IFC 300 Quick Start

Signal converter for electromagnetic flowmeters

Electronic revision:
ER 3.4.0_

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

KROHNE

Warnings and symbols used

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

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.

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.

Safety instructions for the operator

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

LEGAL NOTICE!
The responsibility as to the suitability and intended use of this device rests solely with the user. The supplier assumes no responsibility in the event of improper use by the customer. Improper installation and operation may lead to loss of warranty. In addition, the "Terms and Conditions of Sale" apply which form the basis of the purchase contract.

INFORMATION!

- *Further information can be found in the manual, on the data sheet, in special manuals, certificates and on the manufacturer's website.*
- *If you need to return the device to the manufacturer or supplier, please fill out the form contained in the manual and send it with the device. Unfortunately, the manufacturer cannot repair or inspect the device without the completed form.*

2.1 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 CISPR11:2009. It is intended for use in industrial environment. There may be potential difficulties in ensuring electromagnetic compatibility in other environments, due to conducted as well as radiated disturbances.

2.2 Scope of delivery

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

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

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

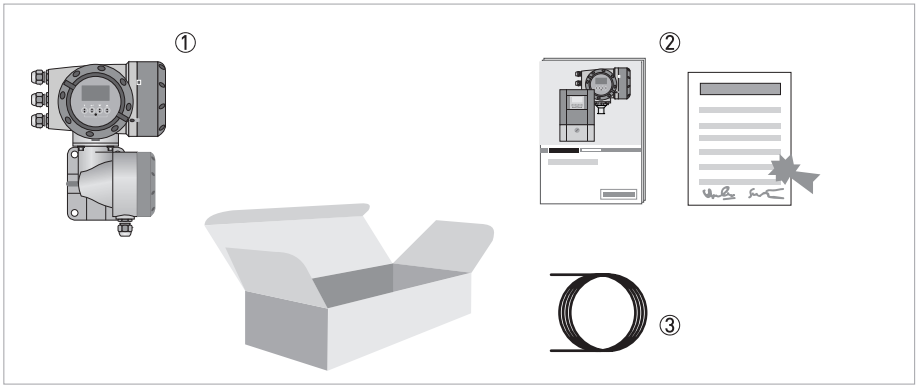

Figure 2-1: Scope of delivery

① Device in the version as ordered
② Documentation (calibration report and Quick Start for flow sensor and signal converter)
③ Signal cable (only for remote version)

Flow sensor	Flow sensor + signal converter IFC 300			
	Compact	Remote field housing	Remote wall-mounted housing	Remote rack-mounted housing R (28 TE) or (21 TE)
OPTIFLUX 1000	OPTIFLUX 1300 C	OPTIFLUX 1300 F	OPTIFLUX 1300 W	OPTIFLUX 1300 R
OPTIFLUX 2000	OPTIFLUX 2300 C	OPTIFLUX 2300 F	OPTIFLUX 2300 W	OPTIFLUX 2300 R
OPTIFLUX 4000	OPTIFLUX 4300 C	OPTIFLUX 4300 F	OPTIFLUX 4300 W	OPTIFLUX 4300 R
OPTIFLUX 5000	OPTIFLUX 5300 C	OPTIFLUX 5300 F	OPTIFLUX 5300 W	OPTIFLUX 5300 R
OPTIFLUX 6000	OPTIFLUX 6300 C	OPTIFLUX 6300 F	OPTIFLUX 6300 W	OPTIFLUX 6300 R
OPTIFLUX 7000	OPTIFLUX 7300 C	-	-	-
WATERFLUX 3000	WATERFLUX 3300 C	WATERFLUX 3300 F	WATERFLUX 3300 W	WATERFLUX 3300 R
TIDALFLUX 2000	-	TIDALFLUX 2300 F	-	-

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

2.3 Storage

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

2.4 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.

2.5 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.*

2.6 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.

2.7 Mounting the field housing, remote version

CAUTION!
Remarks for sanitary applications

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

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

2.7.1 Pipe mounting

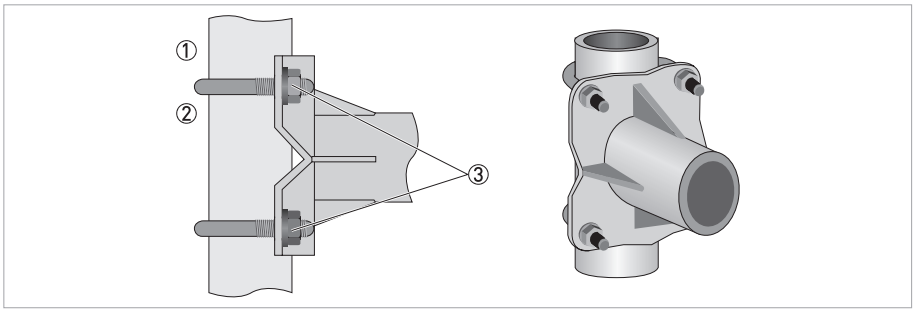

Figure 2-2: Pipe mounting of the field housing

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

2.7.2 Wall mounting

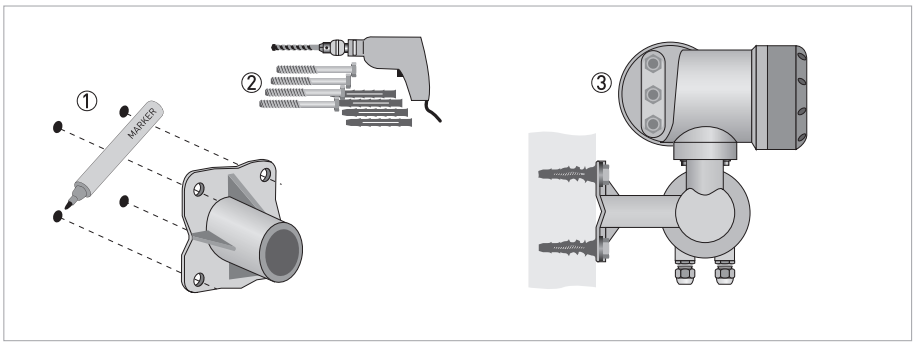

Figure 2-3: Wall mounting of the field housing

① Prepare the holes with the aid of the mounting plate. For further information refer to *Mounting plate of field housing* on page 9.
② Fasten the mounting plate securely to the wall.
③ Screw the signal converter to the mounting plate with the nuts and washers.

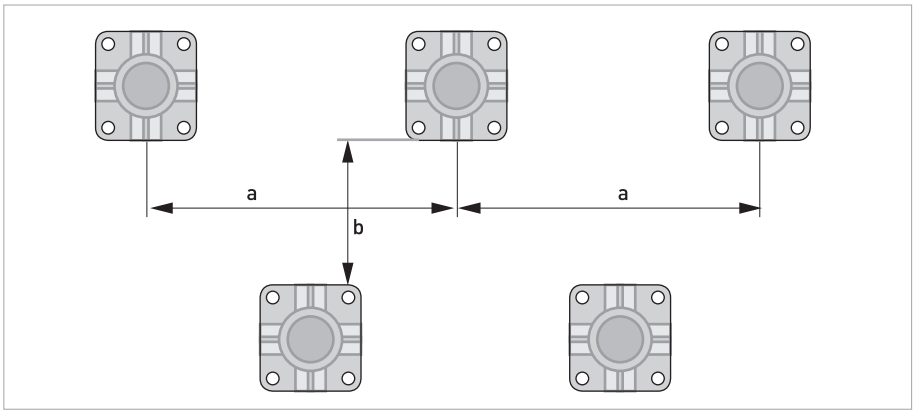

Figure 2-4: Mounting multiple devices next to each other

a ≥ 600 mm / 23.6"
b ≥ 250 mm / 9.8"

2.7.3 Mounting plate of field housing

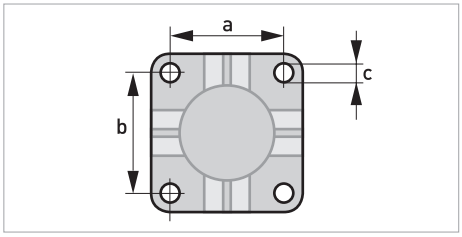

Figure 2-5: Dimensions for mounting plate of field housing

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

Table 2-2: Dimensions in mm and inch

2.7.4 Turning the display of the field housing version

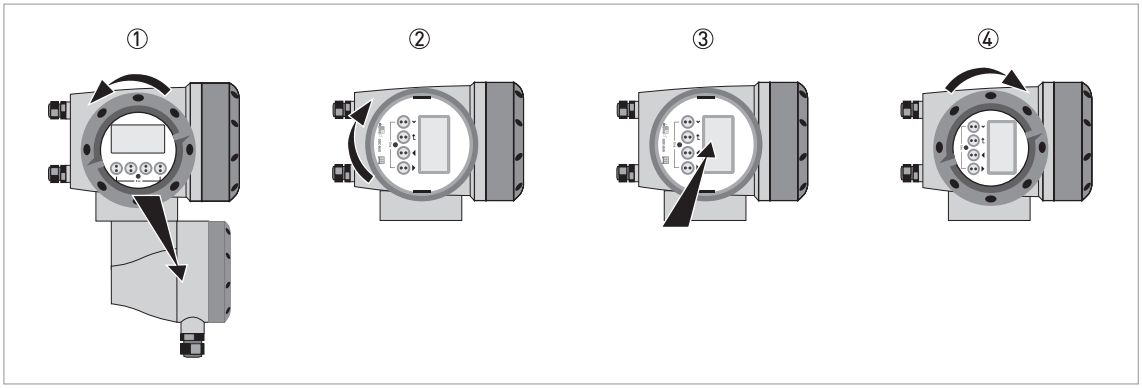

Figure 2-6: Turning the display of the field housing version

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

① Unscrew the cover from the display and operation control unit.
② Pull out the display and rotate it to the required position.
③ Slide the display back into the housing.
④ Re-fit the cover and tighten it by hand.

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

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

2.8 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.

2.8.1 Pipe mounting

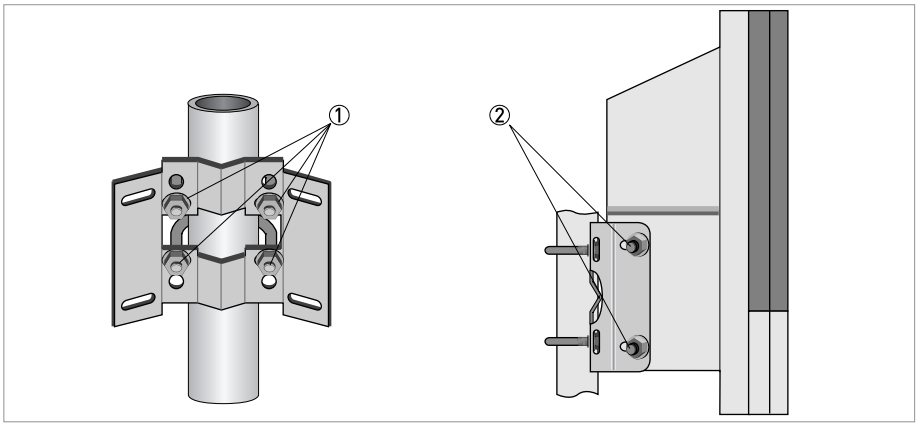

Figure 2-7: Pipe mounting of the wall-mounted housing

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

2.8.2 Wall mounting

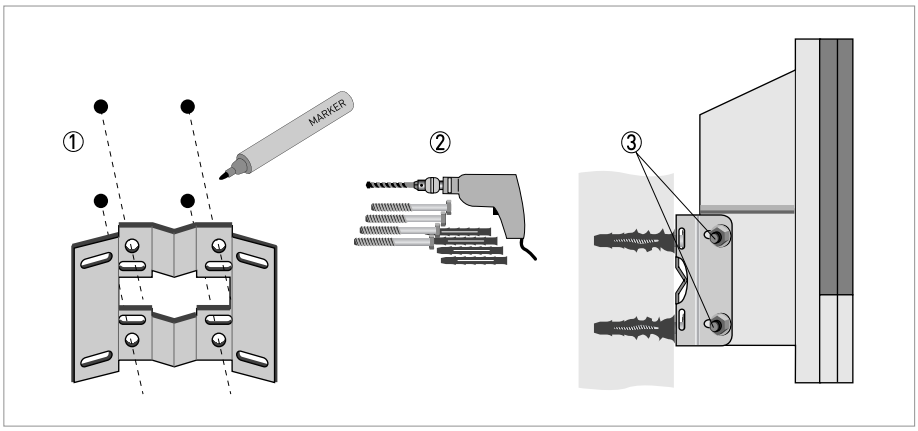

Figure 2-8: Wall mounting of the wall-mounted housing

① Prepare the holes with the aid of the mounting plate. For further information refer to *Mounting plate of wall-mounted housing* on page 13.
② Fasten the mounting plate securely to the wall.
③ Screw the signal converter to the mounting plate with the nuts and washers.

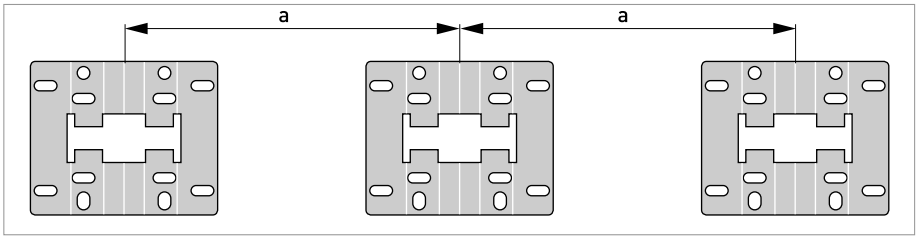

Figure 2-9: Mounting multiple devices next to each other

a ≥ 240 mm / 9.4"

2.8.3 Mounting plate of wall-mounted housing

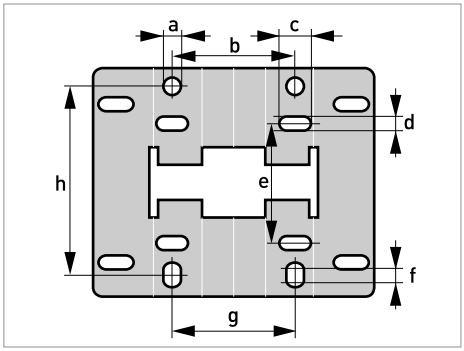

Figure 2-10: Dimensions of mounting plate of wall-mounted housing

	[mm]	[inch]
a	Ø9	Ø0.4
b	64	2.5
c	16	0.6
d	6	0.2
e	63	2.5
f	13	0.5
g	64	2.5
h	98	3.85

Table 2-3: Dimensions in mm and inch

3.1 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.

3.2 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 (see 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.*

3.3 Electrical cables for remote device versions, notes

3.3.1 Notes on signal cables A and B

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

Observe the following notes:

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

3.3.2 Notes on field current cable C

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

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

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

3.3.3 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 GΩ x km
- U_{max} < 24 V
- I_{max} < 100 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.

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

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

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

3.4.1 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: ≥ 50 mm / 2"

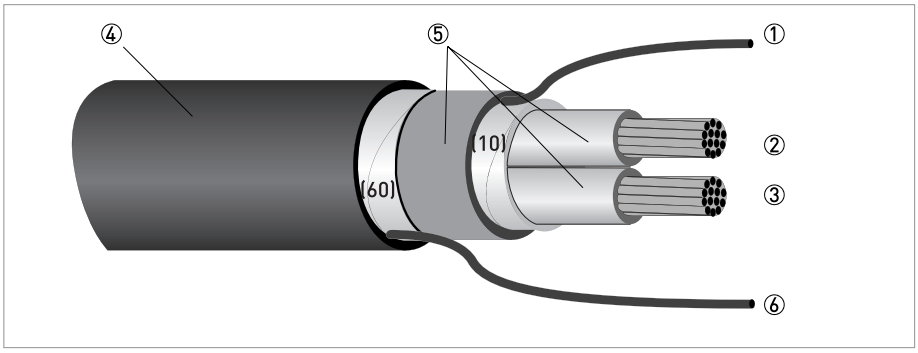

Figure 3-1: Construction of signal cable A

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

3.4.2 Preparing signal cable A, connection to signal converter

Field housing

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

- The outer shield (60) is connected in the field housing directly via the shield and a clip.
- Bending radius: ≥ 50 mm / 2"

Required materials:

- PVC insulating tube, Ø2.5 mm / 0.1"
- Heat-shrinkable tubing
- Wire end ferrule to DIN 46228: E 1.5-8 for the stranded drain wire (1)
- 2 wire end ferrules to DIN 46228: E 0.5-8 for the insulated conductors

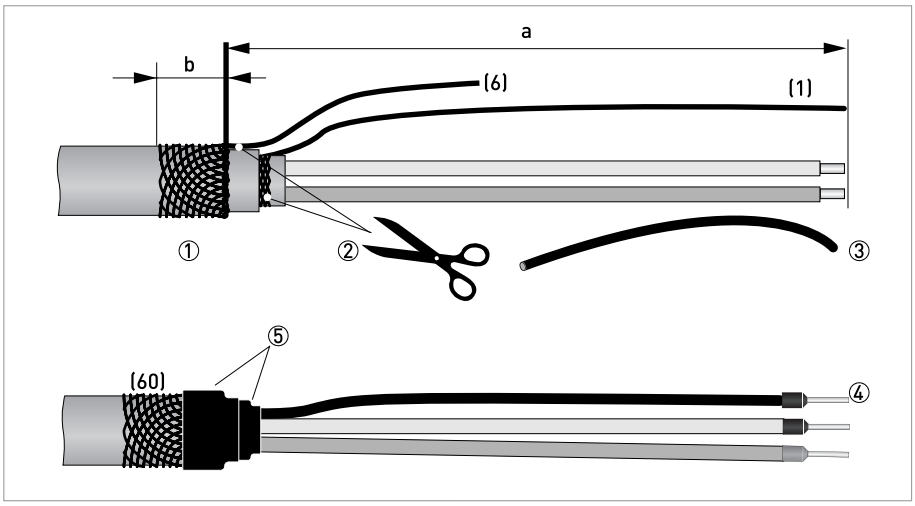

Figure 3-2: Signal cable A, preparation for field housing

a = 80 mm / 3.15"
b = 10 mm / 0.4"

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

Wall mounted housing

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

- The connection of the outer shield is carried out in the wall-mounted housing via the stranded drain wire (6).
- Bending radius: ≥ 50 mm / 2"

Required materials

- Push-on connector 6.3 mm / 0.25", insulation for conductor Ø0.5...1 mm^2 / AWG 20...17
- PVC insulating tube, Ø2.5 mm / 0.1"
- Heat-shrinkable tubing
- Wire end ferrule to DIN 46228: E 1.5-8 for the stranded drain wire (1)
- 2 wire end ferrules to DIN 46228: E 0.5-8 for the insulated conductors

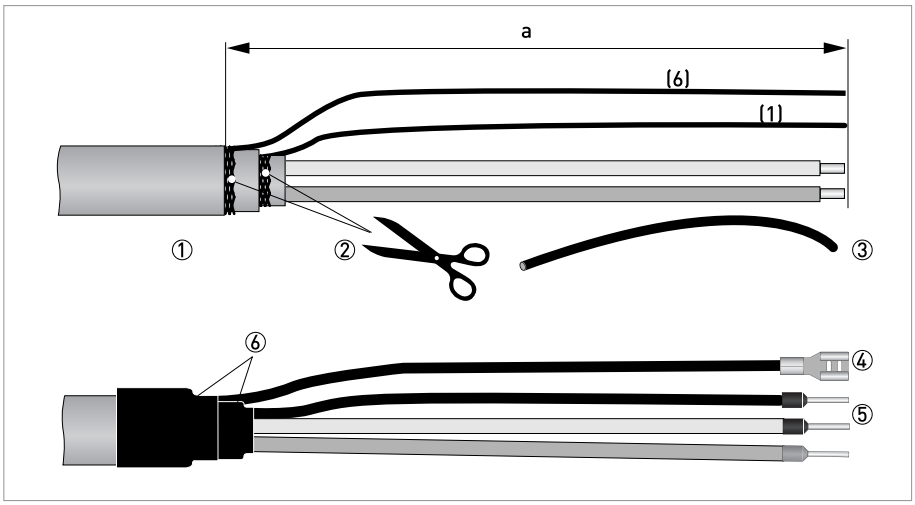

Figure 3-3: Signal cable A, preparation for wall-mounted housing
a = 80 mm / 3.15"

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

3.4.3 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 size		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...2000	8...80	20	A2
OPTIFLUX 4000 F	2.5...150	1/10...6	1	A1
	200...2000	8...80	1	A2
OPTIFLUX 5000 F	2.5...100	1/10...4	1	A1
	150...250	6...10	1	A2
OPTIFLUX 6000 F	2.5...150	1/10...6	1	A1
WATERFLUX 3000 F	25...600	1...24	20	A1

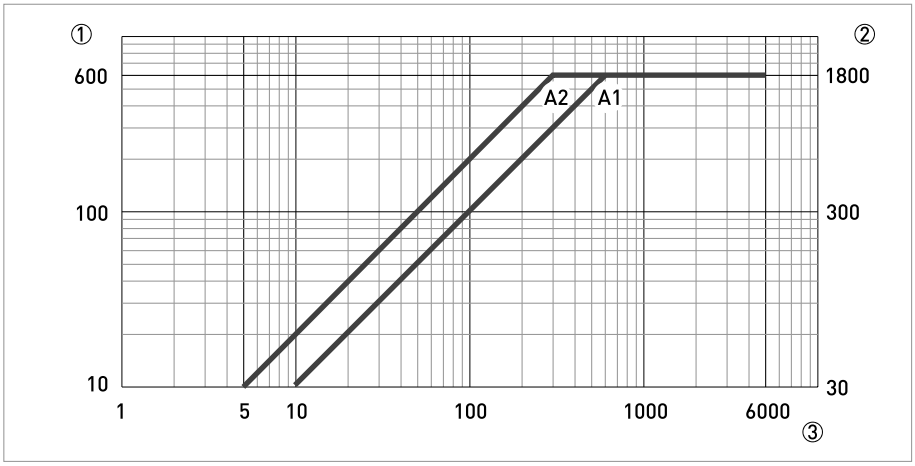

Figure 3-4: Maximum length of signal cable A

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]

3.4.4 Signal cable B (type BTS 300), construction

- Signal cable B is a triple-shielded cable for signal transmission between the flow sensor and signal converter.
- Bending radius: ≥ 50 mm / 2"

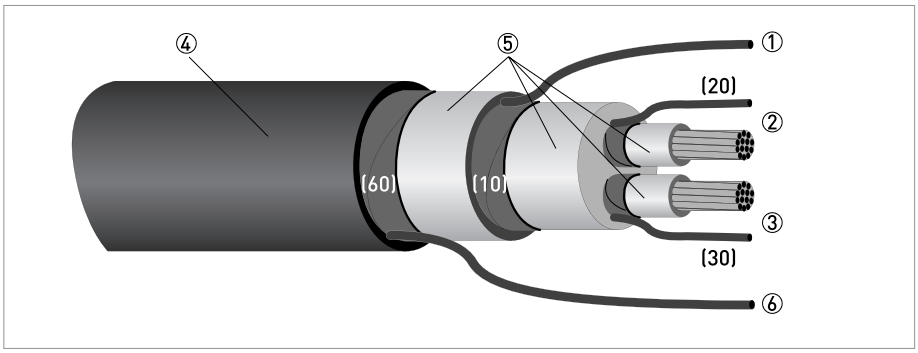

Figure 3-5: Construction of signal cable B

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

3.4.5 Preparing signal cable B, connection to signal converter

Field housing

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

- The outside shield (60) is connected in the field housing directly via the shield and a clip.
- Bending radius: ≥ 50 mm / 2"

Required materials

- PVC insulating tube, Ø2.0...2.5 mm / 0.08...0.1"
- Heat-shrinkable tubing
- Wire end ferrule to DIN 46228: E 1.5-8 for the stranded drain wire (1)
- 4 wire end ferrules to DIN 46228: E 0.5-8 for the insulated conductors 2 and 3 and the stranded drain wires (20, 30)

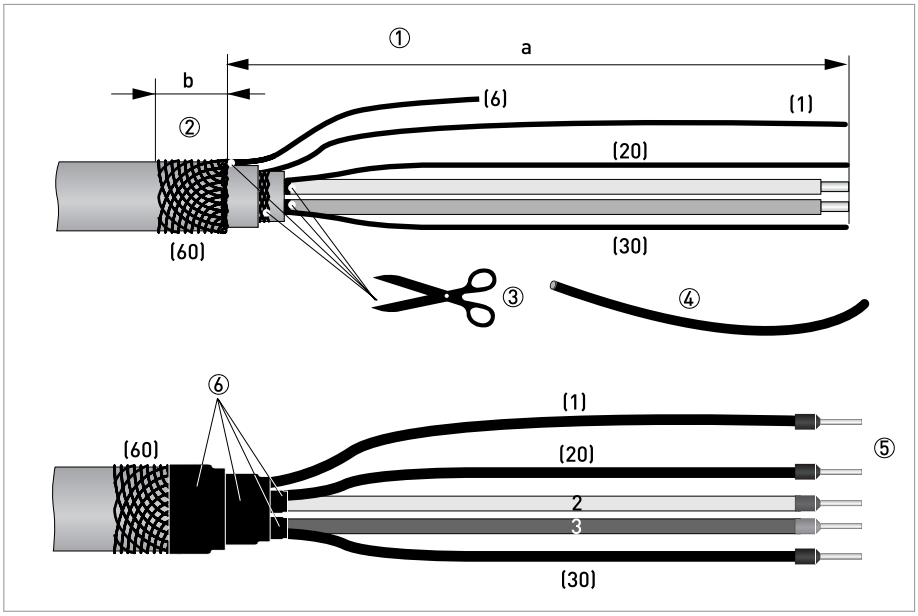

Figure 3-6: Signal cable B, preparation for field housing

a = 80 mm / 3.15"
b = 10 mm / 0.4"

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

Wall-mounted housing

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

- The connection of the outer shield is carried out in the wall-mounted housing via the stranded drain wire (6).
- Bending radius: ≥ 50 mm / 2"

Required materials:

- Push-on connector 6.3 mm / 0.25", insulation for conductor Ø0.5...1 mm^2 / AWG 20...17
- PVC insulating tube, Ø2.5 mm / 0.1"
- Heat-shrinkable tubing
- Wire end ferrule to DIN 46228: E 1.5-8 for the stranded drain wire (1)
- 4 wire end ferrules to DIN 46228: E 0.5-8 for insulated conductors 2 and 3 and the stranded drain wires (20, 30)

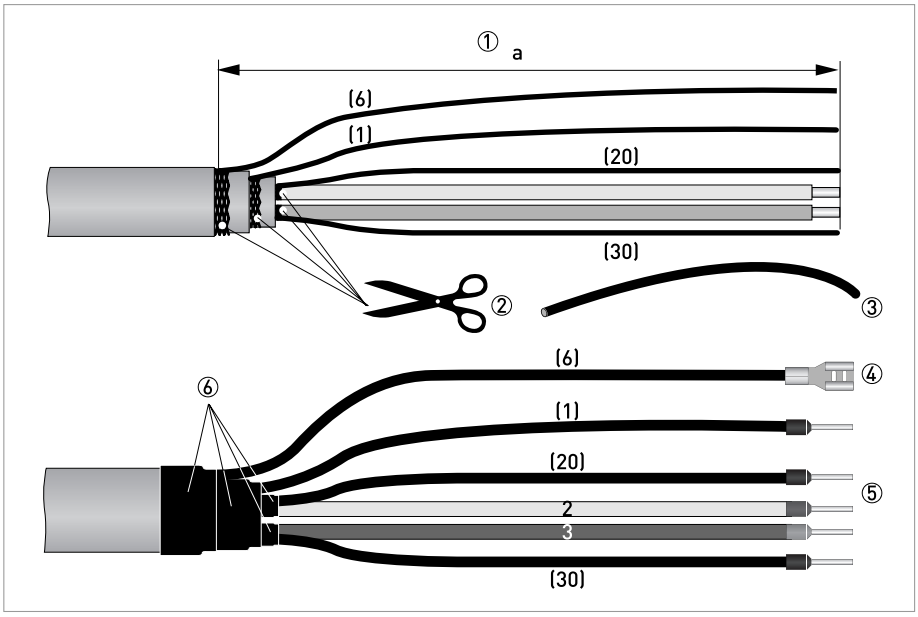

Figure 3-7: Signal cable B, preparation for wall-mounted housing

a = 80 mm / 3.15"

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

3.4.6 Length of signal cable B

INFORMATION!
For temperatures of the medium above 150° C / 300° F, a special signal cable and a ZD intermediate socket are necessary. These are available including the changed electrical connection diagrams.

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

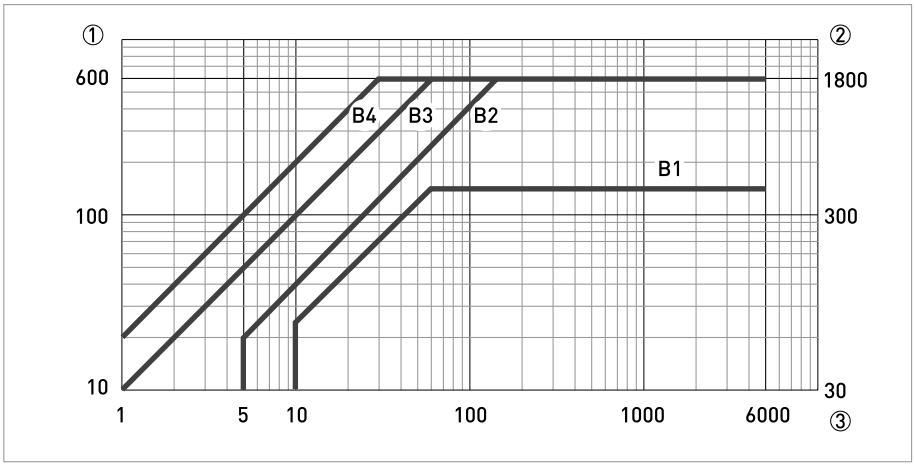

Figure 3-8: Maximum length of signal cable B

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

3.4.7 Preparing field current cable C, connection to signal converter

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

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

- Field current cable C is not part of the scope of delivery.
- Bending radius: ≥ 50 mm / 2"

Required materials:

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

Length and cross-section of field current cable C

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

① Cu = copper cross-section

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

- Flexible cable ≤ 1.5 mm^2 / AWG 14
- Solid cable ≤ 2.5 mm^2 / AWG 12

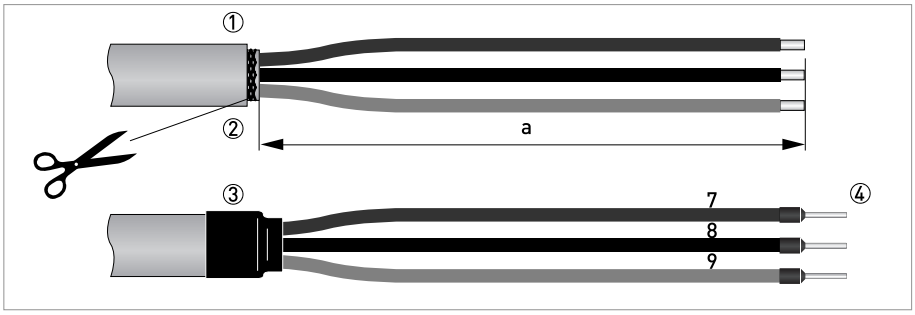

Figure 3-9: Field current cable C, preparation for the signal converter

a = 80 mm / 3.15"

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

3.4.8 Preparing signal cable A, connection to flow sensor

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

- The outer shield (60) is connected in the terminal compartment of the flow sensor directly via the shield and a clip.
- Bending radius: ≥ 50 mm / 2"

Required materials

- PVC insulating tube, Ø2.0...2.5 mm / 0.08...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)

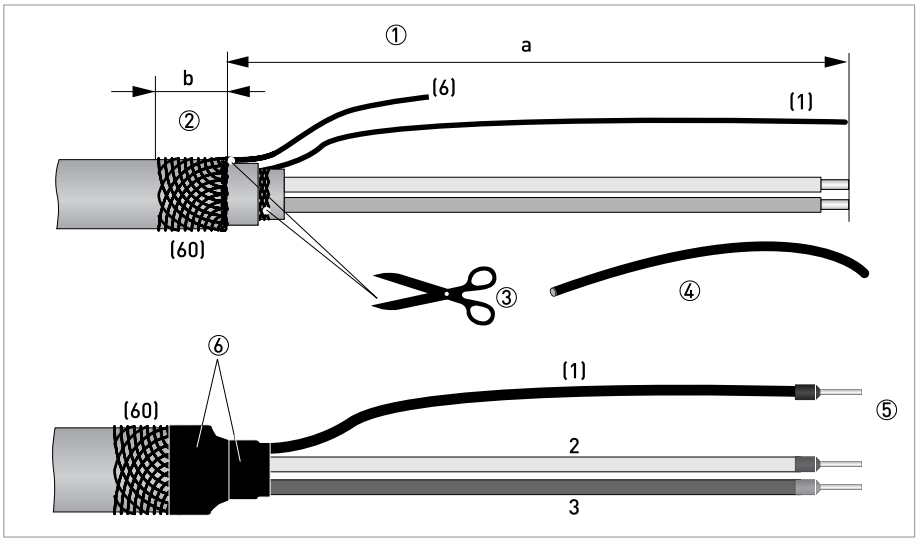

Figure 3-10: Preparing signal cable A, connection to flow sensor

a = 50 mm / 2"
b = 10 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.

3.4.9 Preparing signal cable B, connection to flow sensor

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

- The outer shield (60) is connected in the terminal compartment of the flow sensor directly via the shield and a clip.
- Bending radius: ≥ 50 mm / 2"

Required materials

- PVC insulating tube, Ø2.0...2.5 mm / 0.08...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)

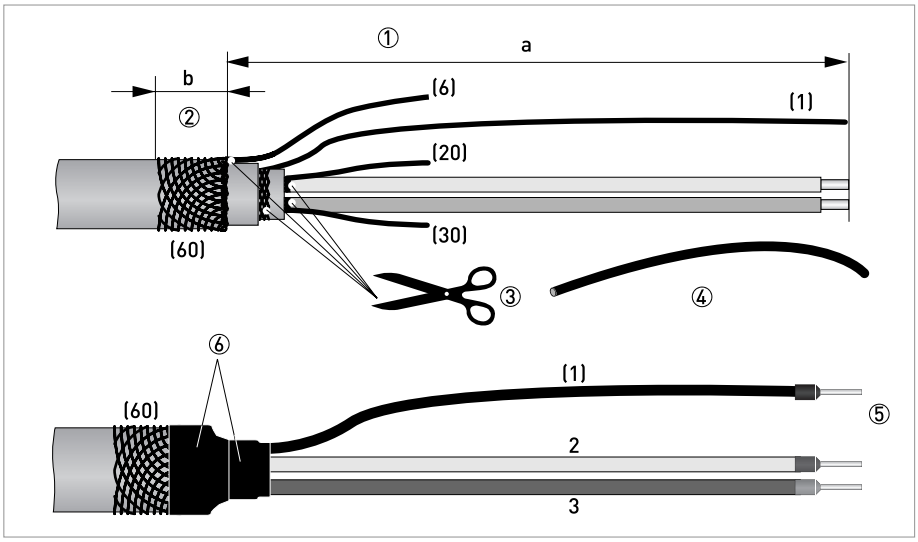

Figure 3-11: Preparing signal cable B, connection to flow sensor

a = 50 mm / 2"
b = 10 mm / 0.4"

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

3.4.10 Preparing field current cable C, connection to flow sensor

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

- Field current cable C is not part of the scope of delivery.
- The shield for field current cable C can be connected to the flow sensor.
- Bending radius: ≥ 50 mm / 2"

Required materials

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

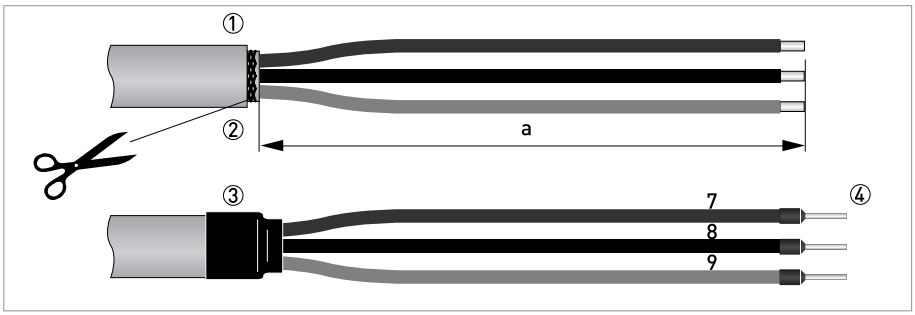

Figure 3-12: Field current cable C, preparation for the flow sensor
a = 50 mm / 2"

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

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

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

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

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

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

3.5.1 Connecting the signal and field current cables, field housing

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

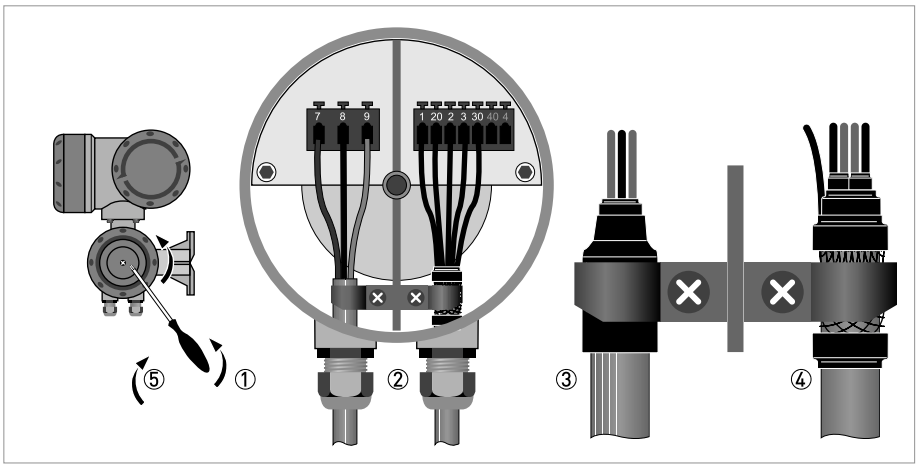

Figure 3-13: Electrical connection of the signal and field current cables, field housing

① Remove the locking screw and open the housing cover.
② Pass the prepared signal and field current cables through the cable entries and connect the corresponding stranded drain wires and conductors.
③ Secure the field current cable using the clip.
Any shield that is present must **NOT** be connected.
④ Secure the signal cable using the clip. This also connects the outer shield to the housing.
⑤ Close the housing cover and secure it with the locking screw.

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

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

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

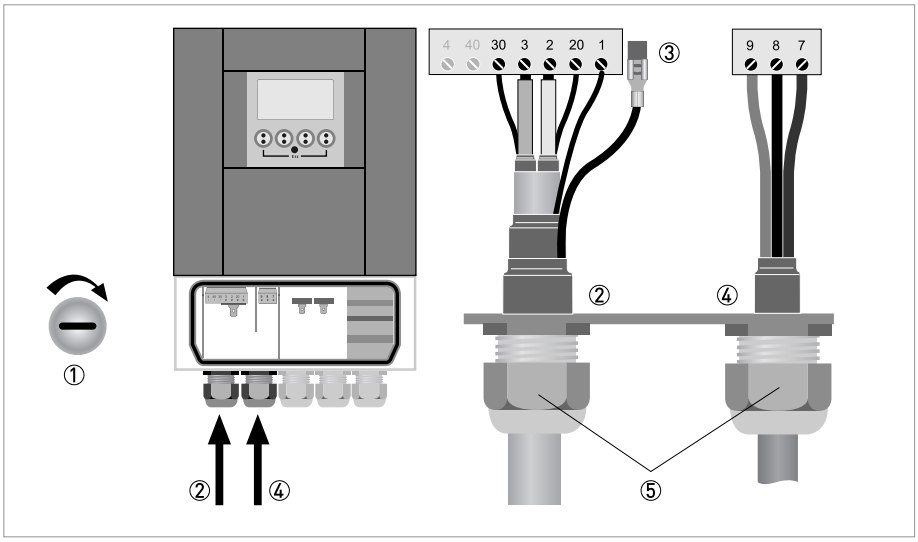

Figure 3-14: Electrical connection of the signal and field current cables, wall-mounted housing

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

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

3.5.3 Connecting the signal and field current cables, 19" rack-mounted housing (28 TE)

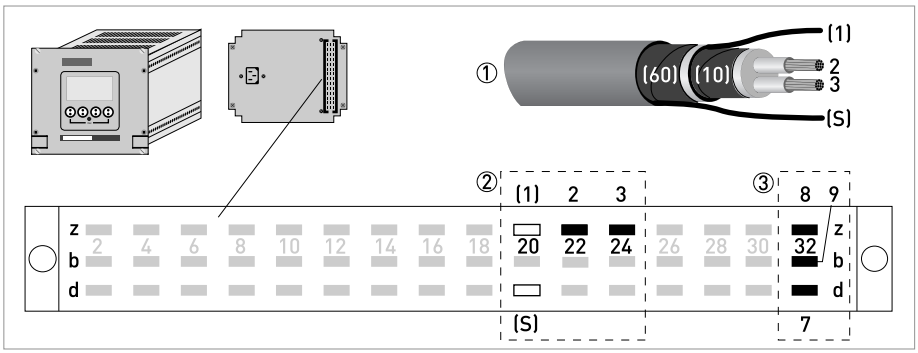

Figure 3-15: Connection signal cable A and field current cable

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

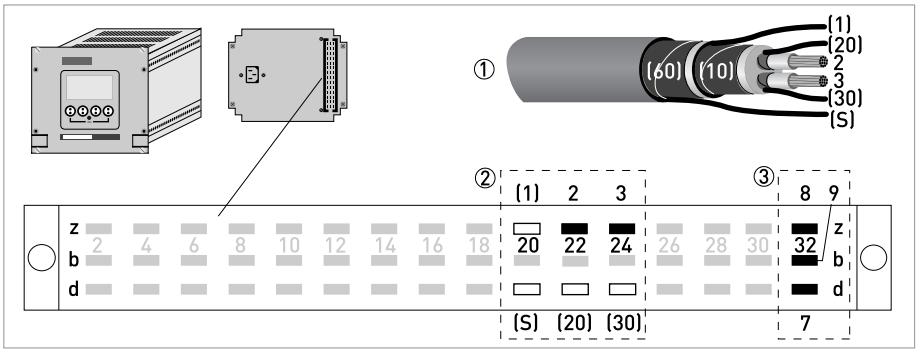

Figure 3-16: Connection signal cable B and field current cable

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

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

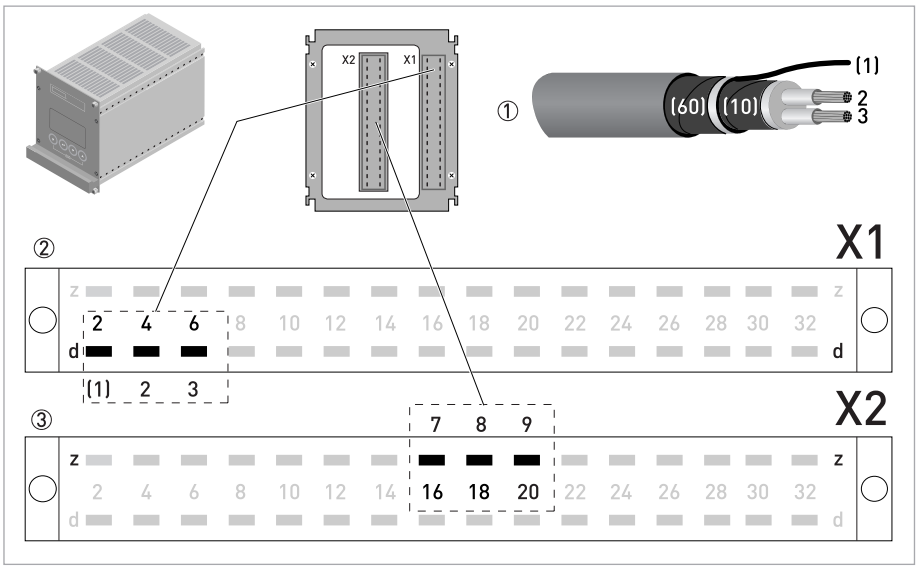

Figure 3-17: Connection signal cable A and field current cable

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

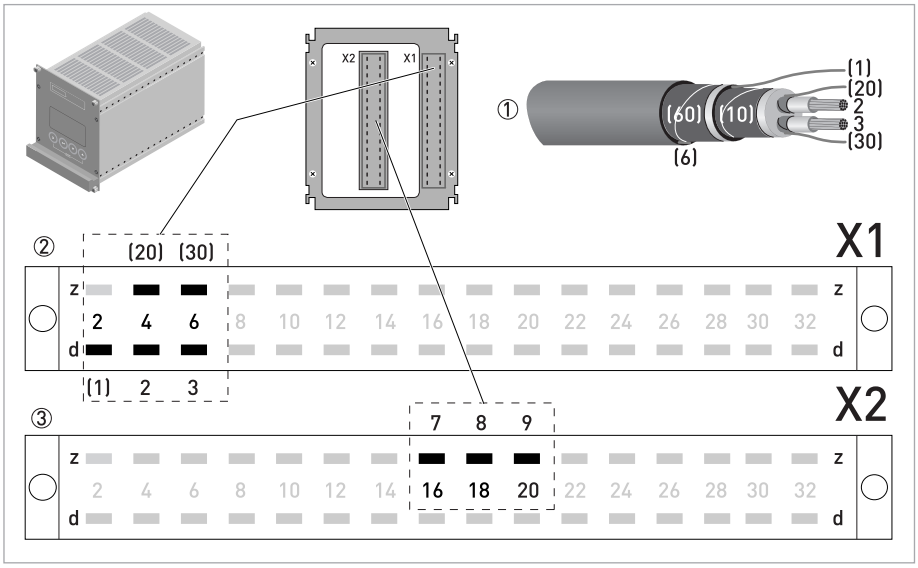

Figure 3-18: Connection signal cable B and field current cable

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

3.5.5 Connection diagram for flow sensor, field housing

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

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

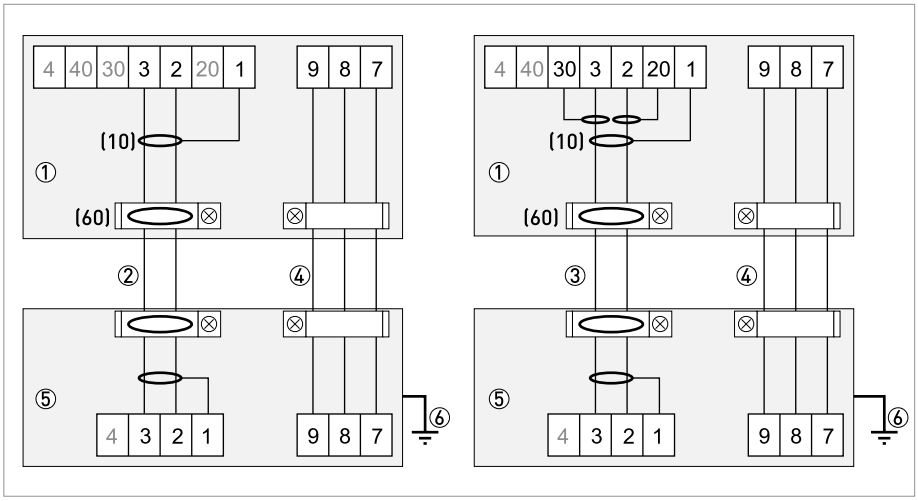

Figure 3-19: Connection diagram for flow sensor, field housing

① Electrical terminal compartment in housing of the signal converter for signal and field current cable
② Signal cable A
③ Signal cable B
④ Field current cable C
⑤ Connection box of flow sensor
⑥ Functional ground FE

3.5.6 Connection diagram for flow sensor, wall-mounted housing

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

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

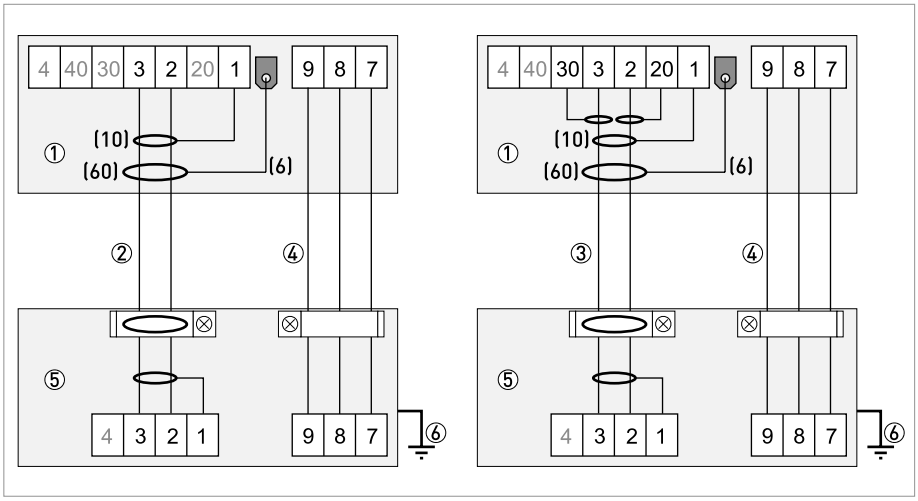

Figure 3-20: Connection diagram for flow sensor, wall-mounted housing

① Electrical terminal compartment in housing of the signal converter for signal and field current cable
② Signal cable A
③ Signal cable B
④ Field current cable C
⑤ Connection box of flow sensor
⑥ Functional ground FE

3.5.7 Connection diagram for flow sensor, 19" rack-mounted housing (28 TE)

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

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

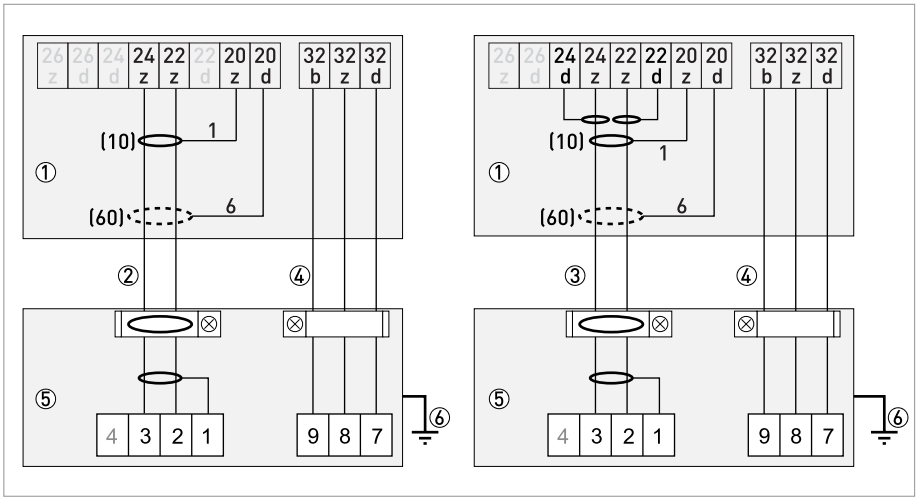

Figure 3-21: Connection diagram for flow sensor, 19" rack-mounted housing (28 TE)

① Electrical terminal compartment in housing of the signal converter for signal and field current cable
② Signal cable A
③ Signal cable B
④ Field current cable C
⑤ Connection box of flow sensor
⑥ Functional ground FE

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

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

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

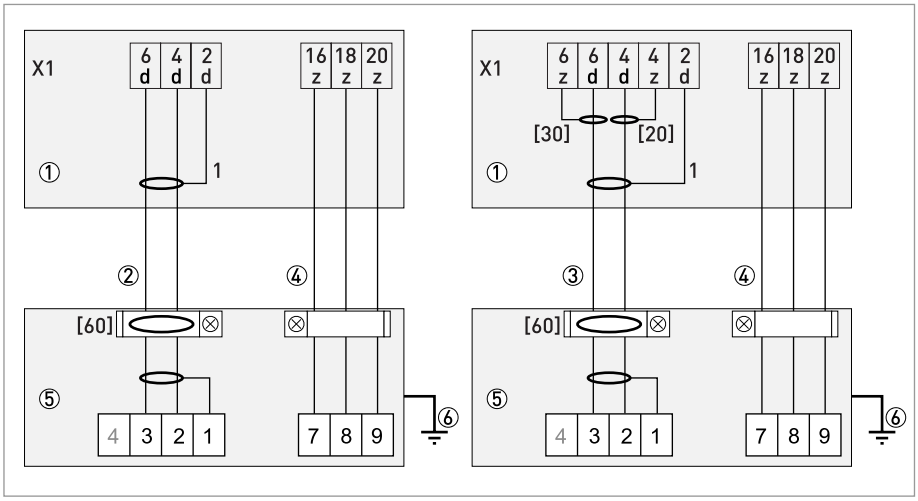

Figure 3-22: Connection diagram for flow sensor, 19" rack-mounted housing (21 TE)

① Electrical terminal compartment in housing of the signal converter for signal and field current cable
② Signal cable A
③ Signal cable B
④ Field current cable C
⑤ Connection box of flow sensor
⑥ Functional ground FE

3.6 Electrical connection only for TIDALFLUX 2000

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

3.7 Grounding the flow sensor

3.7.1 Classical method

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

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

3.7.2 Virtual reference (not valid for TIDALFLUX 2000 & OPTIFLUX 7300 C)

For pipelines which are electrically insulated on the inside (e.g. have an inner liner or are made completely out of plastic), it is also possible to measure without additional grounding rings or electrodes.
The signal converter's input amplifier records the potentials of both measuring electrodes and a patented method is used to create a voltage which corresponds to the potential of the ungrounded medium. This voltage is then the reference potential for signal processing. That means there are no interfering potential differences between the reference potential and the measuring electrodes during signal processing.
Ungrounded use is also possible for systems with voltages and currents in the pipelines, e.g. electrolysis and galvanic systems.

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

Thresholds for measuring operation with the virtual reference

Size	≥ DN10 / ≥ 3/8"
Electrical conductivity	≥200 µS/cm
Signal cable	use only A (type DS 300)
Signal cable length	≤ 50 m / ≤ 150 ft

3.8 Connecting power - all housing variants

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

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

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

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

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

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

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

- Note the data on the nameplate!
- When connecting to functional extra-low voltages, provide a facility for protective separation (PELV) (according to VDE 0100 / VDE 0106 and/or IEC 60364 / IEC 61140 or relevant national regulations).

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

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

- AC: Note the power supply voltage and frequency (50...60 Hz) on the nameplate.
- DC: When connecting to functional extra-low voltages, provide a facility for protective separation (PELV) (according to VDE 0100 / VDE 0106 and/or IEC 60364 / IEC 61140 or relevant national regulations).

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

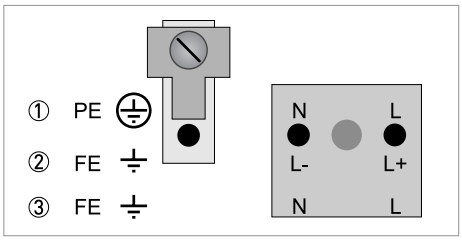

Figure 3-23: Power supply connection (excluding 19" rack-mounted housing)

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

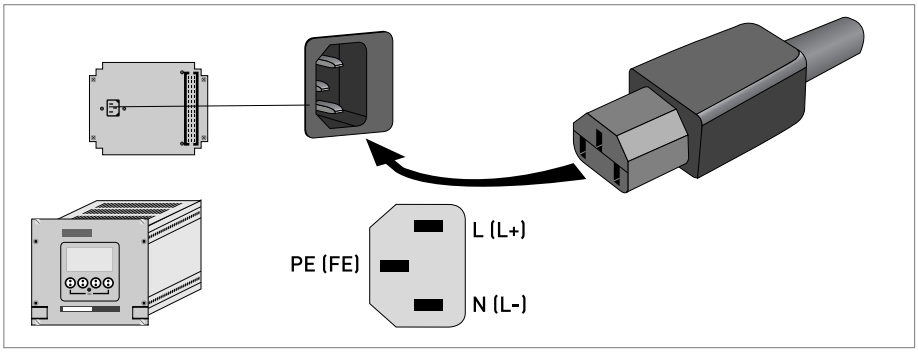

Figure 3-24: Power supply connection for 19" rack-mounted housing (28 TE)

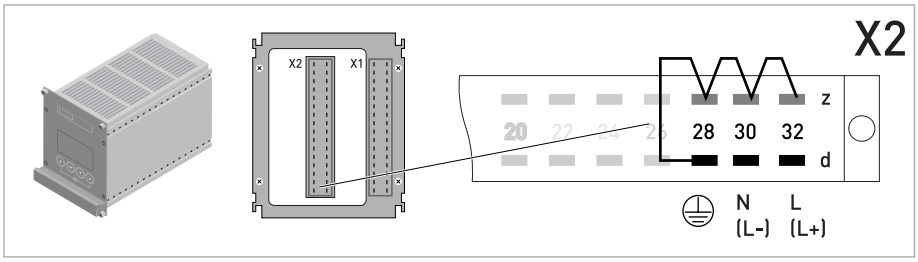

Figure 3-25: Power supply connection for 19" rack-mounted housing (21 TE)

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

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

3.9 Inputs and outputs, overview

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

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

Basic version

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

Ex i version

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

Modular version

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

Bus systems

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

Ex option

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

3.9.2 Description of the CG number

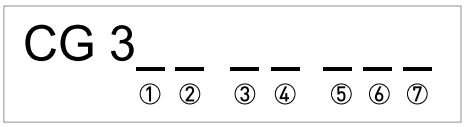

Figure 3-26: Marking (CG number) of the electronics module and input/output variants

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

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

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

Table 3-1: Examples for CG number

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

Table 3-2: Description of abbreviations and CG identifier for possible optional modules on terminals A and B

3.9.3 Fixed, non-alterable input/output versions

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

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

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

Basic I/Os (standard)

1 0 0		I_p + HART® passive ①		S_p / C_p passive ②		S_p passive		P_p / S_p passive ②	
	I_a + HART® active ①								

Ex i I/Os (option)

2 0 0						I_a + HART® active		P_N / S_N NAMUR ②	
3 0 0						I_p + HART® passive		P_N / S_N NAMUR ②	
2 1 0		I_a active		P_N / S_N NAMUR C_p passive ②		I_a + HART® active		P_N / S_N NAMUR ②	
3 1 0		I_a active		P_N / S_N NAMUR C_p passive ②		I_p + HART® passive		P_N / S_N NAMUR ②	
2 2 0		I_p passive		P_N / S_N NAMUR C_p passive ②		I_a + HART® active		P_N / S_N NAMUR ②	
3 2 0		I_p passive		P_N / S_N NAMUR C_p passive ②		I_p + HART® passive		P_N / S_N NAMUR ②	
2 3 0		IIn_a active		P_N / S_N NAMUR C_p passive ②		I_a + HART® active		P_N / S_N NAMUR ②	
3 3 0		IIn_a active		P_N / S_N NAMUR C_p passive ②		I_p + HART® passive		P_N / S_N NAMUR ②	
2 4 0		IIn_p passive		P_N / S_N NAMUR C_p passive ②		I_a + HART® active		P_N / S_N NAMUR ②	
3 4 0		IIn_p passive		P_N / S_N NAMUR C_p passive ②		I_p + HART® passive		P_N / S_N NAMUR ②	

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

PROFIBUS PA (Ex i) (option)

D 0 0			PA+	PA-	PA+	PA-
			FISCO Device		FISCO Device	
D 1 0	I_a active	P_N / S_N NAMUR C_p passive ②	PA+	PA-	PA+	PA-
			FISCO Device		FISCO Device	
D 2 0	I_p passive	P_N / S_N NAMUR C_p passive ②	PA+	PA-	PA+	PA-
			FISCO Device		FISCO Device	
D 3 0	IIn_a active	P_N / S_N NAMUR C_p passive ②	PA+	PA-	PA+	PA-
			FISCO Device		FISCO Device	
D 4 0	IIn_p passive	P_N / S_N NAMUR C_p passive ②	PA+	PA-	PA+	PA-
			FISCO Device		FISCO Device	

FOUNDATION Fieldbus (Ex i) (option)

E 0 0			V/D+	V/D-	V/D+	V/D-
			FISCO Device		FISCO Device	
E 1 0	I_a active	P_N / S_N NAMUR C_p passive ②	V/D+	V/D-	V/D+	V/D-
			FISCO Device		FISCO Device	
E 2 0	I_p passive	P_N / S_N NAMUR C_p passive ②	V/D+	V/D-	V/D+	V/D-
			FISCO Device		FISCO Device	
E 3 0	IIn_a active	P_N / S_N NAMUR C_p passive ②	V/D+	V/D-	V/D+	V/D-
			FISCO Device		FISCO Device	
E 4 0	IIn_p passive	P_N / S_N NAMUR C_p passive ②	V/D+	V/D-	V/D+	V/D-
			FISCO Device		FISCO Device	

PROFINET IO (option)

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

① Function changed by reconnecting
② Changeable

3.9.4 Alterable input/output versions

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

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

CG no.	Connection terminals								
	A+	A	A-	B	B-	C	C-	D	D-
Modular I/Os (option)									
4 _ _		max. 2 optional modules for term. A + B				I_a + HART® active		P_a / S_a active ①	
8 _ _		max. 2 optional modules for term. A + B				I_p + HART® passive		P_a / S_a active ①	
6 _ _		max. 2 optional modules for term. A + B				I_a + HART® active		P_p / S_p passive ①	
B _ _		max. 2 optional modules for term. A + B				I_p + HART® passive		P_p / S_p passive ①	
7 _ _		max. 2 optional modules for term. A + B				I_a + HART® active		P_N / S_N NAMUR ①	
C _ _		max. 2 optional modules for term. A + B				I_p + HART® passive		P_N / S_N NAMUR ①	
PROFIBUS PA (option)									
D _ _		max. 2 optional modules for term. A + B				PA+ (2)	PA- (2)	PA+ (1)	PA- (1)
FOUNDATION Fieldbus (option)									
E _ _		max. 2 optional modules for term. A + B				V/D+ (2)	V/D- (2)	V/D+ (1)	V/D- (1)
PROFIBUS DP (option)									
F _ 0		1 optional module for term. A		Termination P	RxD/TxD-P(2)	RxD/TxD-N(2)	Termination N	RxD/TxD-P(1)	RxD/TxD-N(1)
Modbus (option)									
G _ _ ②		max. 2 optional modules for term. A + B					Common	Sign. B (D1)	Sign. A (D0)
H _ _ ③		max. 2 optional modules for term. A + B					Common	Sign. B (D1)	Sign. A (D0)

① Changeable
② Not activated bus terminator
③ Activated bus terminator

3.10 Electrical connection of the inputs and outputs

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

3.10.1 Field housing, electrical connection of the inputs and outputs

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

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

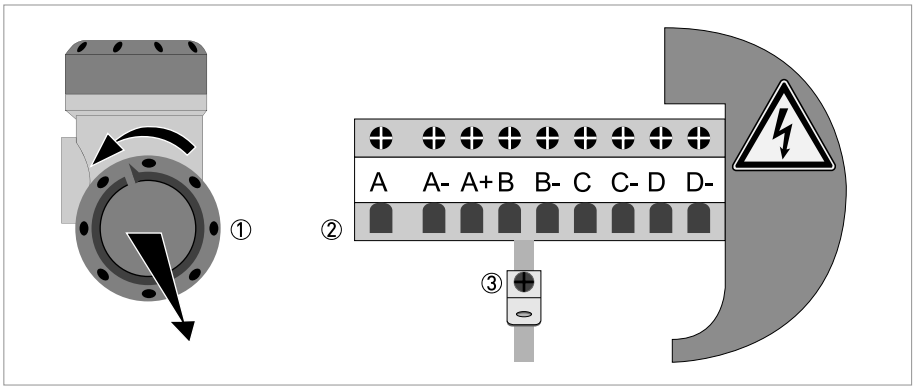

Figure 3-27: Terminal compartment for inputs and outputs in field housing

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

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

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

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

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

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

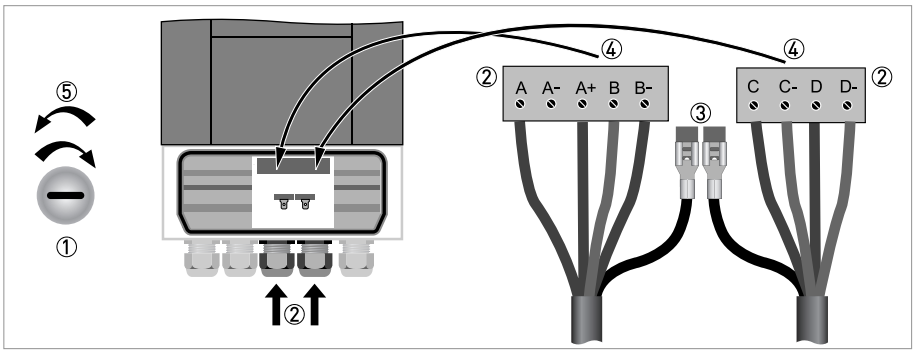

Figure 3-28: Connection of inputs and outputs in wall-mounted housing

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

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

3.10.3 19" rack-mounted housing (28 TE), electrical connection of the inputs and outputs

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

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

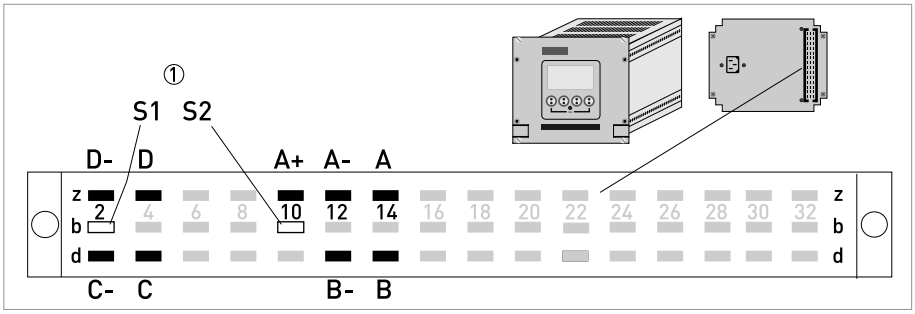

Figure 3-29: Terminal compartment for inputs and outputs in rack-mounted housing

① Shielding

- Connect the conductor to the multipolar plug according to the illustration.
- The signal cable shield is connected to the Pin S.
- Press the plug into the connector.

3.10.4 19" rack-mounted housing (21 TE), electrical connection of the inputs and outputs

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

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

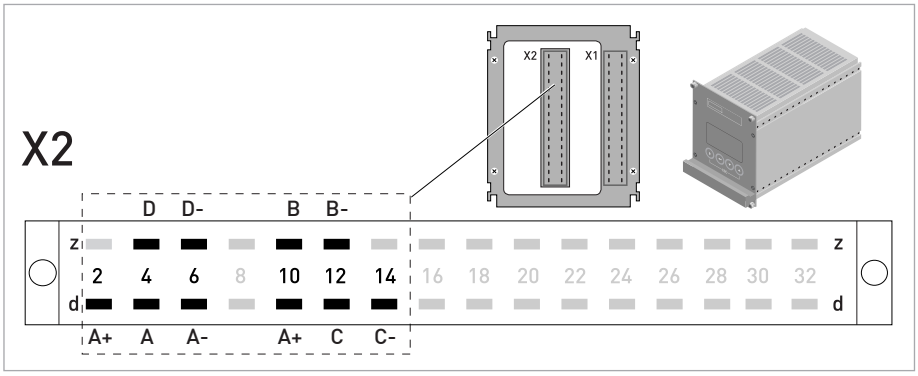

Figure 3-30: Terminal compartment for inputs and outputs in rack-mounted housing

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

3.10.5 Laying electrical cables correctly

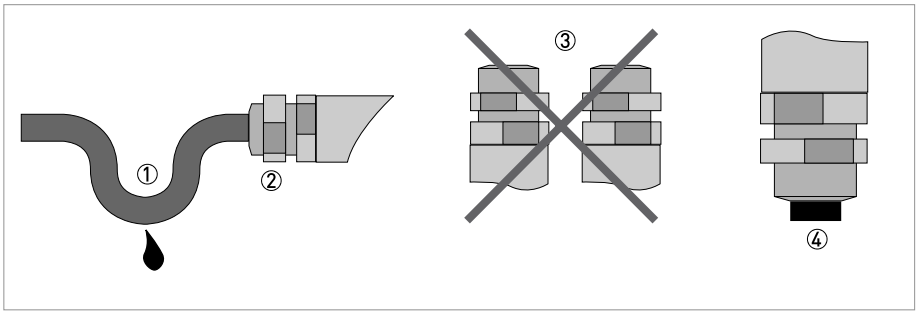

Figure 3-31: Protect housing from dust and water

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

4.1 Switching on the power

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

- The device must be mechanically safe and 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.

4.2 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.

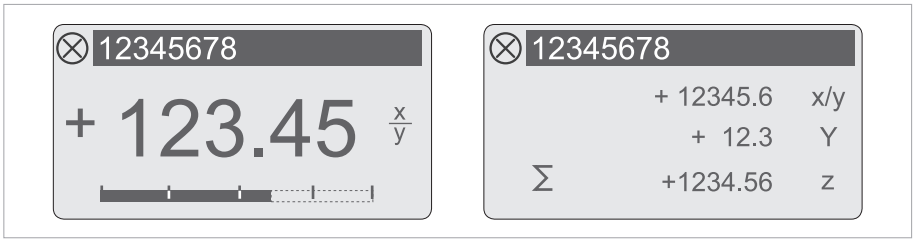

Figure 4-1: Displays in measuring mode (examples for 2 or 3 measured values)
x, y and z denote the units of the measured values displayed

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 ↑ and ↓.

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

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

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