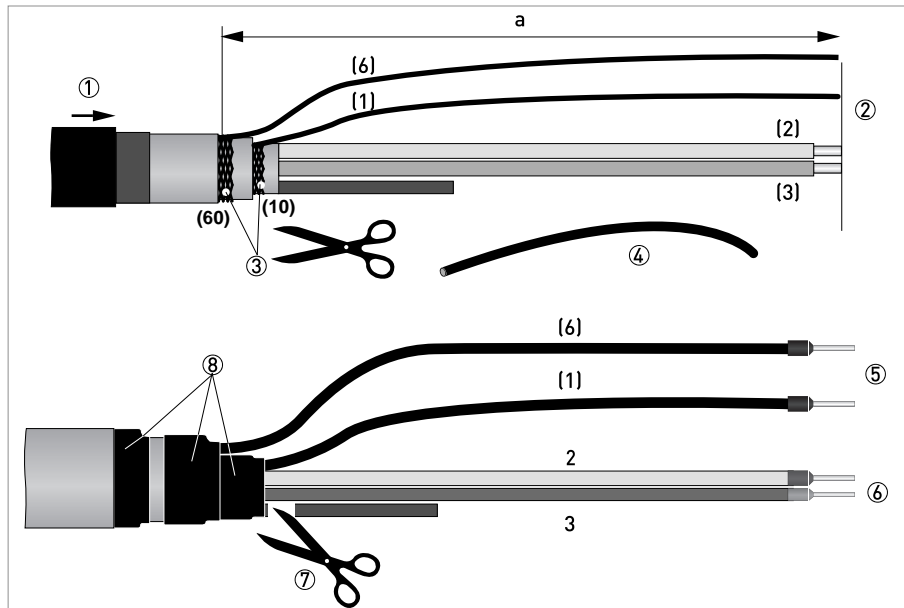


Figure 4-4: Preparation of signal cable A (armoured version)

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 wire end ferrules onto the stranded drain wire.
- ⑥ Crimp the wire end ferrules onto the conductors 2, 3.
- ⑦ Cut the outer sheath and armored 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.

Flow sensor	Nominal diameter		Min. electrical conductivity [μS/cm]	Curve for signal cable A
	DN [mm]	[inch]		
OPTIFLUX 1000 F	10...150	3/8...6	5	A1
OPTIFLUX 2000 F	25...150	1...6	20	A1
	200...1200	8...48	20	A2
OPTIFLUX 4000 F	2.5...150	1/10...6	5	A1
	200...1200	8...48	5	A2
OPTIFLUX 5000 F	2.5...100	1/10...4	5	A1
	150...250	6...10	5	A2
OPTIFLUX 6000 F	2.5...150	1/10...6	5	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

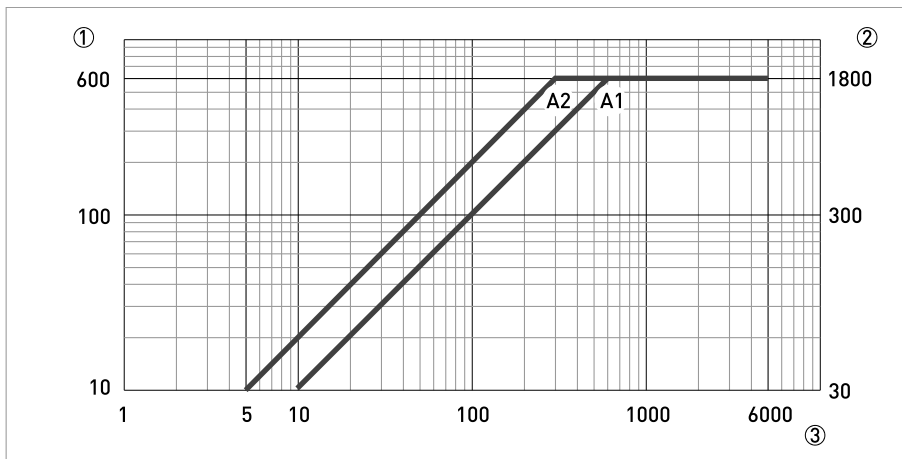


Figure 4-5: Maximum length of signal cable A

- 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 Preparing field current cable C, connection to signal converter



DANGER!

A shielded 2-wire copper cable is used as the field current cable. The shielding **MUST** be connected in the housing of the flow sensor and 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, at least 2-wire copper cable with suitable heat-shrinkable tubing
- Insulating tube, size according to the cable being used
- 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	2 x 0.75 Cu ①	2 x 18
150...300	492...984	2 x 1.5 Cu ①	2 x 14
300...600	984...1968	2 x 2.5 Cu ①	2 x 12

Table 4-2: Length and cross-section of field current cable C

① Cu = copper cross-section

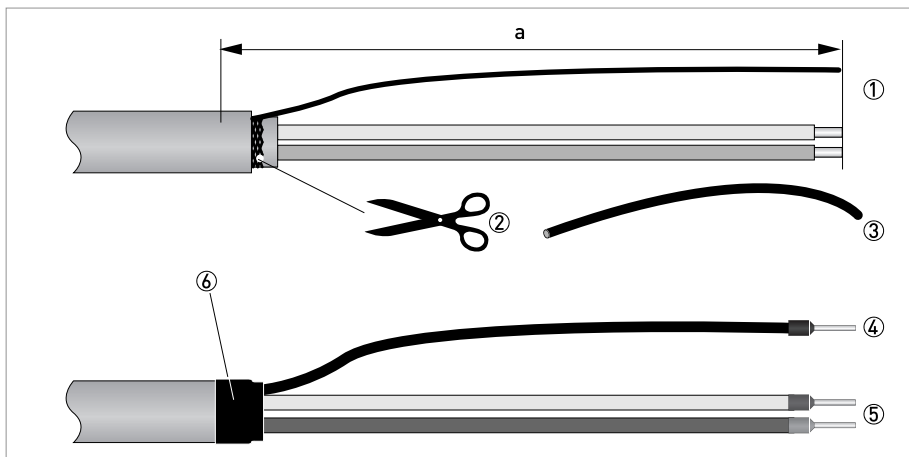


Figure 4-6: Field current cable C, preparation for the signal converter

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



- ① Strip the conductor to dimension a.
- ② If a stranded drain wire is present, remove the shield that is present. Make sure not to damage the stranded drain wire.
- ③ Slide an insulating tube over the stranded drain wire.
- ④ Crimp a wire end ferrule onto the stranded drain wire.
- ⑤ Crimp the wire end ferrules on the conductors.
- ⑥ Pull a shrinkable tube over the prepared cable.

4.4.5 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

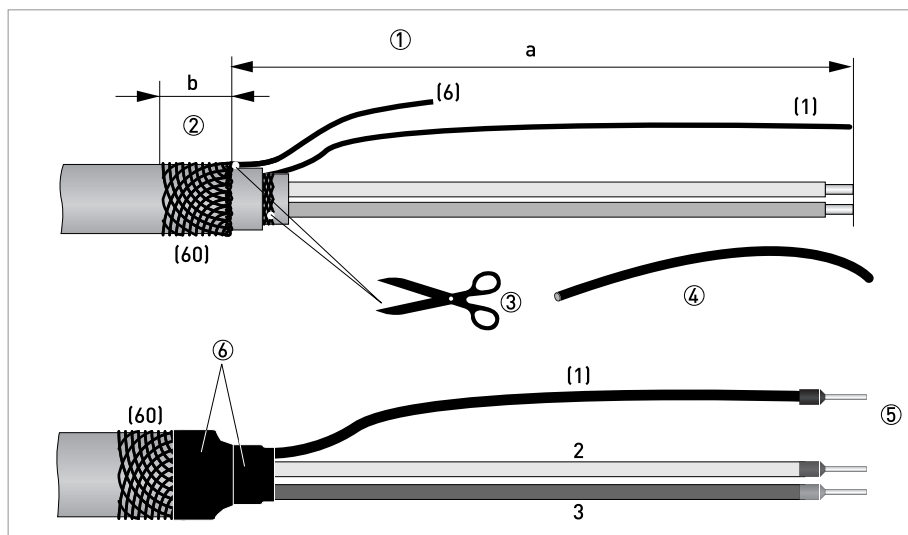


Figure 4-7: Preparing signal cable A, connection to flow sensor

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

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



- 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.

4.4.6 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.

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

- Shielded 2-wire insulated copper cable
- Insulating tube, size according to the cable being used
- Heat-shrinkable tubing
- 2 wire end ferrules to DIN 46228: size according to the cable being used

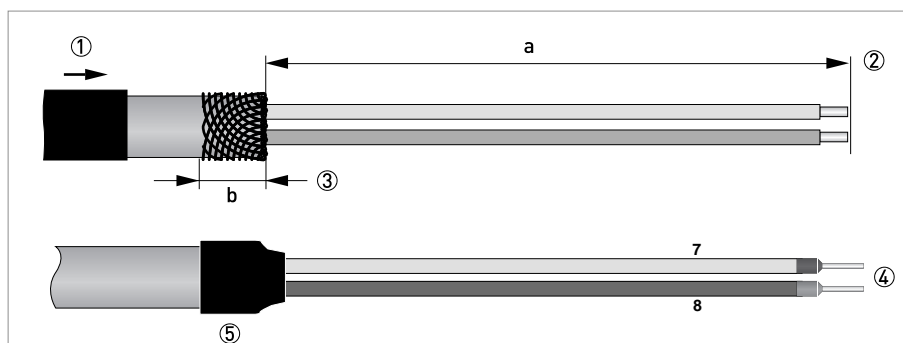


Figure 4-8: Preparation of field current cable C

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

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



- ① Pull the heat-shrinkable tubing over the signal cable.
- ② Strip the conductor to dimension a.
- ③ Trim the outer shield to dimension b and pull it over the outer sheath.
- ④ Crimp the wire end ferrules onto both conductors 7, 8.
- ⑤ Shrink the heat-shrinkable tubing.

4.5 Connecting the signal and field current cables



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 to the signal converter, remote version

**INFORMATION!**

The compact version is supplied preassembled from the factory.

Opening and closing the aluminium housing

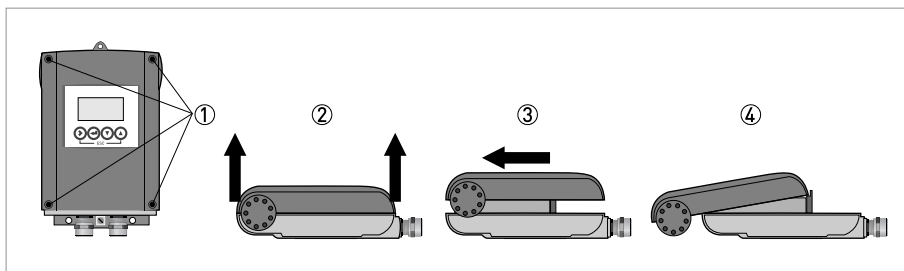


Figure 4-9: Opening and closing the aluminium housing



- ① Loosen the 4 screws with a suitable tool.
 - ② Lift the housing at the top and bottom at the same time.
 - ③ Slide the housing cover upward.
 - ④ The housing cover is guided and held by the inside hinge.
- ➔ There is now access to the terminal compartment for connection.

After completion of work, close the signal converter housing.

Opening and closing the stainless steel housing

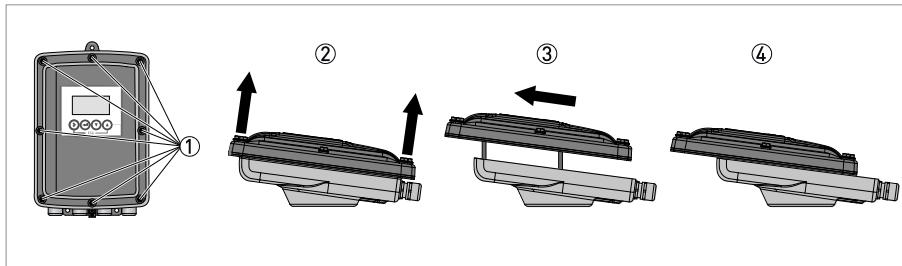


Figure 4-10: Opening and closing the stainless steel housing



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

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

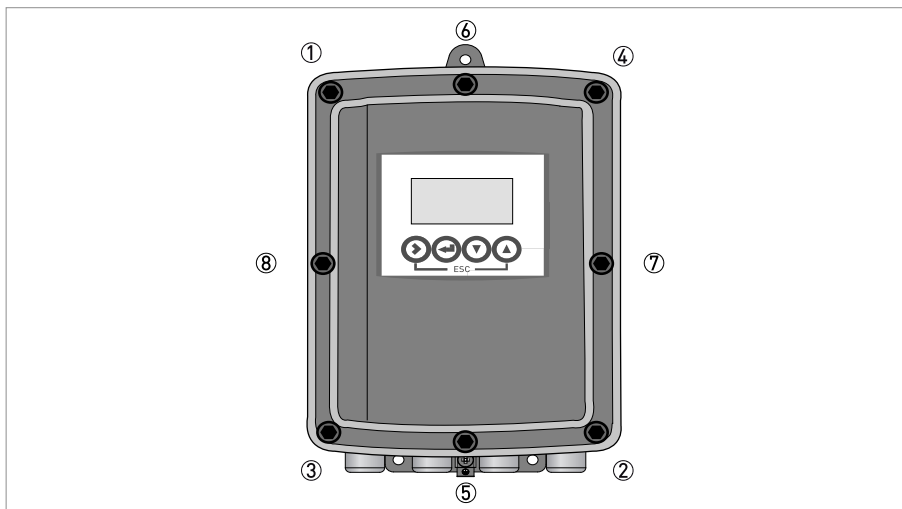


Figure 4-11: Tighten the screws

Connecting the signal and field current cables

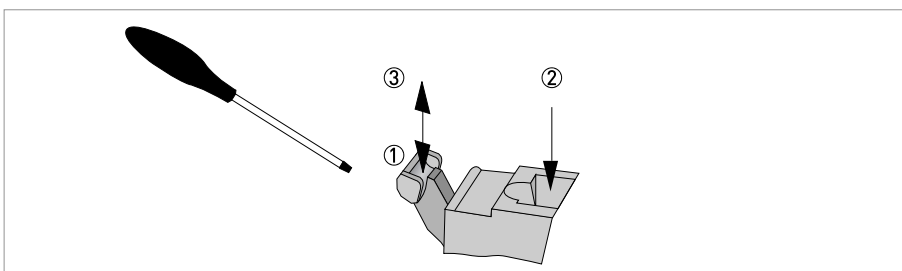


Figure 4-12: Function of the electrical connection terminal

**Connect the electrical conductors as follows:**

- ① Push the lever downwards with a screwdriver in good condition (blade: 3.5 mm wide and 0.5 mm thick).
- ② Insert the electrical conductor into the plug.
- ③ The conductor will be clamped as soon as the lever is released.

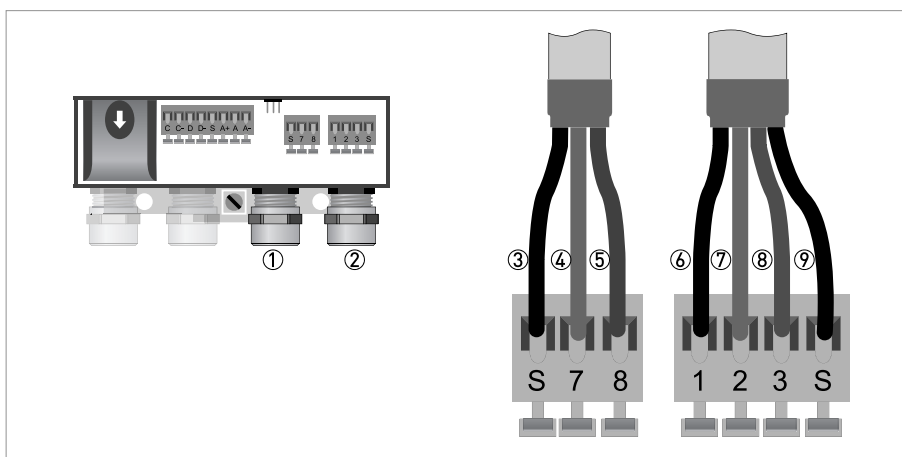


Figure 4-13: Connecting the signal and field current cables

- ① Cable entry for field current cable
- ② Cable entry for signal cable
- ③ Connecting the field current cable shield
- ④ Electrical conductor (7)
- ⑤ Electrical conductor (8)
- ⑥ Stranded drain wire (1) of the inner shield (10) of the signal cable
- ⑦ Electrical conductor (2)
- ⑧ Electrical conductor (3)
- ⑨ Stranded drain wire (S) of the outer shield (60)

4.5.2 Connection diagram for signal and field current cable



DANGER!

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

- A shielded 2-wire copper cable is used as the field current cable. The shielding **MUST** be connected in the housing of the flow sensor and signal converter.
- The outer shield (60) is connected in the terminal compartment of the flow sensor directly via the shield and a clip.
- 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.

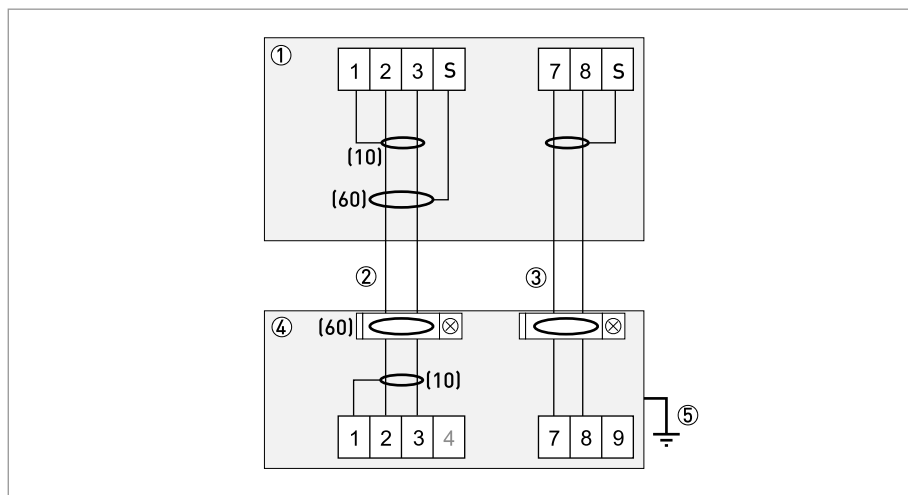


Figure 4-14: Connection diagram for signal and field current cable

- ① Electrical terminal compartment in the signal converter
- ② Signal cable A (type DS 300)
- ③ Field current cable C (type LiYCY)
- ④ Electrical terminal compartment in the flow sensor
- ⑤ Functional ground FE
- (10) inner cable shield
- (60) outer cable shield

4.6 Grounding the flow sensor

4.6.1 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.
- 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 Connecting the power supply



DANGER!

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

- 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, and also a separator (switch, circuit breaker) to isolate the signal converter should be provided for the device in accordance with applicable regulations.

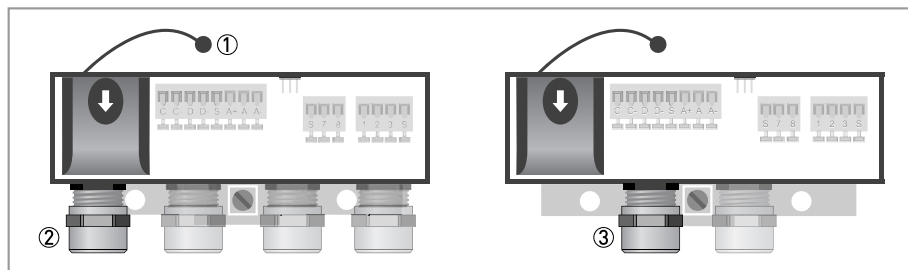


Figure 4-15: Terminal compartment for power supply

- ① Retaining band of the cover
- ② Cable entry for power supply, remote version
- ③ Cable entry for power supply, compact version

Version	Non-Ex	Ex
100...230 VAC	Standard	Optional
24 VDC	Standard	-
24 VAC/DC	Standard	Optional

Table 4-3: Version overview



- Open the cover of the electrical terminal compartment by pressing down and pulling forwards at the same time.

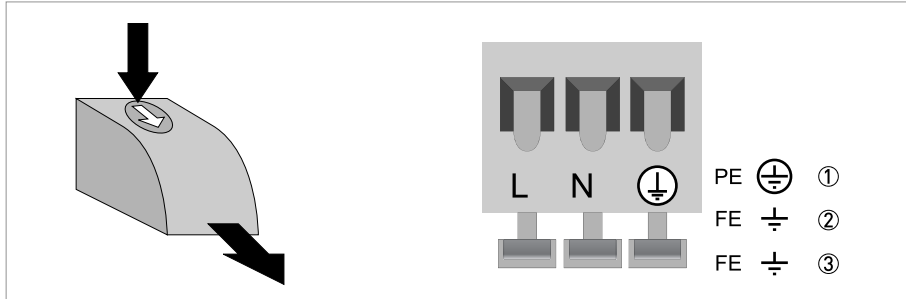


Figure 4-16: Power supply connection

- ① 100...230 VAC (-15% / +10%), 8 VA
- ② 24 VDC (-55% / +30%), 4 W
- ③ 24 VAC/DC (AC: -15% / +10%; DC: -25% / +30%), 7 VA or 4 W



- Close the cover after the power has been connected.

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

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



INFORMATION!

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

24 VDC (tolerance range: -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.



INFORMATION!

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

4.8 Inputs and outputs, overview

4.8.1 Description of the CG number



Figure 4-17: Marking [CG number] of the electronics module and output variants

- ① ID number: 0
- ② ID number: 0 = standard; 9 = special
- ③ Power supply
- ④ Display (language versions)
- ⑤ Input/output version (I/O)

4.8.2 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 number are depicted.

CG no.	Connection terminals							
	C	C-	D	D-	S	A+	A	A-
1 0 0	S _p / C _p ①		P _p / S _p passive ①		②		I _p + HART® passive ③	
						I _a + HART® active ③		

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

- ① Function change by software
- ② Shielding
- ③ Function changed by reconnecting

I _a	I _p	Current output active or passive
P _p		Pulse/frequency output passive
S _p		Status output / limit switch passive
C _p		Control input passive

Table 4-5: Description of used abbreviations

4.9 Description of the inputs and outputs

4.9.1 Current output

- 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 $R_L \leq 750 \Omega$ at $I \leq 22 \text{ mA}$
- 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. 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 outputs on page 43* and refer to *Technical data on page 86*.

**DANGER!**

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

4.9.2 Pulse output and frequency output

- 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: $U_{\text{ext}} \leq 32 \text{ VDC}$

 $I \leq 20 \text{ mA}$ at $f \leq 10 \text{ kHz}$ (over range up to $f_{\text{max}} \leq 12 \text{ kHz}$)
 $I \leq 100 \text{ mA}$ at $f \leq 100 \text{ Hz}$
- Scaling:
Frequency output: in pulses per time unit (e.g. 1000 pulses/s at $Q_{100\%}$);
Pulse output: quantity 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 $Q_{100\%}$)
fixed (pulse width adjustable as required from 0.05 ms...2 s)
- Forward/reverse flow measurement (F/R mode) is possible.
- The pulse output and frequency output can also be used as a status output / limit switch.

**INFORMATION!**

For further information refer to Connection diagrams of outputs on page 43 and refer to Technical data on page 86.

**DANGER!**

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

4.9.3 Pulse output board (REL100 add-on)

This optional add-on PCB is used for electronic counters which are internally driven by 3.3 Volt power source.

- Connect add-on board to terminals D / D- / A+ / A-
- Passive mode:
External power: $U_{\text{ext}} \leq 30 \text{ V}$
 $I_{\text{max}} = 70 \text{ mA}$
Open contact = $R_i > 1 \text{ M}\Omega$
Closed contact = $R_i < 22 \Omega$
 $f_{\text{max}} < 10 \text{ KHz}$
- Analogue output available on terminals A / A-
- Impedance $\leq 500 \Omega$
- Only for non ATEX versions
- Available via spare parts price list

4.9.4 Status output and limit switch

- 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 behave like relay contacts.
- 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 information on the adjustable operating states refer to *Function tables* on page 58.

**INFORMATION!**

For further information refer to *Connection diagrams of outputs* on page 43 and refer to *Technical data* on page 86.

**DANGER!**

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

4.9.5 Control input

**INFORMATION!**

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: $U_{\text{ext}} \leq 32 \text{ VDC}$
- For information on the adjustable operating states refer to *Function tables* on page 58.

**INFORMATION!**

For further information refer to Connection diagrams of outputs on page 43 and refer to Technical data on page 86.

4.10 Electrical connection of the 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.

4.10.1 Electrical connection of the 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!

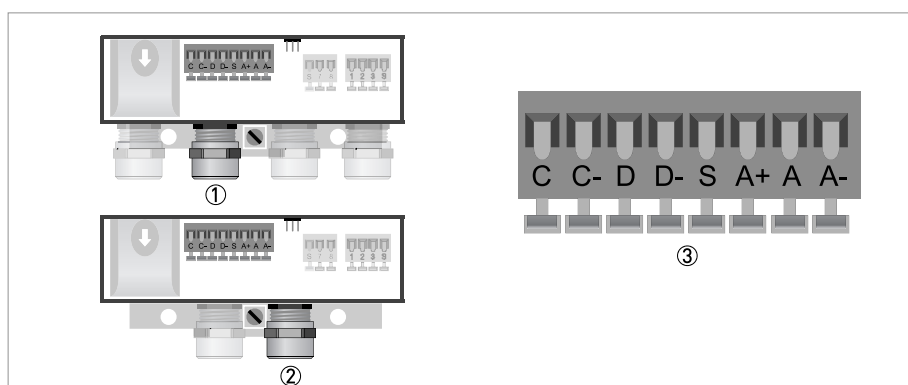


Figure 4-18: Connection of outputs

- ① Cable entry, remote version
- ② Cable entry, compact version
- ③ Terminal S for shield



- Open the housing cover
- Push the prepared cables through the cable entries and connect the necessary conductors.
- Connect the shield.
- Close the housing cover.



INFORMATION!

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

4.10.2 Laying electrical cables correctly

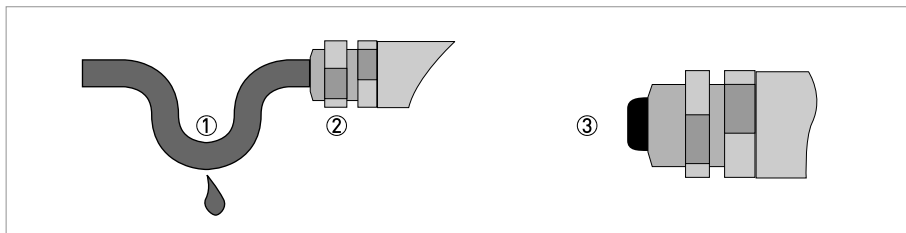


Figure 4-19: Protect housing from dust and water



- ① For compact versions with nearly horizontally-oriented cable entries, lay the necessary electric cables with a drip loop as shown in the illustration.
- ② Tighten the screw connection of the cable entry securely.
- ③ Seal cable entries that are not needed with a plug.

4.11 Connection diagrams of outputs

4.11.1 Important notes

- All groups are electrically isolated from each other and from all other 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_p		Pulse/frequency output passive
S_p		Status output / limit switch passive
C_p		Control input passive

Table 4-6: Description of the used abbreviations

4.11.2 Description of the electrical symbols

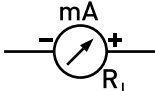
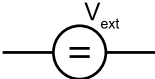
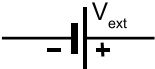
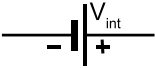

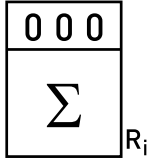

	<p>mA meter 0...20 mA or 4...20 mA and other R_L is the internal resistance of the measuring point including the cable resistance</p>
	<p>DC voltage source (V_{ext}), external power supply, any connection polarity</p>
	<p>DC voltage source (V_{ext}), observe connection polarity according to connection 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 4-7: Description of the electrical symbols

4.11.3 Basic inputs/outputs



CAUTION!
Observe connection polarity.



INFORMATION!
For further information refer to *Description of the inputs and outputs* on page 38 and refer to *HART connection* on page 49.

Current output active (HART®)

- $V_{\text{int, nom}} = 20 \text{ VDC}$
- $I \leq 22 \text{ mA}$
- $R_L \leq 750 \Omega$
- HART® at connection terminals A

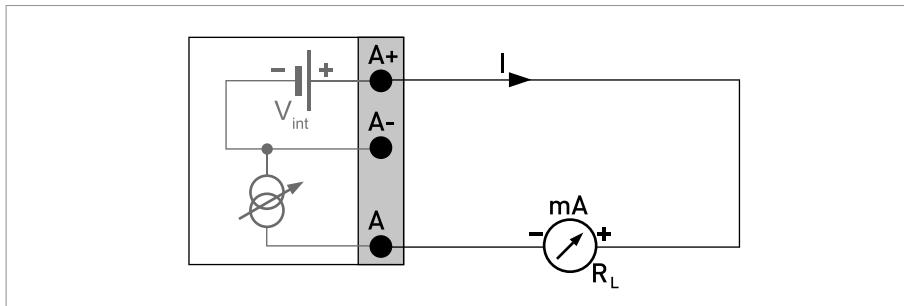


Figure 4-20: Current output active I_a

Current output passive (HART®)

- $V_{\text{int, nom}} = 20 \text{ VDC}$
- $V_{\text{ext}} \leq 32 \text{ VDC}$
- $I \leq 22 \text{ mA}$
- $V_0 \geq 2 \text{ V}$ at $I = 22 \text{ mA}$
- $R_L \leq (V_{\text{ext}} - V_0) / I_{\text{max}}$
- HART® at connection terminals A

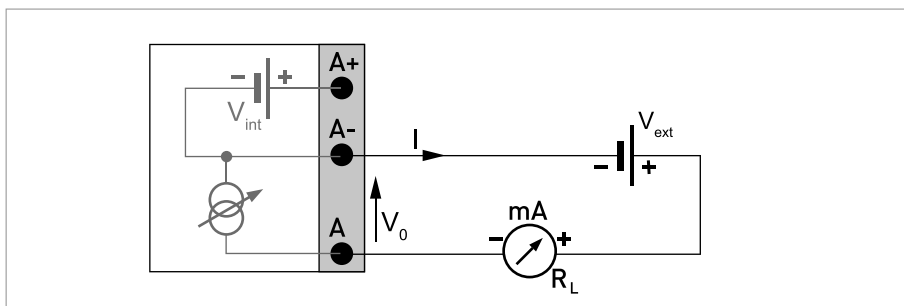


Figure 4-21: Current output passive I_p

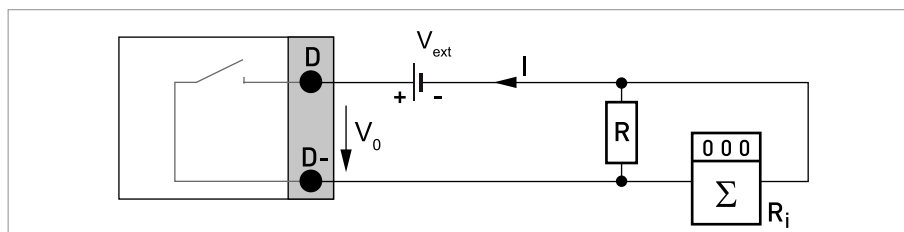
**INFORMATION!**

- Shielding takes place at the electrical connection (S) of the output terminal block.
- Any connection polarity.

Pulse/frequency output passive

- $V_{\text{ext}} \leq 32 \text{ VDC}$
- f_{max} in the operating menu set to $f_{\text{max}} \leq 100 \text{ Hz}$:
 $I \leq 100 \text{ mA}$
 $R_L \leq 47 \text{ k}\Omega$
 closed:
 $V_0 \leq 0.2 \text{ V}$ at $I = 10 \text{ mA}$
 $V_0 \leq 2 \text{ V}$ at $I = 100 \text{ mA}$
 open:
 $I \leq 0.05 \text{ mA}$ at $V_{\text{ext}} = 32 \text{ V}$
- f_{max} in operating menu set to $100 \text{ Hz} < f_{\text{max}} \leq 10 \text{ kHz}$:
 (over range up to $f_{\text{max}} \leq 12 \text{ kHz}$)
 $I \leq 20 \text{ mA}$
 $R_L \leq 10 \text{ k}\Omega$ for $f \leq 1 \text{ kHz}$
 $R_L \leq 1 \text{ k}\Omega$ for $f \leq 10 \text{ kHz}$
 closed:
 $V_0 \leq 1.5 \text{ V}$ at $I = 1 \text{ mA}$
 $V_0 \leq 2.5 \text{ V}$ at $I = 10 \text{ mA}$
 $V_0 \leq 5 \text{ V}$ at $I = 20 \text{ mA}$
 open:
 $I \leq 0.05 \text{ mA}$ at $V_{\text{ext}} = 32 \text{ V}$
- The minimum load impedance $R_{L, \text{min}}$ 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.
- The output is open if the device is de-energised.

Figure 4-22: Pulse/frequency output passive P_p

**INFORMATION!**

Any connection polarity.

Status output / limit switch passive

- $V_{\text{ext}} \leq 32 \text{ VDC}$
- $I \leq 100 \text{ mA}$
- $R_L = 47 \text{ k}\Omega$
 - closed:
 - $V_0 \leq 0.2 \text{ V}$ at $I = 10 \text{ mA}$
 - $V_0 \leq 2 \text{ V}$ at $I = 100 \text{ mA}$
 - open:
 - $I \leq 0.05 \text{ mA}$ at $V_{\text{ext}} = 32 \text{ V}$
- The output is open if the device is de-energised.

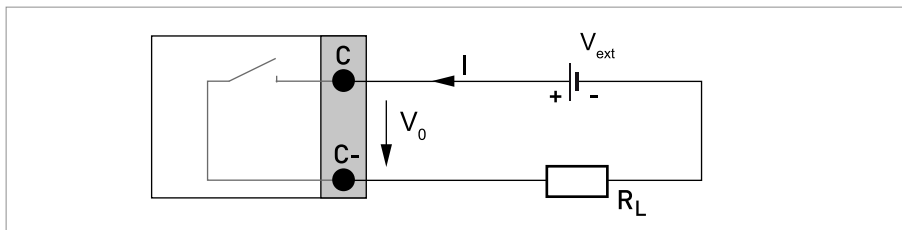


Figure 4-23: Status output / limit switch passive S_p

**INFORMATION!**

- Any connection polarity.

Control input passive

- $V_{\text{ext}} \leq 32 \text{ VDC}$
- $I_{\text{nom}} = 6.5 \text{ mA}$ at $V_{\text{ext}} = 24 \text{ VDC}$
 $I_{\text{nom}} = 8.2 \text{ mA}$ at $V_{\text{ext}} = 32 \text{ VDC}$
- 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.

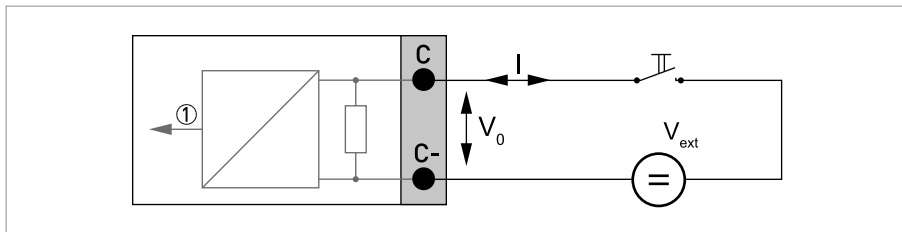


Figure 4-24: Control input passive C_p

① Signal

4.11.4 HART connection



INFORMATION!

The current output always has HART® capability.

- Basic I/O: connection terminals A+/A-/A

All HART® connections (point-to-point and multi-drop operation) both work actively and passively.

Example for active HART® connection (point-to-point)

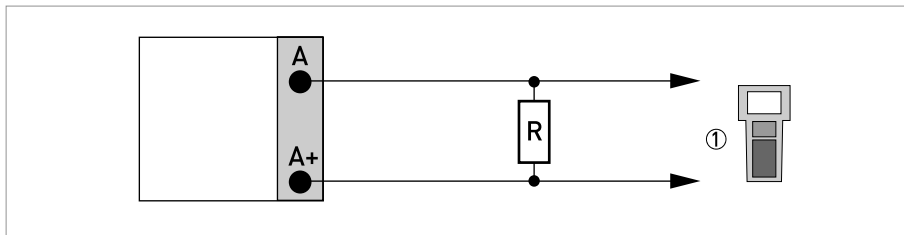


Figure 4-25: HART® connection active (I_a)

① HART® communicator

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

Example for passive HART® connection (multi-drop mode)

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

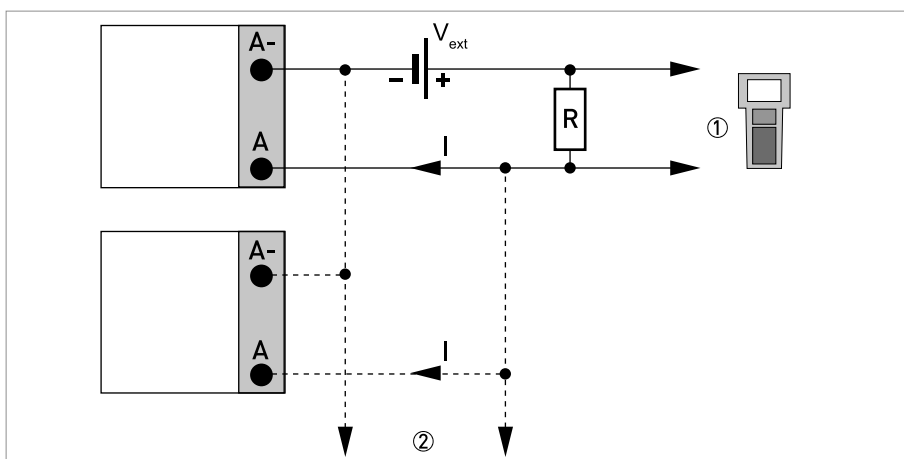


Figure 4-26: HART® connection passive (I_p)

① HART® communicator

② 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 regulations.
- The power connections must have been made in compliance with the regulations.
- The electrical terminal compartments must be secured and the covers have 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.

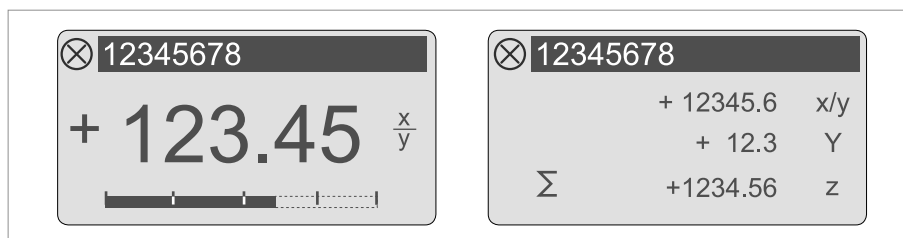


Figure 5-1: Displays in measuring mode (examples for 2 or 3 measured values)
x, y and z denote the units of the measured values displayed

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 78.

6.1 Display and operating elements

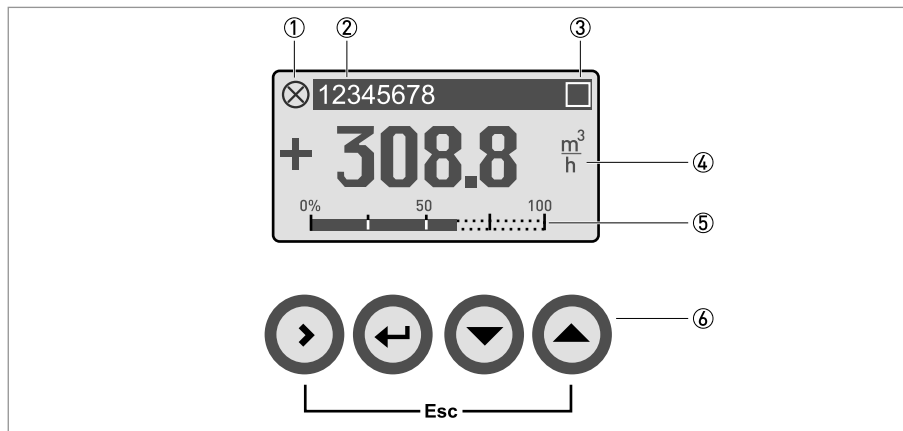


Figure 6-1: Display and operating elements (Example: flow indication with 2 measuring values)

- ① Indicates a possible status message in the status list (see table below for status icons)
- ② Tag number (is only indicated if this number was entered previously by the operator)
- ③ Indicates when a key has been pressed
- ④ 1st measured variable in large representation
- ⑤ Bargraph indication
- ⑥ Keys (see table below for function and representation in text)



INFORMATION!

- *After 5 minutes of inactivity, there is an automatic return to 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 78.

6.1.1 Display in measuring mode with 2 or 3 measured values

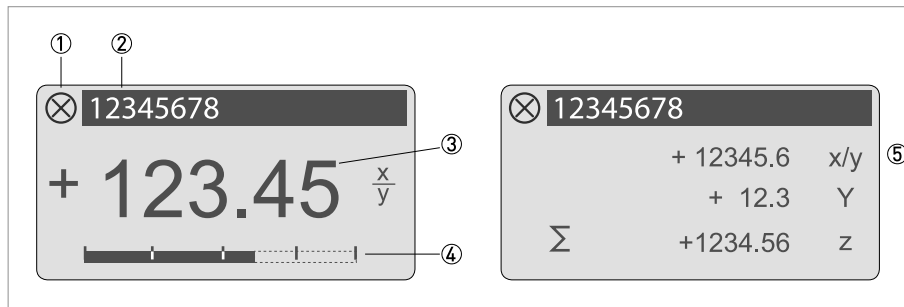


Figure 6-2: Example for display in measuring mode with 2 or 3 measured values

- 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

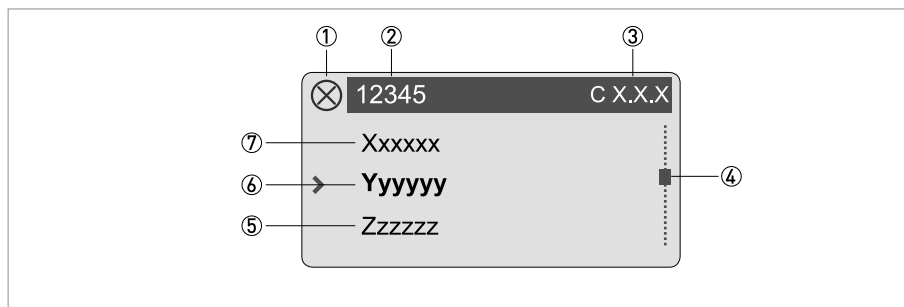


Figure 6-3: Display for selection of submenu and functions, 3 lines

- ① Indicates a possible status message in the status list
- ② Menu, submenu or function name
- ③ Number relating to ④
- 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

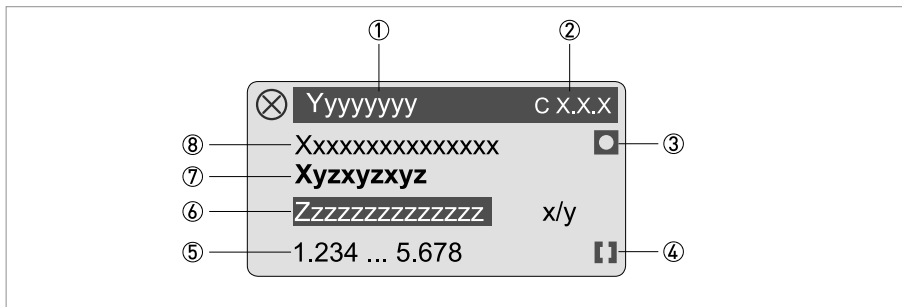


Figure 6-4: Display when setting parameters, 4 lines

- 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

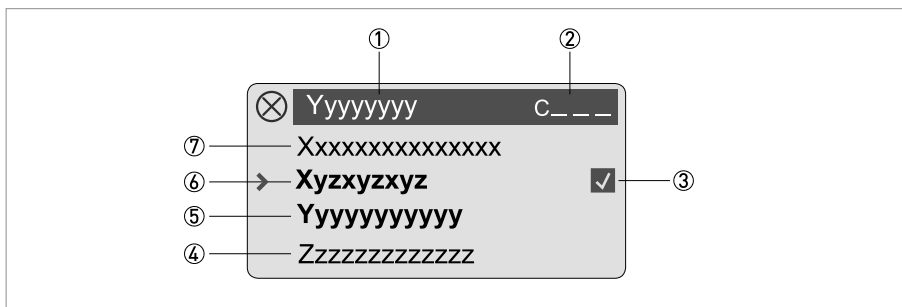


Figure 6-5: Display when previewing parameters, 4 lines

- 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

6.2 Menu structure



INFORMATION!

- The menu structure for the standard device (HART®) is described.
- Note the key function within and between the columns.

Measuring mode	Select menu	↓ ↑	Select menu and/or submenu	↓ ↑	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	
			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	
			A7 process input	> ←	A7.1 device serial no. A7.2 zero calibration A7.3 size 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	
←	B test	> ←	B1 simulation	> ←	Submenus on page 60	> ←
			B2 actual values			
			B3 information			
		↓ ↑		↓ ↑		↓ ↑ >

Table 6-4: Menu structure "A quick setup" and "B test"

Measuring mode		Select menu	Select menu and/or submenu	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 output X	
			C2._ frequency out X	
			C2._ pulse output X	
			C2._ status output X	
			C2._ control input X	
			C2._ limit switch X	
←		> ←	C3 I/O counter	> ←
			C3.1 counter 1	
			C3.2 counter 2	
←		> ←	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 6-5: Menu structure "C setup"

6.3 Function tables



INFORMATION!

- The following tables describe the functions of the standard device with HART[®] connection.
- Depending on the device version, not all functions are available.

6.3.1 Menu "A quick setup"

Function	Setting / Description
A quick setup	

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	Reset error or counter.
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)

A4 analogue outputs

A4 analogue outputs	Applicable to current output (terminal A or C), frequency output (terminal D), limit switch (terminal C and/or D) and the 1st display page / line 1
A4.1 measurement	Select: volume flow / mass flow / diagnosis value / flow speed / coil temperature / conductivity
	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 units	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 L/h (range: 0.0...20 L/h) (1st value = switching point / 2nd value = hysteresis), condition: 2nd value ≤ 1st value
	Query: Use for all outputs? Make setting, see A4.1 above!
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!

Function	Setting / Description
A quick setup	

A5 digital outputs

A5 digital outputs	Valid for pulse output (terminal D) and counter 1.
A5.1 measurement	Select: volume flow / mass flow
	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 or kg or in the unit selected in A5.2
	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"). Setting: x.xxx ± x.xxx L/h (range: 0.0...20 L/h) (1st value = switching point / 2nd value = hysteresis), condition: 2nd value ≤ 1st value
	Query: Use for all outputs? Make setting, see A5.1 above!

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?
	For settings refer to C1.1.1.
A7.3 size	Select from the size table.
A7.5 GKL	Set value acc. to information on nameplate; range: 0.5...20
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.
	For settings refer to C1.1.8.
A7.8 target conduct.	Reference value for on-site calibration; range: 1.000...50000 µS/cm
A7.9 EF electr. factor	For calculation of the conductivity based on the electrode impedance.
	For settings refer to C1.1.11.
A7.10 field frequency	Setting as on flow sensor nameplate = line frequency x value (from the following list): 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 6-6: Description of menu "A quick setup"

6.3.2 Menu "B test"

Function	Setting / Description
B test	

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	Simulation X
B1._ frequency out X	
B1._ control input X	X stands for one of the connection terminals A, C or D Sequence and settings similar to B1.1, see above!
B1._ limit switch X	
B1._ status output X	For the pulse output the set number of pulses are displayed once in a second!

B2 actual values

B2 actual values	Display of 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.
B2.6 act. electr. noise	Refer also to C1.3.13...C1.3.15.
B2.8 act. coil resistance	Display the actual resistance of the field coils depending on the current coil temperature.

B3 information

B3 information	LC display (this format description is only valid for B3.2....3.5 and B3.8) 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.
B3.6 device serial no.	Serial number of the system.
B3.7 electronic serial no.	Serial number of the electronics.
B3.8 Electronic Revision ER	Reference identification number, electronic revision and production date of the device; includes all hardware and software changes

Table 6-7: Description of menu "B test"

6.3.3 Menu "C setup"

Function	Setting / Description
C setup - 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.
C1.1.5 GKL	Set value according to the information on the nameplate. Range: 0.5...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	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
C1.1.11 EF electr. factor	Factor for the 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)
C1.1.13 field frequency	Setting as on flow sensor nameplate = line frequency x value (from the following list): 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: 50 Hz or 60 Hz
C1.1.17 act. coil resistance	Display of the actual resistance of the field coil.

Function	Setting / Description
C setup - C1 process input	

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 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 for "on": 0.01...10 s or for "automatic": 0.1...20 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...20 L/h
	(1st value = switching point / 2nd value = hysteresis), condition: 2nd value ≤ 1st value
C1.2.11 conductivity	Setting the time constant for the conductivity measurement. Only available, if the conductivity measurement is activated in C1.3.1.

Function	Setting / Description
C setup - C1 process input	

C1.3 self test

C1.3 self test	Grouping of all functions related to self test of flow sensor electronics.
C1.3.1 empty pipe	<p>Switch conductivity measurement off and on (measurement of the electrode resistance with or without empty pipe detection).</p> <p>Select: off / 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>
C1.3.2 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>
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>
C1.3.13 electrode noise	<p>Switch the automatic test off or on.</p> <p>Select: off / on</p>
C1.3.14 limit electr. noise	<p>Only available if electrode noise is activated in C1.3.13.</p> <p>Range: 0.000...12 m/s</p> <p>Noise above this threshold generates an error of category [S].</p>
C1.3.15 act. electr. noise	<p>Only available if electrode noise is activated in C1.3.13.</p> <p>Activation takes place only after setting mode is exited!</p>
C1.3.16 settling of field	<p>Automatic test switched off / on.</p> <p>Select: off / on</p>
C1.3.17 diagnosis value	<p>Select diagnosis value for testing the various analogue outputs.</p> <p>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)</p>

Function	Setting / Description
C setup - C1 process input	

C1.4 information

C1.4 information	Grouping of all functions related to information with respect to flow sensor and flow 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 date on which the flow sensor was calibrated.
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.

C1.5 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.
C1.5.2 volume flow	For sequence refer to B1.2.

Table 6-8: Description of menu "C setup - C1 process input"

Function	Setting / Description
C setup - C2 I/O (Inputs/Outputs)	

C2.1 hardware

C2.1 hardware	Configuration of connection terminals. Selection depends on signal converter version.
C2.1.1 terminals A	Select: off (switched off) / current output
C2.1.3 terminals C	Select: off (switched off) / current output / status output / limit switch / control input
C2.1.4 terminals D	Select: off (switched off) / frequency output / pulse output / status output / limit switch

C2._ current out X

C2._ current out X	X stands for connection terminals A _ stands for C2.2 (A)
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 ≤ 21.5 mA and out of current range
C2._3 error current	Specify error current. xx.x mA; range: 3...22 mA Condition: outside of extended range

Function	Setting / Description
C setup - C2 I/O (Inputs/Outputs)	
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 [F] & [S])
C2._5 measurement	Measurements for activating the output. Select: volume flow / mass flow / diagnosis value / flow speed / coil temperature / conductivity
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; the magnifying function in the extended lower range, only makes sense in combination with a status output)
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.
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.

Function	Setting / Description
C setup - C2 I/O (Inputs/Outputs)	

C2._ frequency out X

C2._ frequency out X	X stands for connection terminals D
	_ stands for 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. Limitation is at 120% of this pulse rate or at $1/(1.5 * \text{pulse width})$ whatever is lower.
	Range: 1...10000 Hz
C2._4 measurement	Measurements for activating the output.
	Select: volume flow / mass flow / diagnosis value / flow speed / coil temperature / conductivity
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._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".

Function	Setting / Description
C setup - C2 I/O (Inputs/Outputs)	

C2._ pulse output X

C2._ pulse output X	X stands for connection terminals D _ stands for 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 max. pulse rate) / fixed (fixed pulse rate, for setting refer to "C2._3 max. 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 For pulse widths below 0.5 seconds the max. pulse rate has to be adjusted to $1/(2 * \text{pulse width})$ to prevent overrange messages.
C2._3 max. pulse rate	Maximum pulse rate. Limitation is at 120% of this pulse rate or at $1/(1.5 * \text{pulse width})$ whatever is lower. Range: 1...10000 Hz
C2._4 measurement	Measurements for activating the output. Select: volume flow / mass flow
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._5
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 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._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".

Function	Setting / Description
C setup - C2 I/O (Inputs/Outputs)	

C2._ status output X

C2._ status output X	X (Y) stands for one of the connection terminals C or D _ stands for 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 78) / 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 78) / 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) / output A (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) / error in device (output set, signals status of the category "error in device" refer to <i>Status messages and diagnostic information</i> on page 78)
C2._2 current output Y	Only appears if output A or C is set under "mode" and this output is a "current output". Select: polarity (is signalled) / over range (is signalled) / automatic range (signals lower range)
C2._2 frequency out Y and pulse output Y	Only appears if output D is set under "mode" and this output is a "frequency output" or "pulse output". Select: polarity (is signalled) / over range (is signalled)
C2._2 status output Y	Only appears if output C or D is set under "mode" 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	Only appears if output C or D is set under "mode" and this output is a "limit switch". Select: status off (is always selected here if "status output X" is connected with a limit switch)
C2._2 off	Only appears if output A, C or D is set under "mode" 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
C setup - C2 I/O (Inputs/Outputs)	

C2._ limit switch X

C2._ limit switch X	X stands for one of the connection terminals C or D _ stands for C2.4 (C) / C2.5 (D)
C2._1 measurement	Select: volume flow / mass flow / diagnosis value / flow speed / coil temperature / conductivity
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".

C2.4 control input C

C2.4.1 mode	Definition of the control input. off (control input switched off) / hold all outputs (hold current values, not display and counters) / output X (hold current values) / all outputs to zero (current values = 0%, not display and counters) / output X to zero (current value = 0%) / reset all counters (reset all counters to "0") / reset counter X (only counter X (1 or 2) is reset to "0") / stop all counters / stop counter X (stop only counter X (1 or 2) / zero outp.+stop Cnt. (all outputs to "0", stop all counters, not the display) / error reset (all resettable errors are deleted)
C2.4.2 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))
C2.4.3 information	Serial number of the I/O board, software version number and production date of the circuit board.
C2.4.4 simulation	For sequence refer to "B1._ control input X".

Table 6-9: Description of menu "C setup - C2 I/O (Inputs/Outputs)"

Function	Setting / Description
C setup - C3 I/O counter	
C3.1 counter 1	Set function of counter.
C3.2 counter 2	_ stands for 1, 2 (= counter 1, 2) The basic version (standard) has only 2 counters! 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
C3._3 low flow cutoff	Sets low flow values to "0". Range: 0.0...20% [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. For this status output the "counter X preset" has to be set. Preset value (max. 8 digits) x.xxxxx in selected unit; refer to C5.7.10 and C5.7.13
C3._6 reset counter	For sequence refer to A3.2 and A3.3.
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 (exit 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 6-10: Description of menu "C setup - C3 I/O counter"

Function	Setting / Description
C setup - C4 I/O HART	
C4 I/O HART	<p>Selection or display of the 4 dynamic variables (DV) for HART®.</p> <p>The HART® current output (terminal A for basic I/O) always has a fixed link to the primary variables (PV).</p> <p>Fixed links of the other DVs (1-3) are only possible if one additional analogue output (frequency output) is available. If not, the "measurement" can be freely selected from the following list. Select: flow speed / volume flow / mass flow / diagnosis value / coil temperature / conductivity / counter 1 / counter 2 / operating hours</p> <p>X stands for connection terminals A, C and D</p> <p>_ stands for 1, 2, 3 or 4</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	(4th 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 output 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. The "measurement" cannot be changed!
C4._1 HART dynamic var.	<p>Measurements of the dynamic variables for HART®.</p> <p>Select: flow speed / volume flow / mass flow / diagnosis value / coil temperature / conductivity / counter 1 / counter 2 / operating hours</p>

Table 6-11: Description of menu "C setup - C4 I/O HART"

Function	Setting / Description
C setup - 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.

C5.2 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)
C5.2.5 SW.REV.UIS	Serial number of the circuit board, version number of user interface software, production date of the circuit board.

Function	Setting / Description
C setup - C5 device	

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 the "measurement" for the 1st line. Select: volume flow / mass flow / diagnosis value / flow speed / coil temperature / conductivity
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". x.xxx ± x.xxx %; range: 0.0...20 % [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 / diagnosis value / flow speed / counter 1 / counter 2 / conductivity / coil temperature / operating hours
C5._9 format 2.line	Specify position after decimal point (only available if this 2nd line is activated). 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 / diagnosis value / flow speed / counter 1 / counter 2 / conductivity / coil temperature / operating hours
C5._11 format 3.line	Specify position after decimal point (only available if this 3rd line is activated). Select: automatic (adaptation is automatic) / X (= none) ...X.XXXXXXXXX (max. 8 digits)

Function	Setting / Description
C setup - C5 device	

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. $\pm xxx \pm xxx\%$; range: -100...+100% (1st value = lower limit / 2nd value = upper limit); condition: 1st value \leq 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 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

Function	Setting / Description
C setup - C5 device	

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); cf/h; cf/min; cf/s; gal/h; gal/min; gal/s; IG/h; IG/min; IG/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 76:
C5.7.3 [m ³ /s]*factor	Specification of the conversion factor, based on m ³ /s: For text to be specified refer to <i>Set free units</i> on page 76:
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 76:
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 76
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; hL; mL; gal; IG; in ³ ; cf; yd ³ ; 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 76:
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 76
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 76:
C5.7.15 [kg]*factor	Specification of the conversion factor, based on kg: xxx.xxx refer to <i>Set free units</i> on page 76
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 76:
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 76

Function	Setting / Description
C setup - C5 device	

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) / 01...15 (Multi-Drop operation, current output is set to the 0% value)
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 ; / - + , . *

C5.9 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)
C5.9.4 process input	Activate quick access to the important process input parameters. Select: yes (activated) / no (not activated)

Table 6-12: Description of menu "C setup - C5 device"

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 6-13: 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
>	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.
↓	A3.3 counter 2	
>	Query: reset counter? Select: no	-
↓ or ↑	Query: reset counter? Select: yes	-
↵	A3.2 counter 1 or A3.3 counter 2	Counter has been reset.
3 x ↵	Measuring mode	-

Table 6-14: 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 78.

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 6-15: 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 6-16: 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	Error 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 configuration	Invalid configuration: display software, bus parameter or main software do not match existing configuration.	If device configuration unchanged: defective, replace electronic unit.
F display	Error, operational fault in the display. Parameter or hardware error. No measurement possible.	Defective, replace electronic unit.
F sensor electronic	Error, operational fault in the 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 output A	Error, operational fault in current output. Parameter or hardware error. No measurement possible.	Defective, replace electronic unit.
F current output C		
F software user interface	Fault revealed by CRC check of operation software.	Replace electronic unit.
F hardware settings	The set hardware parameters do not match the identified hardware. A dialogue appears in the display.	Answer queries in dialogue mode, follow directions. Defective, replace electronic unit.
F hardware detection	Existing hardware cannot be identified.	Defective, replace electronic unit.
F RAM/ROM error IO1	A RAM or ROM error is detected during the CRC check.	Defective, replace electronic unit.

Table 6-17: Operational faults in device

Messages on the display	Description	Actions
Status: F _ _ _ _ _	Application-dependent fault, device OK, but measured values affected.	Application test or operator action necessary.
F application error	Application-dependent fault, but device is okay.	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!
F flow exceeding limit	Measuring range exceeded, filter setting limits measured values. No message if empty pipe. 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.	Limitation C1.2.1, increase values.
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 on "manual", increase the value in C1.1.15. If "standard" is set, set the field frequency in C1.1.13 according to the 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 converter, check the connection of the signal cable.
F open circuit A	Load on current output A too high, effective current too low.	Current not correct, mA output cable has open circuit or load too high. Check cable, reduce load (set < 750 Ω).
F open circuit C		
F over range A	The current or the corresponding measured value is limited by a filter setting.	Check with "C2.1 hardware" or the sticker in the 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 C		
F over range D	The pulse rate or the corresponding measured value is limited by a filter setting. Or the demanded pulse rate is too high.	
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		

Table 6-18: 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 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!
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 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 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. Counter has overrun and started again at zero.	-
S overflow counter 2	This is counter 2. 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 field frequency too high	The field frequency is set so high that the field current cannot settle. The measured values displayed are too low.	Set field frequency lower; refer to C1.1.13.

Table 6-19: Measurements out of specification

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.
C test sensor	Test function of the flow sensor electronics is active.	-

Table 6-20: Simulation of the measured values

Messages on the display	Description	Actions
Status: I _ _ _ _ _	Information (current measurement OK)	
I counter 1 stopped	This is counter 1. 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. 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 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 over range conductivity	The limits for the conductivity measurement have been exceeded (> 10000 $\mu\text{S}/\text{cm}$) or are lower than permitted (< 0.1 $\mu\text{S}/\text{cm}$).	If the flow sensor has been properly connected and filled with medium, this does not affect the flow measurement. The conductivity measured values cannot be used.
I control input C act.	This message appears when the control input is active.	-
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 write cycles overfl.	The maximum number of write cycles of the EEPROM has been exceeded.	-
I conductivity off	Conductivity measurement switched off.	Changing of settings in C1.3.1.
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 diagnosis channel off	Diagnosis value switched off.	Changing of settings in C1.3.17.

Table 6-21: Information

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 Returning the device to the manufacturer

7.3.1 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.*

7.3.2 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:			

7.4 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.

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.

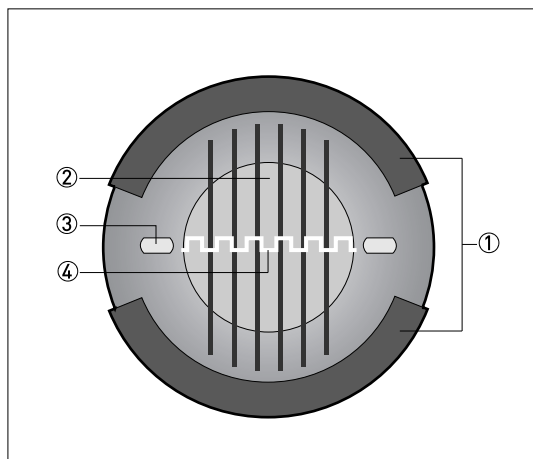


Figure 8-1: Measuring principle

- 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 construction	The measuring system consists of a flow sensor and a signal converter.
Flow sensor	
OPTIFLUX 1000	DN10...150 / 3/8...6"
OPTIFLUX 2000	DN25...1200 / 1...48"
OPTIFLUX 4000	DN2.5...1200 / 1/10...48"
OPTIFLUX 5000	Flange: DN15...300 / 1/2...12" Sandwich: DN2.5...100 / 1/10...4"
OPTIFLUX 6000	DN2.5...150 / 1/10...6"
WATERFLUX 3000	DN25...600 / 1...24"
OPTIPROBE	DN80...3200 / 3...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 x100 C (x = 1, 2, 4, 5, 6) or WATERFLUX 3100 C or OPTIPROBE 300 C (0° & 45° version)
Remote version (W)	IFC 100 W
	With the exception of the OPTIFLUX 1000 and WATERFLUX 3000 all flow sensors are also available as Ex versions.
Options	
Outputs	Current output (including HART®), pulse output, frequency output, status output and/or limit switch
Counter	2 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, empty pipe detection, stabilisation
Communication interface	HART® as standard

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"
	Ambient temperatures below -25°C / -13°F may affect the readability of the display.
Operating elements	4 push buttons for operator control of the signal converter without opening the housing.
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 measuring pages, 1 status page, 1 graphic 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
	Northern Europe: English, Danish, Polish, Finnish, Norwegian
	Southern Europe: English, Turkish
	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

Measuring accuracy

Max. measuring accuracy	Standard: ±0.3% of the measured value ±1 mm/s, depending on the flow sensor.
	Option (optimised accuracy with extended calibration): ±0.2% of the measured value ±1.5 mm/s, depending on the flow sensor.
	For further information refer to the technical data of the respective flow sensor.
	Special calibrations are available on request.
	Current output electronics: ±10 µA; ±100 ppm/°C (typically: ±30 ppm/°C)
Repeatability	±0.1%

Operating conditions

Temperature	
Process temperature	Refer to the technical data of the flow sensor.
Ambient temperature	-40...+65°C / -40...+149°F
	For compact devices is the maximum ambient temperature reduced depending on the flow sensor type and the process temperature. For details refer to the flow sensor manual.
	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.
	Ambient temperatures below -25°C / -13°F may affect the readability of the display.
Storage temperature	-40...+70°C / -40...+158°F
Pressure	
Medium	Refer to the technical data of the flow sensor.
Ambient pressure	Atmosphere: altitude up to 2000 m / 6561.7 ft above sea level
Chemical properties	
Electrical conductivity	All media except for water: $\geq 5 \mu\text{S}/\text{cm}$ (also refer to the technical data of the flow sensor)
	Water: $\geq 20 \mu\text{S}/\text{cm}$
Type of measurement	Electrical conductive liquids
Solid content (volume)	$\leq 10\%$ for OPTIFLUX flow sensors
Gas content (volume)	$\leq 3\%$ for OPTIFLUX flow sensors
Flow rate	For detailed information, refer to chapter "Flow tables".
Other conditions	
Ingress protection according to IEC 60529	Standard version with aluminium housing: IP66/67 (according to NEMA 4/4X)
	Optional version with stainless steel housing: IP69

Installation conditions

Installation	For detailed information, refer to chapter "Installation".
Inlet/outlet runs	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: Aluminium with a polyester topcoat
	Option: Stainless steel 1.4404 / AISI 316L
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 specifications.
Power supply	100...230 VAC (-15% / +10%), 50/60 Hz; non-Ex: standard; Ex: optional 240 VAC + 5% is included in the tolerance range.
	24 VDC (-55% / +30%); only available as non-Ex version 12 VDC - 10% is included in the tolerance range.
	24 VAC/DC (AC: -15% / +10%; DC: -25% / +30%); non-Ex: standard; Ex: optional 12 V is not included in the tolerance range.
Power consumption	AC: 7 VA
	DC: 4 W
Signal cable	Only necessary for remote versions.
	DS 300 (type A) Max. length: 600 m / 1968 ft (depending on electrical conductivity and flow sensor version)
Cable entries	Standard: M20 x 1.5 (8...12 mm)
	Option: 1/2 NPT, PF 1/2

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 abbreviations	V_{ext} = external voltage; R_L = load + resistance; V_0 = terminal voltage; I_{nom} = nominal current
Current output	
Output data	Volume flow, mass flow, diagnostic value, flow velocity, coil temperature, conductivity
Settings	Without HART®
	Q = 0%: 0...20 mA; Q = 100%: 10...21.5 mA
	Error identification: 20...22 mA
	With HART®
	Q = 0%: 4...20 mA; Q = 100%: 10...21.5 mA
	Error identification: 3...22 mA
Operating data	
Active	$V_{\text{int, nom}} = 20 \text{ VDC}$
	$I \leq 22 \text{ mA}$
	$R_L \leq 750 \Omega$
	HART® at terminals A
Passive	$V_{\text{ext}} \leq 32 \text{ VDC}$
	$I \leq 22 \text{ mA}$
	$V_0 \geq 2 \text{ V}$ at $I = 22 \text{ mA}$
	$R_L \leq (V_{\text{ext}} - V_0) / I_{\text{max}}$
	HART® at terminals A
HART®	
Description	HART® protocol via active and passive current output
	HART® version: V5
	Universal Common Practice HART® parameter: completely supported
Load	$\geq 230 \Omega$ at HART® test point; Note maximum load for current output!
Multi-drop mode	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 / 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: adjustable as automatic, symmetric or fixed (0.05...2000 ms)
Operating data	
Passive	$V_{\text{ext}} \leq 32 \text{ VDC}$
	f_{max} in operating menu set to $f_{\text{max}} \leq 100 \text{ Hz}$: $I \leq 100 \text{ mA}$ 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 $I \leq 20 \text{ mA}$
Low flow cut off	
Function	Switching point and hysteresis separately adjustable for each output, counter and the display
Switching point	Set in increments of 0.1%.
	0...20% (current output, frequency output) or 0...±9.999 m/s (pulse output)
Hysteresis	Set in increments of 0.1%.
	0...5% (current output, frequency output) or 0...5 m/s (pulse output)
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	
Passive	$V_{\text{ext}} \leq 32 \text{ VDC}$ $I \leq 100 \text{ mA}$ 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 $I \leq 100 \text{ mA}$
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	
Passive	$V_{\text{ext}} \leq 32 \text{ VDC}$ $I_{\text{nom}} = 6.5 \text{ mA}$ at $V_{\text{ext}} = 24 \text{ VDC}$ $I_{\text{nom}} = 8.2 \text{ mA}$ at $V_{\text{ext}} = 32 \text{ VDC}$ 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 $I_{\text{nom}} = 2.8 \text{ mA}$

Approvals and certificates

Declaration of conformity	This device fulfils the statutory requirements of the relevant directives. The manufacturer certifies successful testing of the product by applying the conformity mark on the device.
	For more information on the directives, standards and the approved certifications, please refer to the declaration of conformity supplied with the device or downloadable from the manufacturer's website.
Marine certificate	
EU RO MR Type Approval	Certificate mutually recognized by: ABS, BV, CCS, CRS, DNG-GL, IRS, KR, ClassNK, PRS, RINA, RS
	For certificate and details refer to the manufacturer website.
Standard version	Non-Ex
Hazardous areas	
ATEX	Option (only OPTIFLUX 2100 C and OPTIFLUX 4100 C)
	II 2 G Ex e [ia] mb IIC T4 (DN10...20; DN200...300; DN350...3000)
	II 2 G Ex d e [ia] mb IIC T4 (DN25...150)
	II 2 G Ex e [ia] mb q T4/T3 (DN25...150; DN200...300)
	II 2 D Ex tD A21 IP64 T120°C (all nominal sizes)
	Option (only W version)
	II 2 D Ex tD A21 IP64 T135°C
IECEX	Option (only OPTIFLUX 2100 C and OPTIFLUX 4100 C)
	Ex e [ia] mb IIC T4 (DN10...20; DN200...300; DN350...3000)
	Ex d e [ia] mb IIC T4 (DN25...150)
	Ex tD A21 IP64 T120°C (all nominal sizes)
	Option (only W version)
	Ex e [ia] mb IIC T4
	Ex tD A21 IP64 T135°C
FM/CSA	Option (only OPTIFLUX 2100 C and OPTIFLUX 4100 C)
	Class I, Div 2, Group A, B, C and D
	Option (only W version)
	Class I, Div 2, Group A, B, C and D Ordinary location
Other standards and approvals	
Vibration resistance	Tested according to IEC 60068-2-64
NAMUR	NE 21, NE 43, NE 53

Table 8-1: Technical data

8.3 Dimensions and weight

8.3.1 Housing

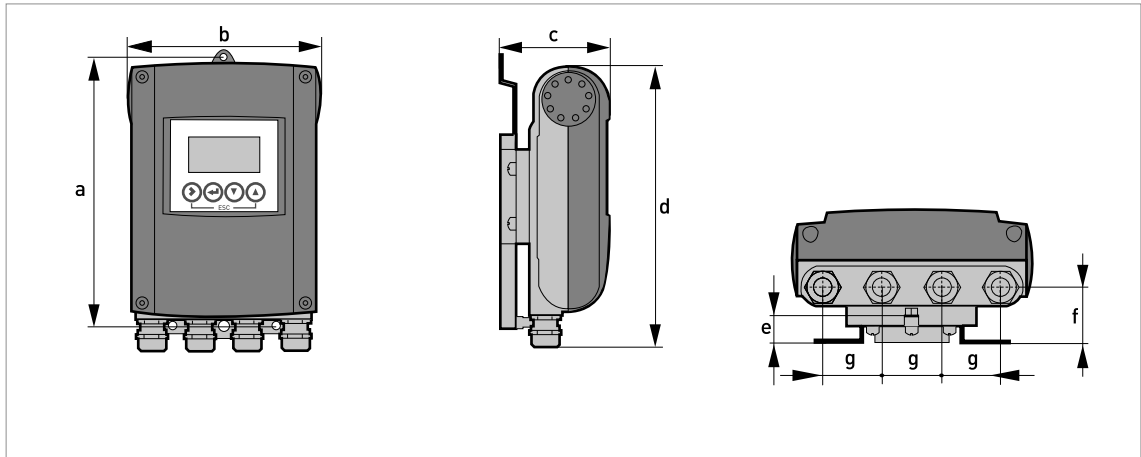


Figure 8-2: Dimensions of the wall-mounted version, aluminium housing

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

Table 8-2: Dimensions and weight in mm and kg

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

Table 8-3: Dimensions and weight in inch and lb

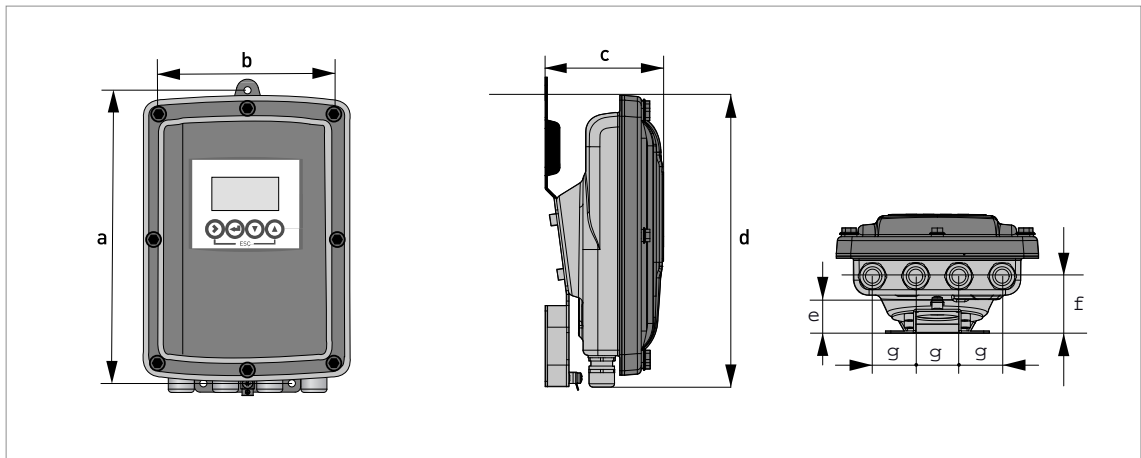


Figure 8-3: Dimensions of wall-mounted and compact 10° version, stainless steel housing

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

Table 8-4: Dimensions and weight in mm and kg

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

Table 8-5: Dimensions and weight in inch and lb



INFORMATION!
The compact 10° version is without mounting plate.

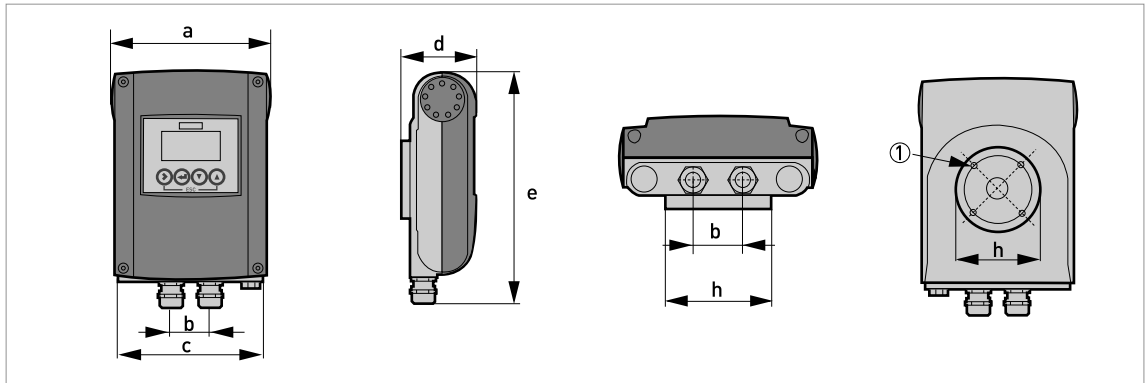


Figure 8-4: Dimensions of compact 0° version, aluminium housing

① 4 x M 6

	Dimensions [mm]								Weight [kg]
	a	b	c	d	e	f	g	h	
0° version	161	40	155	81.5	257	-	-	Ø72	Std: 1.9 Ex: 2.4

Table 8-6: Dimensions and weight in mm and kg

	Dimensions [inch]								Weight [lb]
	a	b	c	d	e	f	g	h	
0° version	6.34	1.57	6.1	3.21	10.12	-	-	Ø2.83	Std: 4.2 Ex: 5.3

Table 8-7: Dimensions and weight in inch and lb

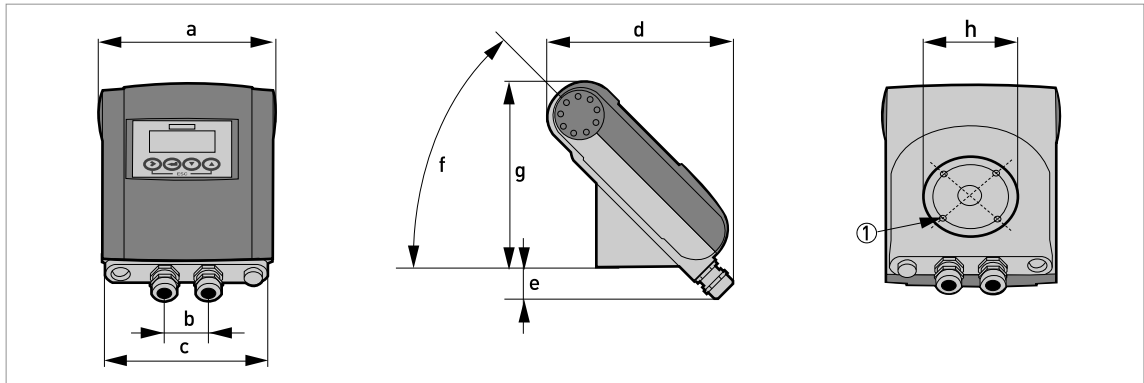


Figure 8-5: Dimensions of compact 45° version, aluminium housing

① 4 x M 6

	Dimensions [mm]								Weight [kg]
	a	b	c	d	e	f	g	h	
45° version	161	40	155	184	27.4	45°	186	Ø72	Std: 2.1 Ex: 2.6

Table 8-8: Dimensions and weight in mm and kg

	Dimensions [inch]								Weight [lb]
	a	b	c	d	e	f	g	h	
45° version	6.34	1.57	6.10	7.24	1.08	45°	7.32	Ø2.83	Std: 4.6 Ex: 5.7

Table 8-9: Dimensions and weight in inch and lb

8.3.2 Mounting plate of wall-mounted version, aluminium housing

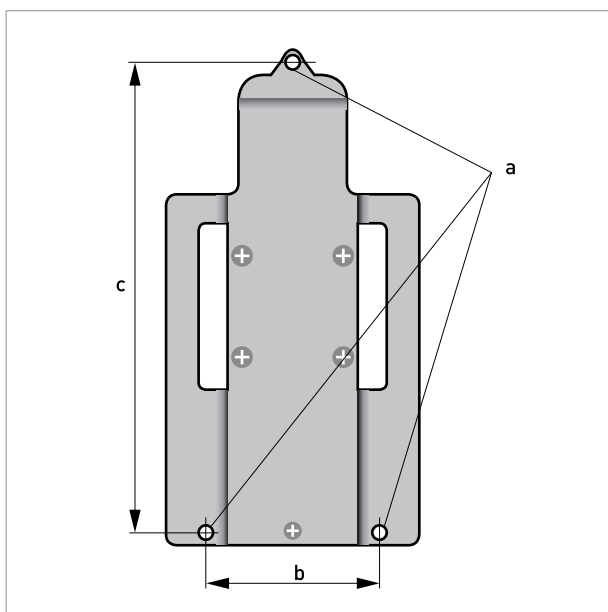


Figure 8-6: Dimensions of mounting plate of wall-mounted version, aluminium housing

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

Table 8-10: Dimensions in mm and inch

8.3.3 Mounting plate of wall-mounted version, stainless steel housing

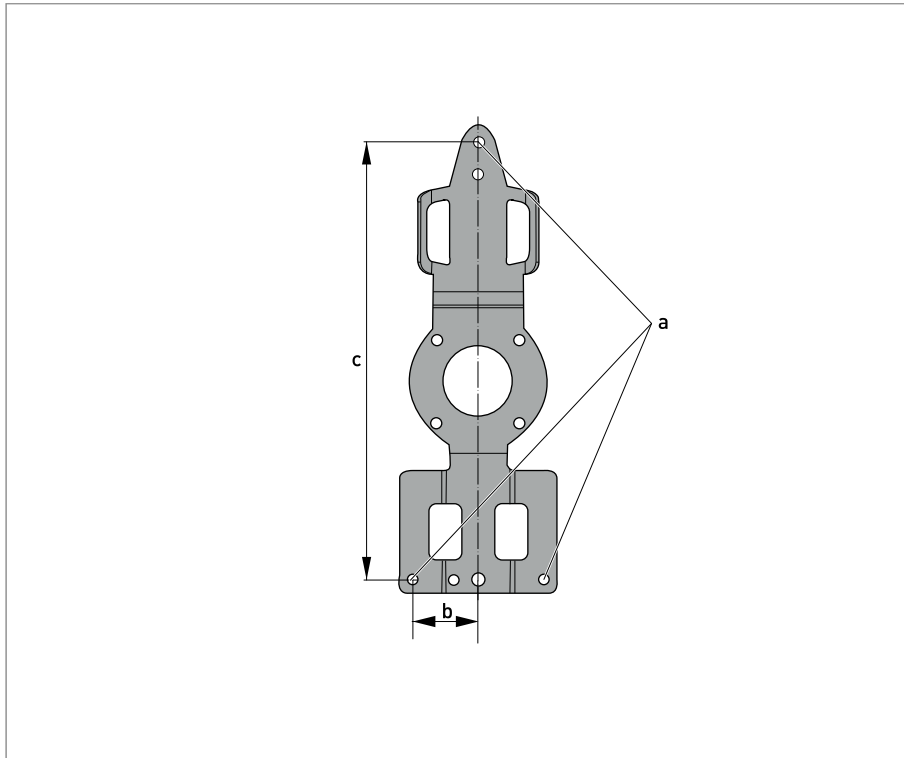


Figure 8-7: Dimensions of mounting plate of wall-mounted version, stainless steel housing

	[mm]	[inch]
a	Ø6.5	Ø0.26
b	40	1.6
c	267.9	10.55

Table 8-11: Dimensions in mm and inch

8.4 Flow tables

	$Q_{100\%}$ in m^3/h			
v [m/s]	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

Table 8-12: Flow rate in m/s and m^3/h

	Q ₁₀₀ % in US gallons/min			
v [ft/s]	1	3.3	10	40
DN [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

Table 8-13: 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	SW.REV.UIS	SW.REV.MS	HART [®]	
				Device Revision	DD Revision
2008-02-29	2.0.x	2.0.x	2.0.x	2	1
2010-01-04	2.1.x	2.1.x	3.0.x	3	1
2011-12-12	3.0.x	3.0.x	4.0.x	3	1
2014-08-01	3.1.x	3.1.x	4.0.x	4	1

Table 9-1: Software history

Manufacturer ID:	69 (0x45)
Device:	217 (0xD9)
HART [®] Universal Revision:	5
FC 375/475 system SW.Rev.:	≥ 1.8
AMS [®] version:	≥ 7.0
PDM [®] version:	≥ 6.0
FDT version:	≥ 1.2

Table 9-2: HART[®] identification codes and revision numbers

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.

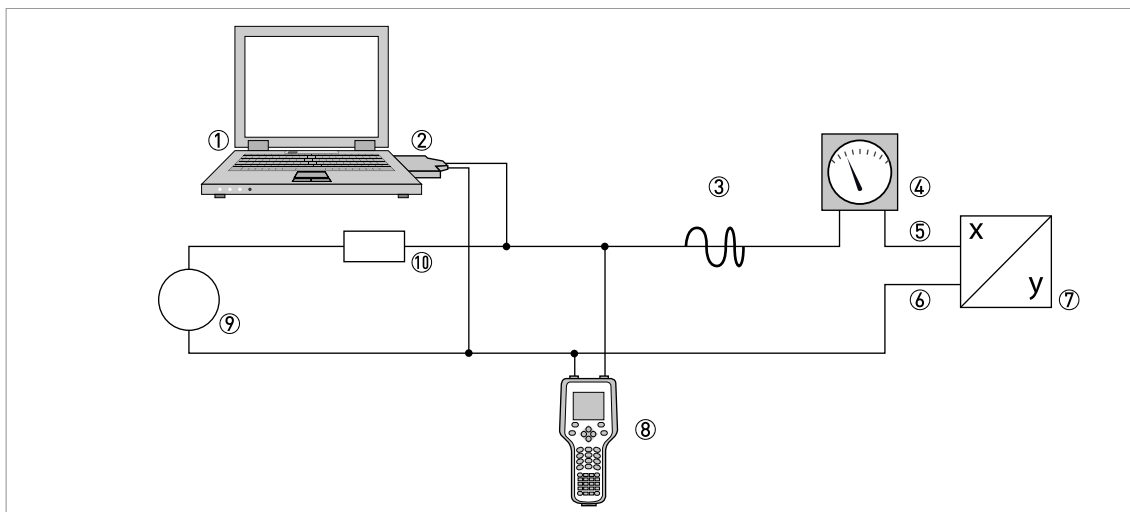


Figure 9-1: Point-to-Point connection

- 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!

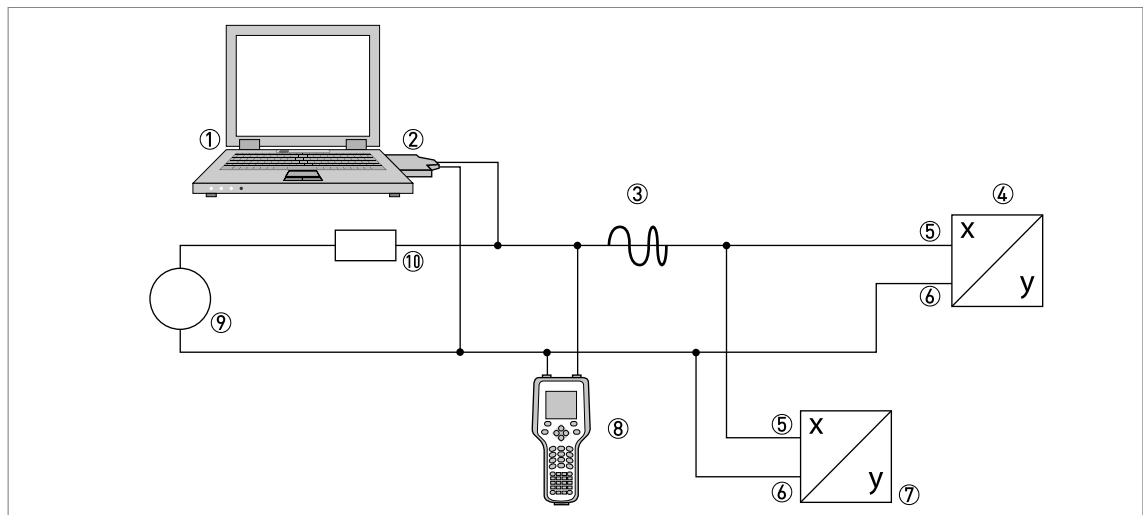


Figure 9-2: Multi-Drop connection (2-wire connection)

- 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.

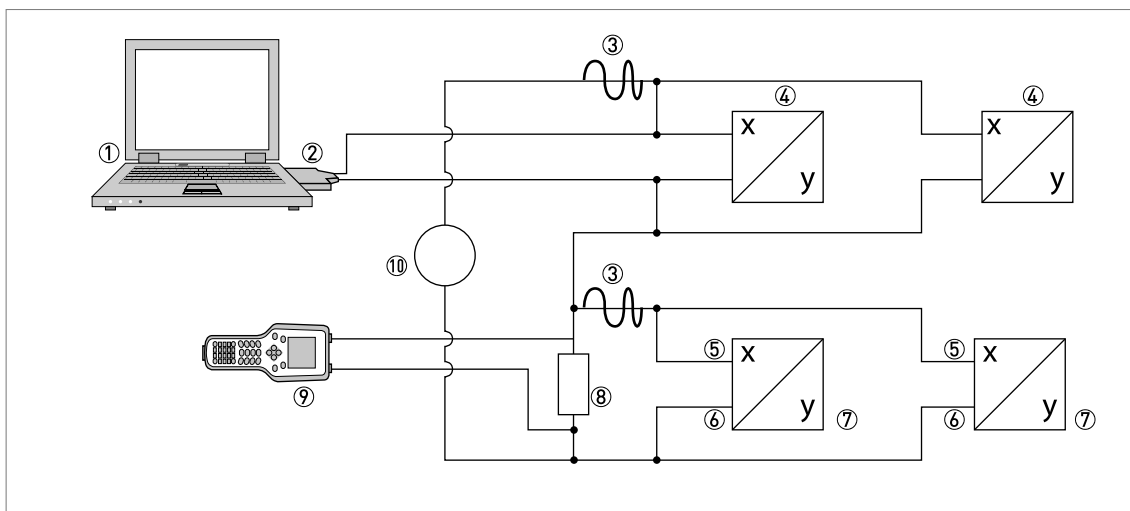


Figure 9-3: Multi-Drop connection (3-wire connection)

- 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 and 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 = Fourth Variable

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

Table 9-3: Connection of the terminals to the HART[®] dynamic variables

The signal converter can provide up to 8 measurement-related 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	6	Counter	-
counter 2	14	Counter	
diagnosis value	25	Linear	Function and availability depends on diagnosis value setting.
operating hours	1	Counter	-

Table 9-4: Description of the HART[®] device variables

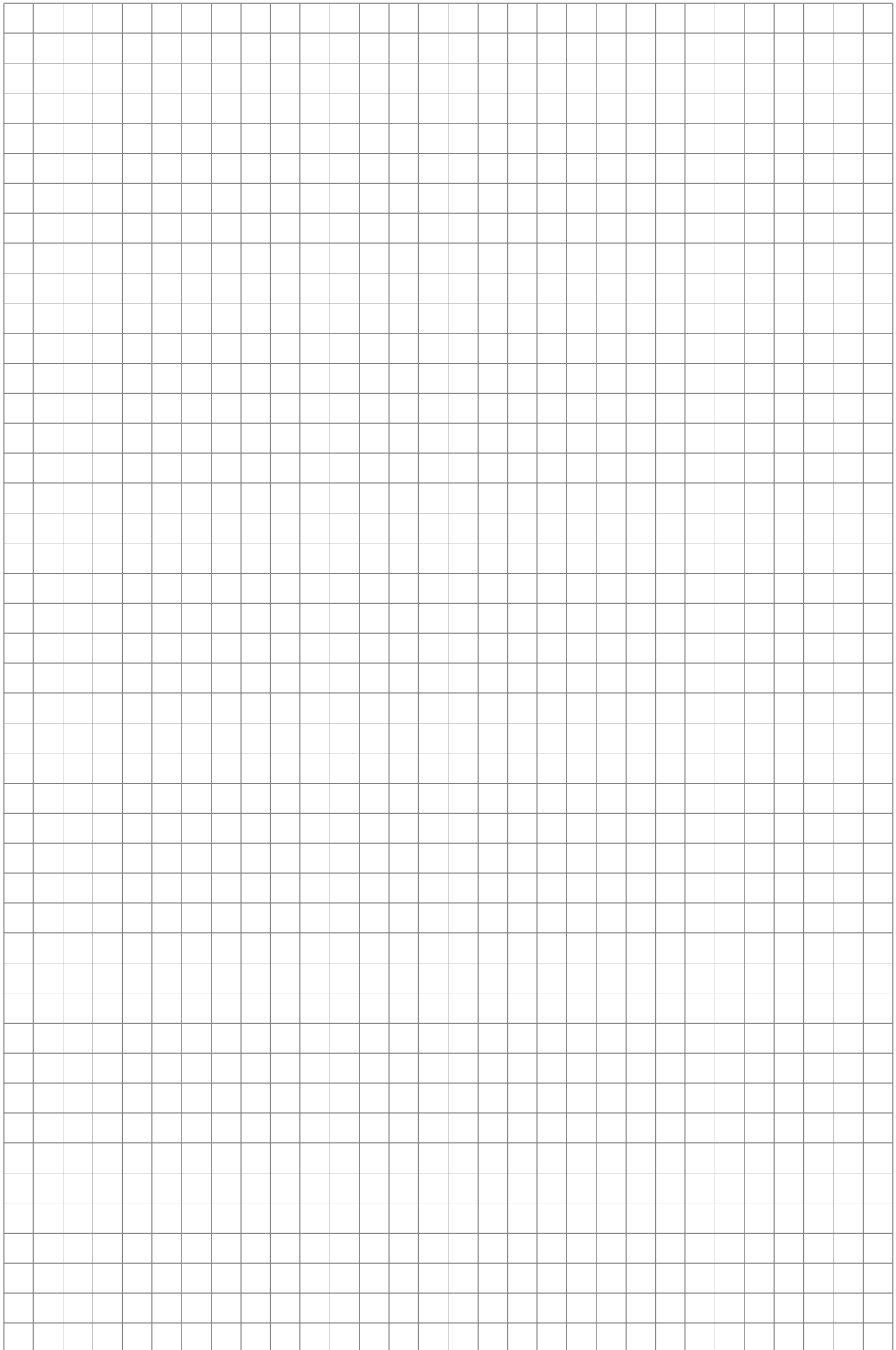
For the dynamic variables connected to the linear analogue outputs for current and/or frequency, the assignment of the device variables takes place by selecting the linear measurement for these outputs under the appropriate function of the signal converter. It follows that the dynamic variables connected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

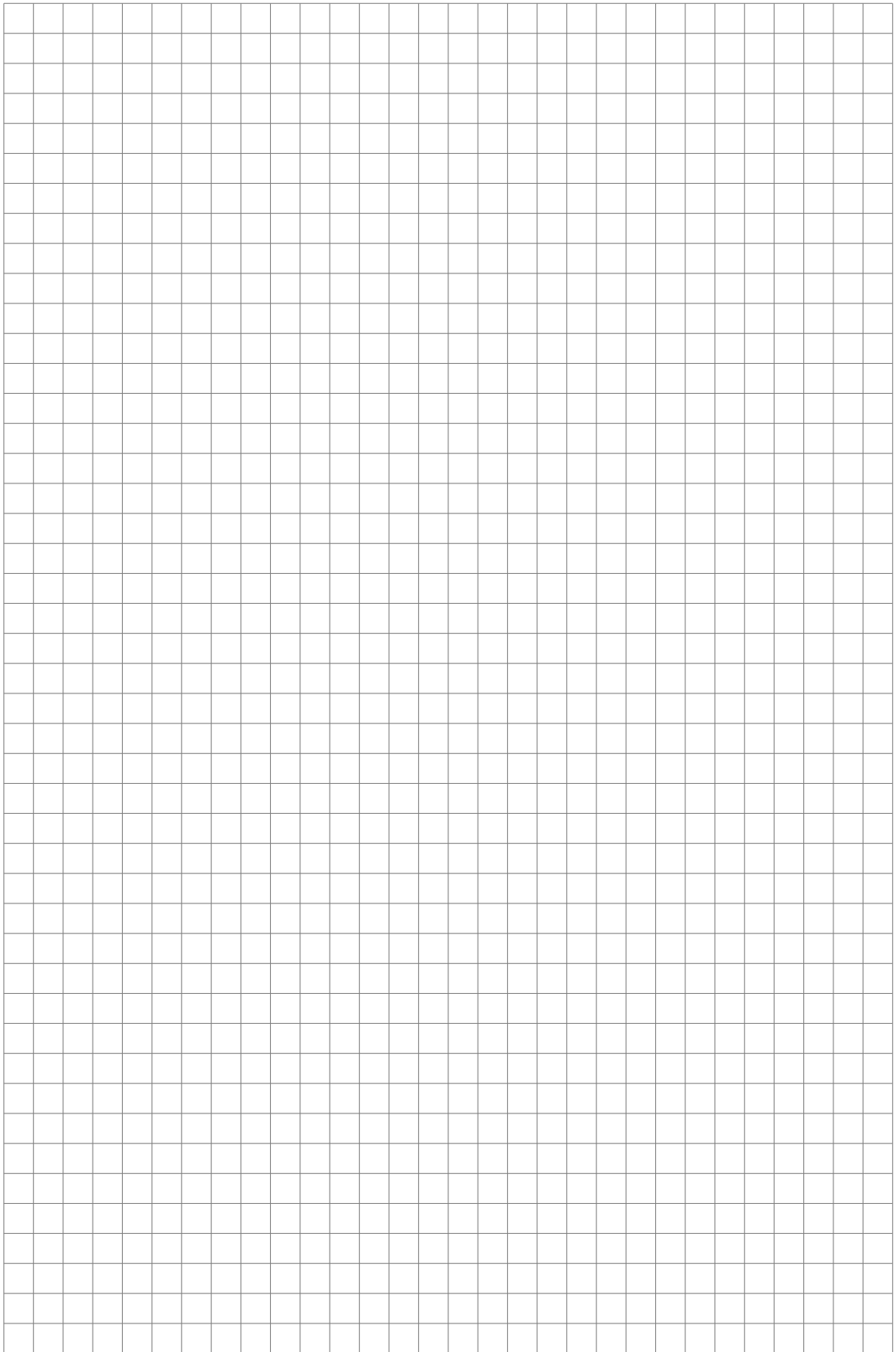
The HART[®] dynamic variable PV is always connected to the HART[®] current output which is, for example, assigned to the volume flow.

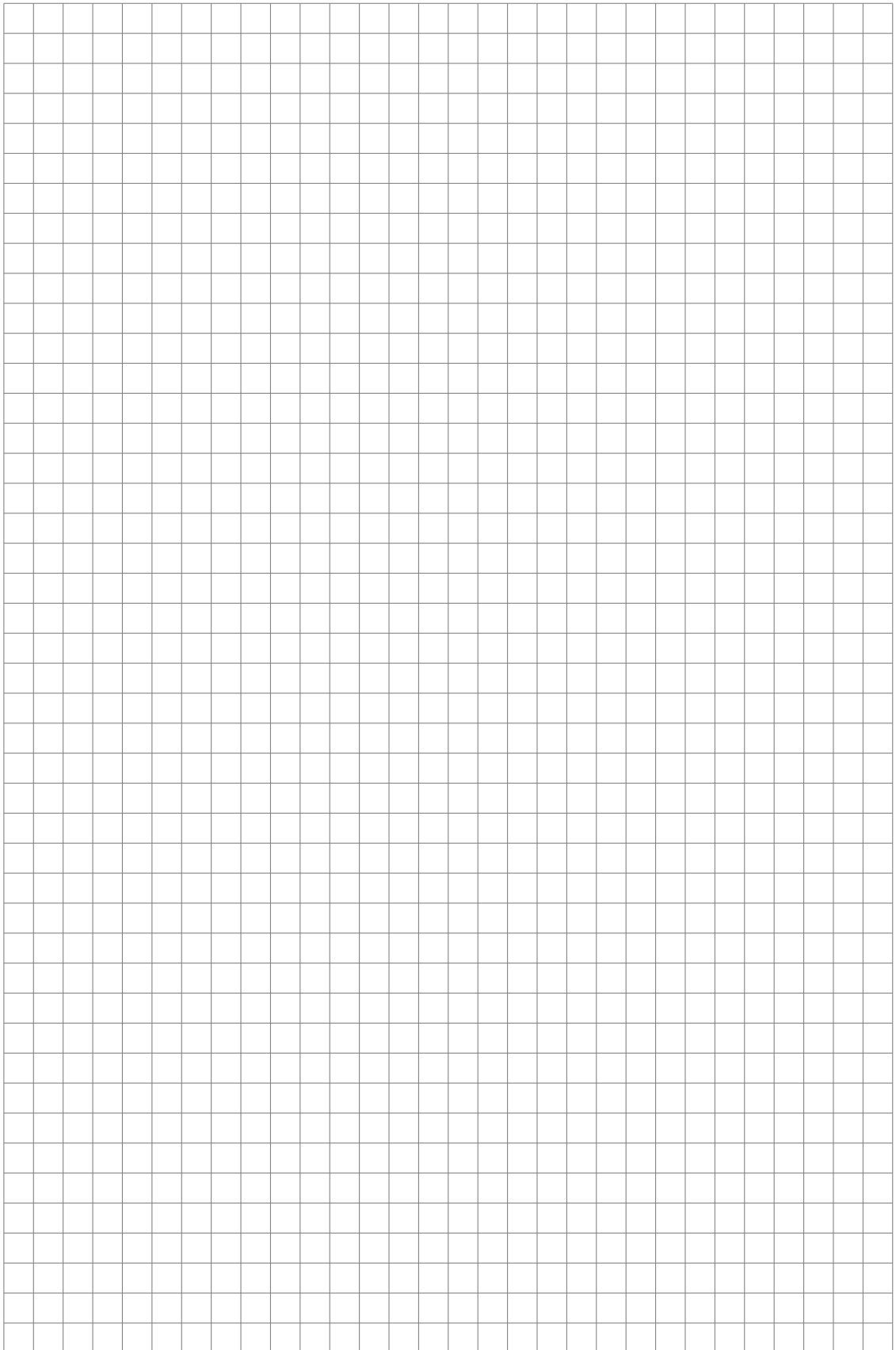
A totaliser device variable can thus not be assigned to the dynamic variable PV because the PV is always connected to the HART[®] current output.

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

The totaliser 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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