



## IFC 400 Technical Datasheet

### Signal converter for electromagnetic flowmeters

- High measuring accuracy and long-term stability
- Smart diagnostics according to NAMUR NE 107
- Developed according to IEC 61508, SIL 2/3 certified



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

<b>1</b>	<b>Product features</b>	<b>3</b>
1.1	The versatile solution .....	3
1.2	Options and variants .....	5
1.3	Possible scope of delivery for signal converter / flow sensor.....	8
1.4	Measuring principle.....	8
<b>2</b>	<b>Technical data</b>	<b>9</b>
2.1	Technical data.....	9
2.2	Dimensions and weight .....	21
2.2.1	Housing .....	21
2.2.2	Mounting plate of field housing .....	22
2.2.3	Mounting plate of wall-mounted housing .....	22
2.3	Flow tables .....	23
<b>3</b>	<b>Installation</b>	<b>25</b>
3.1	Intended use .....	25
3.2	Installation specifications .....	25
3.3	Mounting of the compact version.....	25
3.4	Mounting the field housing, remote version .....	26
3.4.1	Pipe mounting .....	26
3.4.2	Wall mounting .....	27
3.5	Mounting the wall-mounted housing, remote version .....	28
3.5.1	Pipe mounting .....	28
3.5.2	Wall mounting .....	29
<b>4</b>	<b>Electrical connections</b>	<b>30</b>
4.1	Important notes on electrical connection .....	30
4.2	Preparing the signal and field current cables .....	30
4.2.1	Signal cable A (type DS 300-3), construction .....	30
4.2.2	Length of signal cable A.....	31
4.2.3	Signal cable B (type BTS 300-3), construction .....	32
4.2.4	Length of signal cable B .....	33
4.3	Connecting the signal and field current cables .....	34
4.3.1	Connection diagram for flow sensor, field housing .....	35
4.3.2	Connection diagram for flow sensor, wall-mounted housing .....	36
4.3.3	Connection diagram for flow sensor, rack-mounted housing.....	37
4.4	Power supply connection .....	38
4.5	Inputs and outputs, overview .....	40
4.5.1	Combinations of the inputs/outputs (I/Os) .....	40
4.5.2	Description of the CG number .....	40
4.5.3	Fixed, non-alterable input/output versions.....	42
4.5.4	Alterable input/output versions.....	42
4.6	Laying electrical cables correctly .....	43

## 1.1 The versatile solution

The **IFC 400** is a very complete signal converter, featuring a wide range of variants and options to match almost any application requirements in process industries.

The robust and reliable signal converter is compatible with almost any OPTIFLUX and the WATERFLUX flow sensor. Its measurement performance is excellent even in more difficult applications like mediums with low conductivity or mediums with high solid content or entrained air, corrosive and or abrasive mediums.

The IFC 400 is designed according to the unified General Device Concept (GDC) that is used for the volume flow, mass flow and analysis converters. The design concept offers an uniform user interface and menu structure and also an uniform electronics suitable for various housings, uniform device and process diagnostics functions and uniform communication interfaces. This offers great time and cost benefits with regard to procurement, engineering, operation and servicing.

It is developed according to IEC 61508 and depending on the I/O and flow sensor variant suited for use in safety applications SIL 2/3.

Conforming to the NAMUR standard NE 107 for status and error handling, the IFC 400 features enhanced flowmeter diagnostics. This provides extensive self-checking of internal circuits and information regarding the health of the flow sensor, but just as importantly, vital information about the process and process conditions.

The IFC 400 signal converter provides a large variety of flowmeter and process diagnostic functions guaranteeing reliable measurements. Detection of deposits or coating on the electrodes, temperature and conductivity changes in the medium, gas bubbles or solids, and an empty pipe are good examples of process diagnostics functions. The flow velocity and volume can be read from the display or in analogue form via the current output (4...20 mA) as well as by frequency or pulse outputs. Measuring values and diagnostic information can be transmitted via HART® communication.



[signal converter in field housing]

- ① Power supply via 100...230 VAC (standard) or 24 VAC/DC (optional)
- ② Communication with any third party system possible via HART®
- ③ 4 optical keys (standard display) or 4 push buttons (advanced display) for operator control without opening the housing
- ④ Intuitive navigation and a wide variety of languages integrated as standard for ease of operation

## Highlights

- For flow sensors over a diameter range of DN2.5...3000 / NPS1/10...120"
- Developed according to IEC 61508, SIL 2/3 certified
- Safe configuration via local display or HART®
- Partial proof test capable
- Smart diagnostics, covering entire devices in less than a minute
- NE 107 status indicated by display background light
- Continuous measurement of volume flow and flow velocity  
Integrated conductivity measurement, mass flow (at constant density) and coil temperature
- High measuring accuracy and long-term stability:  $\pm 0.2\%$  of measured value  $\pm 1$  mm/s
- Optical and mechanical keys for ease of use
- Redundant data storage in signal converter housing
- Real time clock for logging events
- Overall, flexible lock concept
- HART® 7
- Power supply via 100...230 VAC (standard) or 24 VAC/DC (optional)
- Available inputs and outputs: current output (including HART®), pulse/frequency output, status output and control input

## Industries

- Chemicals
- Water & Wastewater
- Pulp & Paper
- Minerals & Mining
- Pharmaceuticals
- Oil production & Refineries
- Iron, Steel & Metals

## Applications

- Volume flow measurements, process control and monitoring, blending, batching
- Mediums with low conductivity, high solid content or entrained air
- Sudden change in pH value
- Pulsating or turbulent flows
- Abrasive sludge and slurries, pastes
- Wide range of corrosive chemicals
- (Sea)Water flow measurements in a wide range of industries
- Well water injection



### Virtual reference

Electromagnetic flowmeters featuring virtual reference offer an innovative grounding method that allows the flow sensor to be installed in any pipe, without grounding rings or grounding electrodes.



### OPTICHECK technology built-in

State-of-the-art measuring devices combine robust measuring principles and powerful electronics to produce a wide range of readings and device-specific data. OPTICHECK technology built in leverages the features of the devices to translate their available comprehensive measuring system data into sophisticated diagnostics information for plant personnel. It goes beyond extensive device diagnostics, self-tests and on-site verification. With measurement principle-specific application diagnostics, this technology also allows in-depth insights into the process and thus opens up far-reaching possibilities for device monitoring, condition-based maintenance and optimisation of measurement technology and systems.

## 1.2 Options and variants

### Compact or remote housing variants



(signal converter in compact housing)

The IFC 400 signal converter is available in different variants and offers superior performance in any conceivable application.

Next to the field housing there is a wall-mounted housing and a rack mounted housing. The wall-mounted signal converter can be installed remotely for locations where the flow sensor is difficult to access, or ambient temperature conditions or vibrations prevent a compact variant.

The signal converter in the rack-mounted housing is typically used in a central control room.



(signal converter in wall-mounted housing)

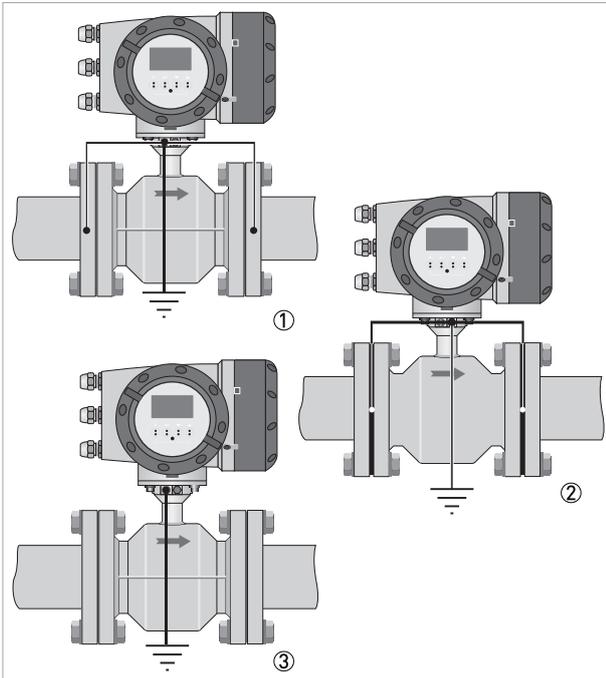
The compact and field housing versions of the signal converter is suitable for hazardous areas with approvals for ATEX and IECEx.

The IFC 400 in combination with the OPTIFLUX 4000 flow sensor is SIL 2/3 certified. This makes it suitable for flow measurement in safety-related applications.



(signal converter in rack-mounted housing)

## Virtual reference option simplifies installation



- ① Metal pipes
- ② Non metal pipes
- ③ Virtual reference option

Based on a special method, developed by KROHNE, called virtual reference or grounding, electromagnetic flowmeters can be installed in any type of pipeline, without grounding rings or electrodes.

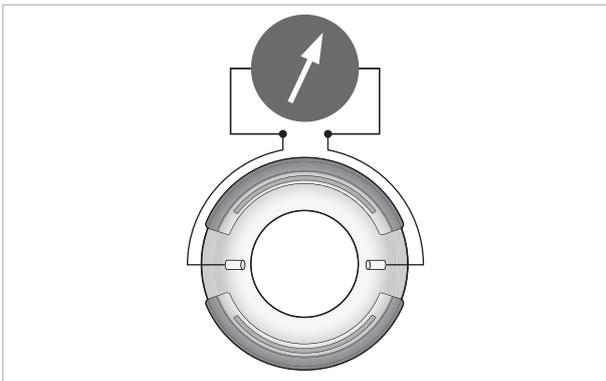
The virtual reference option on the IFC 400 provides complete isolation of the signal converters input amplifier and coil power circuits.

It is ideal for applications in the water and wastewater industry where large diameters are common or in case of abrasive or corrosive application that require rings of expensive materials. In these case the costs for grounding rings can be substantial.

Virtual reference also increases safety as it decreases the number of potential leakage points.

Furthermore it is no longer necessary to select the right grounding ring (material) and reduces the risk of wrong installation of grounding rings and gaskets.

## Extensive diagnostics of the device and application



(Resistance measurement between electrodes)

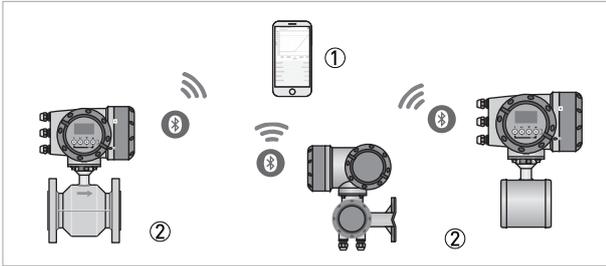
The primary focus of a user for a flowmeter is that it delivers reliable and robust measurements. To achieve this all electromagnetic flowmeters are calibrated before leaving the factory. In addition, KROHNE was one of the first to introduce extensive diagnostic features.

The IFC 400 provides a wide range of diagnostic functions on the flow sensor, signal converter and process integrated in the signal converter. The IFC 400 automatically performs an online cyclical verification to determine whether the measuring device is still within its specifications regarding accuracy and linearity.

The IFC 400 diagnostics features can detect potential problems in the process such as: gas bubbles, solids, electrode corrosion, deposits on the electrodes, conductivity changes, empty pipe, partial filling of the flow sensor, disrupted flow profiles and external magnetic fields.

Diagnostic information are available via local display, status outputs and PACTware.

## Bluetooth® option



- ① Smartphone / tablet with OPTICHECK Flow Mobile app
- ② Bluetooth® enabled flowmeter

With Bluetooth®, secure wireless communication (<20 m / 65.6 ft) with the device is possible using the free download OPTICHECK Flow Mobile app for Google Android™ and Apple® iOS smartphone and tablet.

Use in Ex zone 1 is possible with suitable devices.

Device commissioning, verification, diagnostics and monitoring are available without the need to remove the device from the line or interrupt the process.

Bluetooth® communication is available as an option at the time of ordering or as an add-on feature following delivery (option activated by password).

## OPTICHECK Flow Mobile for on-site verification



OPTICHECK Flow Mobile provides internal verification using device diagnostics over secure wireless Bluetooth® communication.

The device snapshot function creates a file of measured values, diagnostics, device configuration and the event log to be emailed to the manufacturer specialists for analysis.

## OPTICHECK tool for on-site verification



(Suitcase with OPTICHECK and all cables and accessories)

The OPTICHECK provides an inline health check of the device under test by an external tool.

A hard copy of the verification report can be printed for every flowmeter. The verification data are digitally stored.

Contact us for more information or for an on-site service visit.

### 1.3 Possible scope of delivery for signal converter / flow sensor

Flow sensor	Flow sensor + signal converter IFC 400			
	Compact version	Remote field housing	Remote wall-mounted housing	Remote rack-mounted housing (21 TE)
OPTIFLUX 1000	OPTIFLUX 1400 C	OPTIFLUX 1400 F	OPTIFLUX 1400 W	OPTIFLUX 1400 RL
OPTIFLUX 2000	OPTIFLUX 2400 C	OPTIFLUX 2400 F	OPTIFLUX 2400 W	OPTIFLUX 2400 RL
OPTIFLUX 4000	OPTIFLUX 4400 C	OPTIFLUX 4400 F	OPTIFLUX 4400 W	OPTIFLUX 4400 RL
OPTIFLUX 5000	OPTIFLUX 5400 C	OPTIFLUX 5400 F	OPTIFLUX 5400 W	OPTIFLUX 5400 RL
OPTIFLUX 6000	OPTIFLUX 6400 C	OPTIFLUX 6400 F	OPTIFLUX 6400 W	OPTIFLUX 6400 RL
WATERFLUX 3000	WATERFLUX 3400 C	WATERFLUX 3400 F	WATERFLUX 3400 W	WATERFLUX 3400 RL

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

### 1.4 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.

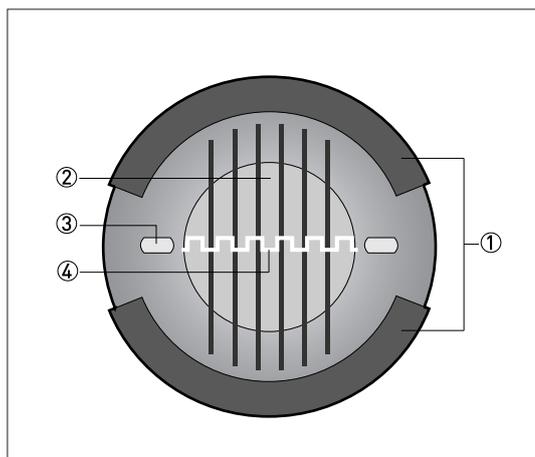


Figure 1-1: Measuring principle

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

## 2.1 Technical data

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

### Measuring system

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

### Design

Modular design	The measuring system consists of a flow sensor and a signal converter.
<b>Flow sensor</b>	
OPTIFLUX 1000	DN10...150 / NPS3/8...6
OPTIFLUX 2000	DN25...3000 / NPS1...120
OPTIFLUX 4000	DN2.5...3000 / NPS1/10...120
OPTIFLUX 5000	Flange: DN15...300 / NPS1/2...12 Sandwich: DN2.5...100 / NPS1/10...4
OPTIFLUX 6000	DN2.5...150 / NPS1/10...6
WATERFLUX 3000	DN25...600 / NPS1...24
	The flow sensors are also available as Ex versions.
<b>Signal converter</b>	
Compact version (C)	OPTIFLUX x400 C (x = 1, 2, 4, 5, 6) or WATERFLUX 3400 C
Field housing (F) - remote version	IFC 400 F
	Compact and field housing versions are also available as Ex versions.
Wall-mounted housing (W) - remote version	IFC 400 W
Rack-mounted housing (R) - remote version	IFC 400 RL
<b>Options</b>	
Outputs / inputs	Current output (including HART®), pulse output, frequency output and/or status output, limit switch and/or control input (depending on the I/O version)
Totaliser	2 (optional 3) internal totalisers with a max. of 8 counter places (e.g. for counting volume and/or mass units)
Verification	Integrated verification, diagnostic functions: measuring device, process, measured value, empty pipe detection, stabilisation
Communication interface	HART® as standard

Display and user interface	
Standard display	LC display, backlit white.
	Size: 128 x 64 pixels, corresponds to 59 x 31 mm = 2.32" x 1.22"
	Display module can be positioned/rotated in 90° increments.
	4 optical keys for operator control of the signal converter without opening the housing.
	Ambient temperatures below -25°C / -13°F, may affect the readability of the display.
Advanced display	LC display, backlit white, red, orange, yellow or blue depending on the device status according to NE 107:2017
	Size: 256 x 128 pixels, corresponds to 59 x 31 mm = 2.32" x 1.22"
	Display module can be positioned/rotated in 90° increments.
	4 push buttons and 4 optical keys for operator control of the signal converter without opening the housing.
	Ambient temperatures below -25°C / -13°F, may affect the readability of the display.
Remote operation	PACTware™ (including Device Type Manager (DTM))
	HART® Handheld 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.
	OPTICHECK Flow Mobile app via wireless Bluetooth® interface
Display functions	
Operating menu	Setting the parameters using 2 measured value pages, status page, graphics page (measured values and graphics are freely adjustable)
Language display texts	Available languages: English, German, French, Danish, Spanish, Italian, Dutch, Polish, Portuguese, Swedish, Turkish, Norwegian, Russian, Chinese
Measurement functions	<b>Units:</b> Metric, British and US units selectable as desired from lists for volume/mass flow and counting, velocity, temperature, pressure
	<b>Measured values:</b> Volume flow, flow velocity, conductivity, mass flow (at constant density), coil temperature, flow direction (not a displayed unit – but available via outputs)
Diagnostic functions	<b>Standards:</b> VDI / NAMUR / WIB 2650 and NE 107 / IEC 61508
	<b>Status messages:</b> Output of status messages optional via display, current and/or status output, HART® or bus interface
	<b>Sensor and sensor electronics diagnosis:</b> Redundant sensor signal monitoring, sensor and process diagnostics (empty-pipe detection, full-pipe detection, noise detection, sensor linearity check, asymmetry detection), sensor cable monitoring, monitoring of internal signals, CPU diagnostics, internal data integrity checks, internal communication monitoring
	<b>Signal converter and inputs/outputs:</b> Data bus monitoring, current output connections, current readback with redundant calibration, factory calibration integrity, electronics temperature monitoring, CPU diagnostics, supply voltage monitoring

## Measuring accuracy

Flow measurement	
Reference conditions	Depending on the flow sensor version. Refer to the technical data of the flow sensor.
Maximum measuring error	$\pm 0.15\%$ of the measured value $\pm 1$ mm/s, depending on the flow sensor. For further information refer to the technical data of the respective flow sensor. Current output electronics: $\pm 5 \mu\text{A}$
Repeatability	0.1% of the measured value, minimum $\pm 1$ mm/s
Conductivity measurement	
Conductivity range	DN2.5...6 / 1/10...1/4": 20...2000 $\mu\text{S/cm}$ DN10...125 / 3/8...5": 20...10000 $\mu\text{S/cm}$ DN150...600 / 6...24": 20...50000 $\mu\text{S/cm}$
Maximum measuring error	$\pm 10\%$ of the measured value
Repeatability	$\pm 5\%$
Cable length (in field housing)	$\leq 30$ m / 98 ft

## Operating conditions

Temperature	
Process temperature	Refer to the technical data of the flow sensor.
Humidity	Relative humidity up to 100%, annual average < 90% relative humidity (in closed housings) Avoid condensation inside the signal converter.
Ambient temperature	Depending on the version and combination of outputs. It is advised to protect the signal converter from external heat sources such as direct sunlight as higher temperatures reduce the life cycle of electronic components. <b>Standard version:</b> Without second I/O module: $-40...+60^\circ\text{C}$ / $-40...+140^\circ\text{F}$ With second I/O module: $-40...+50^\circ\text{C}$ / $-40...+122^\circ\text{F}$ <b>Version with extended temperature:</b> Without second I/O module: $-40...+65^\circ\text{C}$ / $-40...+149^\circ\text{F}$ With second I/O module: $-40...+60^\circ\text{C}$ / $-40...+140^\circ\text{F}$ Ambient temperatures below $-25^\circ\text{C}$ / $-13^\circ\text{F}$ , may affect the readability of the display.
Storage temperature	$-40...+70^\circ\text{C}$ / $-40...+158^\circ\text{F}$
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	Electrical conductive liquids in general: $\geq 1 \mu\text{S/cm}$ Demineralised water: $\geq 20 \mu\text{S/cm}$
Type of measurement	Electrical conductive liquids
Solid content (volume)	Up to 70% The greater the solid content, the less accurate the measurements!
Gas content (volume)	Up to 5% The greater the gas content, the less accurate the measurements!

Flow rate	For detailed information, refer to chapter "Flow tables".
<b>Other conditions</b>	
Ingress protection according to IEC 60529	C (compact version) & F (field housing): IP66/67 (according to NEMA 4/4X/6)
	W (wall-mounted housing): IP65/66 (according to NEMA 4/4X)
	RL (rack-mounted housing (21 TE)): IP20 (according to NEMA 1); Use: Indoor only, level of pollution 2 and relative humidity < 75%

### Installation conditions

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

### Materials

Signal converter housing	Version C and F: die-cast aluminium powder coated (Epoxy primer and Polyester topcoat)
	Version W: polyamide
	Version RL (21 TE): aluminium and aluminium sheet, partially polyester-coated
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
	24 VAC/DC (AC: -15% / +10%, 50/60 Hz; DC: -55% / +30%)
Power consumption	AC: 22 VA
	DC: 12 W
Signal cable	Only for remote versions.
	<b>DS 300-3 (type A):</b> Max. length: 600 m / 1968 ft (depending on electrical conductivity and flow sensor version) <b>Note:</b> The DS 300 signal cable cannot be used for SIL devices.
	<b>BTS 300-3 (type B):</b> Max. length: 600 m / 1968 ft (depending on electrical conductivity and flow sensor version) <b>Note:</b> For cable lengths > 50 m / 164 ft used with SIL devices refer to the "OPTIFLUX x400 Safety manual".
Field current cable	<b>SIL devices:</b> A shielded 3-wire copper cable is required! The shield <b>MUST</b> be connected in the housing of the signal converter.
	<b>Non-SIL devices:</b> A shielded cable is not required.
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 used abbreviations	$V_{ext}$ = external voltage; $R_L$ = load resistance; $V_0$ = terminal voltage; $I_{nom}$ = nominal current  Safety limit values (Ex i): $V_i$ = max. input voltage; $I_i$ = max. input current; $P_i$ = max. input power rating; $C_i$ = max. input capacity; $L_i$ = max. input inductivity		
<b>Current output</b>			
Output data	Volume flow, mass flow, diagnostic value, flow velocity, coil temperature, conductivity		
Settings	<b>Without HART®</b>		
	Q = 0%: 0...20 mA; Q = 100%: 10...20 mA		
	Alarm signal: selectable 0...22 mA		
	<b>With HART®</b>		
	Q = 0%: 4...20 mA; Q = 100%: 10...20 mA		
	Alarm signal: selectable 3...22 mA		
Operating data	<b>Basic I/O</b>	<b>Modular I/O</b>	<b>Ex i I/O</b>
Active	$V_{int} = 24 \text{ VDC}$  $I \leq 22 \text{ mA}$  Terminals A and B: $R_L \leq 1 \text{ k}\Omega$ Terminals C: $R_L \leq 250 \Omega$		$V_{int} = 21 \text{ VDC}$  $I \leq 22 \text{ mA}$  $R_L \leq 400 \Omega$
			$V_0 = 21 \text{ V}$ $I_0 = 90 \text{ mA}$ $P_0 = 0.5 \text{ W}$ $C_0 = 90 \text{ nF} / L_0 = 2 \text{ mH}$ $C_0 = 110 \text{ nF} / L_0 = 0.5 \text{ mH}$ Linear characteristics
	Observe connection polarity.		
Passive	$V_{ext} \leq 30 \text{ VDC}$  $I \leq 22 \text{ mA}$  $V_0 \geq 2.3 \text{ V}$  Terminals C: $R_L \leq 250 \Omega$ $R_{L, max} = (V_{ext} - V_0) / I_{max}$		$V_{ext} \leq 30 \text{ VDC}$  $I \leq 22 \text{ mA}$  $V_0 \geq 4 \text{ V}$  $R_{L, max} = (V_{ext} - V_0) / I_{max}$
			$V_i = 30 \text{ V}$ $I_i = 100 \text{ mA}$ $P_i = 1 \text{ W}$ $C_i = 10 \text{ nF}$ $L_i \sim 0 \text{ mH}$
	Observe connection polarity.		Any connection polarity.

<b>HART®</b>			
Description	HART® protocol via active and passive current output		
	HART® version: 7		
	Universal HART® parameter: completely integrated		
Load	≥ 230 Ω at HART® test point; Note maximum load for current output!		
Multi-Drop operation	Disabled loop current mode, output current = 0%, e.g. 4 mA		
	Multi-Drop address adjustable in operation menu 0...63		
Device drivers	Available for FC 375/475, AMS, PDM, FDT/DTM		
Registration	At HART Communication Foundation		
	Yes		
<b>Pulse output or frequency output</b>			
Output data	Pulse output: volume flow, mass flow		
	Frequency output: volume flow, mass flow, diagnostic value, flow velocity, coil temperature, conductivity		
Function	Can be set as a pulse output or frequency output		
Pulse rate/frequency	0.01...10000 pulses/s or Hz (5000 Hz for phase-shifted or NAMUR outputs)		
Settings	Mass or volume per pulse or max. frequency for 100% flow		
	Pulse width: adjustable as automatic, symmetric or fixed (0.05...2000 ms)		
Operating data	<b>Basic I/O</b>	<b>Modular I/O</b>	<b>Ex i I/O</b>
Active	-	$V_{nom} = 24 \text{ VDC}$	-
		$f_{max}$ in operating menu set to $f_{max} \leq 100 \text{ Hz}: I \leq 20 \text{ mA}$	
		open: $I \leq 0.05 \text{ mA}$	
		closed: $V_{0, nom} = 24 \text{ V at } I = 20 \text{ mA}$	
-	-	$f_{max}$ in operating menu set to $100 \text{ Hz} < f_{max} \leq 10 \text{ kHz}: I \leq 20 \text{ mA}$	-
		open: $I \leq 0.05 \text{ mA}$	
		closed: $V_{0, nom} = 22.5 \text{ V at } I = 1 \text{ mA}$ $V_{0, nom} = 21.5 \text{ V at } I = 10 \text{ mA}$ $V_{0, nom} = 19 \text{ V at } I = 20 \text{ mA}$	
		Any connection polarity.	

Operating data	Basic I/O	Modular I/O	Ex i I/O
Passive	$V_{ext} \leq 32 \text{ VDC}$		-
	$f_{max}$ in operating menu set to $f_{max} \leq 100 \text{ Hz}; I \leq 100 \text{ mA}$  $R_{L, max} = 47 \text{ k}\Omega$ $R_{L, min} = (V_{ext} - V_0) / I_{max}$  open: $I \leq 0.05 \text{ mA}$ at $V_{ext} = 32 \text{ VDC}$  closed: $V_{0, max} = 0.2 \text{ V}$ at $I \leq 10 \text{ mA}$ $V_{0, max} = 2 \text{ V}$ at $I \leq 100 \text{ mA}$		
	$f_{max}$ in operating menu set to $100 \text{ Hz} < f_{max} \leq 10 \text{ kHz}; I \leq 20 \text{ mA}$  $R_{L, max} = 47 \text{ k}\Omega$ $R_{L, min} = (V_{ext} - V_0) / I_{max}$  open: $I \leq 0.05 \text{ mA}$ at $V_{ext} = 32 \text{ VDC}$  closed: $V_{0, max} = 1.5 \text{ V}$ at $I \leq 1 \text{ mA}$ $V_{0, max} = 2.5 \text{ V}$ at $I \leq 10 \text{ mA}$ $V_{0, max} = 5.0 \text{ V}$ at $I \leq 20 \text{ mA}$		
	Any connection polarity.		
NAMUR	-	Passive to IEC 60947-5-6  $V_{ext} = 8.2 \text{ V} \pm 0.1 \text{ VDC}$ $R = 1 \text{ k}\Omega \pm 10 \Omega$  Nominal current for open: $I = 0.6 \text{ mA}$ closed: $I = 3.8 \text{ mA}$	Passive to IEC 60947-5-6  $V_{ext} = 8.2 \text{ V} \pm 0.1 \text{ VDC}$ $R = 1 \text{ k}\Omega \pm 10 \Omega$  Nominal current for open: $I = 0.43 \text{ mA}$ closed: $I = 4.5 \text{ mA}$
	Any connection polarity.		$V_i = 30 \text{ V}$ $I_i = 100 \text{ mA}$ $P_i = 1 \text{ W}$ $C_i = 10 \text{ nF}$ $L_i \sim 0 \text{ mH}$
<b>Low flow cut-off</b>			
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)		
Hysteresis	Set in increments of 0.1%.		
	0...20% (current output, frequency output)		
<b>Time constant</b>			
Function	The time constant corresponds to the elapsed time until 63% of the end value has been reached according to a step function.		
Settings	Set in increments of 0.1 seconds.		
	0...100 seconds		

Status output / limit switch			
Function and settings	Adjustable as automatic measuring range conversion, display of flow direction, counter overflow, error, switching point or empty pipe detection		
	Valve control with activated dosing function		
	Status and/or control: ON or OFF		
Operating data	Basic I/O	Modular I/O	Ex i I/O
Active	-	$V_{int} = 24 \text{ VDC}$ $I \leq 20 \text{ mA}$ open: $I \leq 0.05 \text{ mA}$ closed: $V_{0, nom} = 24 \text{ V at } I = 20 \text{ mA}$ Observe connection polarity.	-
Passive	$V_{ext} = 32 \text{ VDC}$ $I \leq 100 \text{ mA}$ $R_{L, max} = 47 \text{ k}\Omega$ $R_{L, min} = (V_{ext} - V_0) / I_{max}$ open: $I \leq 0.05 \text{ mA at } V_{ext} = 32 \text{ VDC}$ closed: $V_{0, max} = 0.2 \text{ V at } I \leq 10 \text{ mA}$ $V_{0, max} = 2 \text{ V at } I \leq 100 \text{ mA}$ Any connection polarity.		-
NAMUR	-	Passive to IEC 60947-5-6 $V_{ext} = 8.2 \text{ V} \pm 0.1 \text{ VDC}$ $R = 1 \text{ k}\Omega \pm 10 \Omega$ Nominal current for open: $I = 0.6 \text{ mA}$ closed: $I = 3.8 \text{ mA}$	Passive to IEC 60947-5-6 $V_{ext} = 8.2 \text{ V} \pm 0.1 \text{ VDC}$ $R = 1 \text{ k}\Omega \pm 10 \Omega$ Nominal current for open: $I = 0.43 \text{ mA}$ closed: $I = 4.5 \text{ mA}$ $V_i = 30 \text{ V}$ $I_i = 100 \text{ mA}$ $P_i = 1 \text{ W}$ $C_i = 10 \text{ nF}$ $L_i = 0 \text{ mH}$
		Any connection polarity.	

Control input			
Function	Hold value of the outputs (e.g. for cleaning work), set value of the outputs to "zero", counter and error reset, range change.		
	Start of dosing when dosing function is activated.		
Operating data	Basic I/O	Modular I/O	Ex i I/O
Active	-	$V_{int} = 24 \text{ VDC}$ Ext. contact open: $V_{0, nom} = 22 \text{ V}$ Ext. contact closed: $I_{nom} = 4 \text{ mA}$ Switching point for identifying "contact open or closed": Contact closed (on): $V_0 \leq 10 \text{ V}$ at $I_{nom} = 1.9 \text{ mA}$ Contact open (off): $V_0 \geq 12 \text{ V}$ at $I_{nom} = 1.9 \text{ mA}$	-
		Observe connection polarity.	
Passive	$8 \text{ V} \leq U_{ext} \leq 32 \text{ VDC}$ $I_{max} = 9.5 \text{ mA}$ at $V_{ext} \leq 32 \text{ V}$ Switching point for identifying "contact open or closed": Contact open (off): $V_0 \leq 2.5 \text{ V}$ at $I_{nom} = 0.1 \text{ mA}$ Contact closed (on): $V_0 \geq 8 \text{ V}$ at $I_{nom} = 3.2 \text{ mA}$	$3 \text{ V} \leq V_{ext} \leq 32 \text{ VDC}$ $I_{max} = 9.5 \text{ mA}$ at $V_{ext} \leq 24 \text{ V}$ $I_{max} = 9.5 \text{ mA}$ at $V_{ext} \leq 32 \text{ V}$ Switching point for identifying "contact open or closed": Contact open (off): $V_0 \leq 2.5 \text{ V}$ at $I_{nom} = 1.9 \text{ mA}$ Contact closed (on): $V_0 \geq 3 \text{ V}$ at $I_{nom} = 1.9 \text{ mA}$	$5.5 \text{ V} \leq V_{ext} \leq 30 \text{ VDC}$ $I_{max} = 6 \text{ mA}$ at $V_{ext} \leq 24 \text{ V}$ $I_{max} = 6.5 \text{ mA}$ at $V_{ext} \leq 30 \text{ V}$ Switching point for identifying "contact open or closed": Contact open (off): $V_0 \leq 3.5 \text{ V}$ at $I \leq 0.5 \text{ mA}$ Contact closed (on): $V_0 \geq 5.5 \text{ V}$ at $I \geq 4 \text{ mA}$ $V_i = 30 \text{ V}$ $I_i = 100 \text{ mA}$ $P_i = 1 \text{ W}$ $C_i = 10 \text{ nF}$ $L_i = 0 \text{ mH}$
	Any connection polarity.	Observe connection polarity.	Any connection polarity.

Operating data	Basic I/O	Modular I/O	Ex i I/O
NAMUR	-	Active to IEC 60947-5-6  Switching point for identifying "contact open or closed": Contact open (off): $V_{0, nom} = 6.3 \text{ V}$ at $I_{nom} < 1.9 \text{ mA}$ Contact closed (on): $V_{0, nom} = 6.3 \text{ V}$ at $I_{nom} > 1.9 \text{ mA}$  Detection of cable break: $V_0 \geq 8.1 \text{ V}$ at $I \leq 0.1 \text{ mA}$  Detection of cable short circuit: $V_0 \leq 1.2 \text{ V}$ at $I \geq 6.7 \text{ mA}$  Observe connection polarity.	-
<b>Bluetooth® interface</b>			
Description	The interface offers wireless connectivity to the device via Bluetooth® Low Energy 5.0.		
	The used frequency range of Bluetooth® Low Energy is 2400...2480 MHz. The maximum output power of the device is 30 mW.		
	OPTICHECK Flow Mobile app is available for Google Android™ and Apple® iOS mobile devices.		
	Supported mobile devices must have at least the following features: - Bluetooth® Low Energy 4.0 interface or higher  For the minimal supported versions of Google Android™ or Apple® iOS refer to the latest version of the OPTICHECK Flow Mobile app available in "Google Play™ store" or "Apple App Store".		
Functionality	Display status, measurement & diagnostic data		
	Device parametrization and guided configuration wizards		
	Advanced diagnostic methods		
	Full device backup and restore		

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, regulations, standards and certifications, please refer to the declaration of conformity supplied with the device or downloadable from the manufacturer's website.
Standard version	Non-Ex
Functional safety according to IEC 61508	Depends on I/O variant and flow sensor. For detailed information refer to the "OPTIFLUX x400 Safety manual".
<b>Hazardous areas</b> (Original and latest certificates are available on the manufacturer website)	
<b>Compact flowmeter version</b>	
ATEX	II 2(1)G Ex db eb [ia Ga] mb IIC T6...T3 Gb (DN2.5...15)
	II 2(1)G Ex db eb [ia Ga] mb IIC T6...T3 Gb (DN10...20)
	II 2(1)G Ex db eb [ia Ga] IIC T6...T3 Gb (DN25...150)
	II 2(1)G Ex db eb [ia Ga] q IIC T5...T3 Gb (DN25...150 special)
	II 2(1)G Ex db eb [ia Ga] q IIC T6...T3 Gb (DN200...300)
	II 2(1)G Ex db eb [ia Ga] IIC T6...T3 Gb (DN350...3000)
	II 2D Ex tb IIIC T85...T150°C Db (DN2.5...3000)
IECEx	Ex db eb [ia Ga] mb IIC T6...T3 Gb (DN2.5...15)
	Ex db eb [ia Ga] mb IIC T6...T3 Gb (DN10...20)
	Ex db eb [ia Ga] IIC T6...T3 Gb (DN25...150)
	Ex db eb [ia Ga] q IIC T5...T3 Gb (DN25...150 special)
	Ex db eb [ia Ga] q IIC T6...T3 Gb (DN200...300)
	Ex db eb [ia Ga] IIC T6...T3 Gb (DN350...3000)
	Ex tb IIIC T85...T150°C Db (DN2.5...3000)
<b>Field version of signal converter</b>	
ATEX	II 2G Ex db eb [ia Ga] IIC T6 Gb
	II 2D Ex tb IIIC T85°C Db
IECEx	Ex db eb [ia Ga] IIC T6 Gb
	Ex tb IIIC T85°C Db
<b>Other standards and approvals</b>	
Vibration and shock resistance	<b>IEC 60068-2-64, Vibration (broadband random)</b> 5...200 Hz, ASD 0.01 g <sup>2</sup> /Hz, 3 directions, each 120 minutes
	<b>IEC 60068-2-27, Shock (IEC 60721-3-4, Class 4M12)</b> Half sine wave, 2 g, pulse duration 6 ms, 3 directions, positive and negative sense, each 100 times
NAMUR	NE 21, NE 43, NE 53, NE 107, NE 131

Table 2-1: Technical data

## 2.2 Dimensions and weight

### 2.2.1 Housing

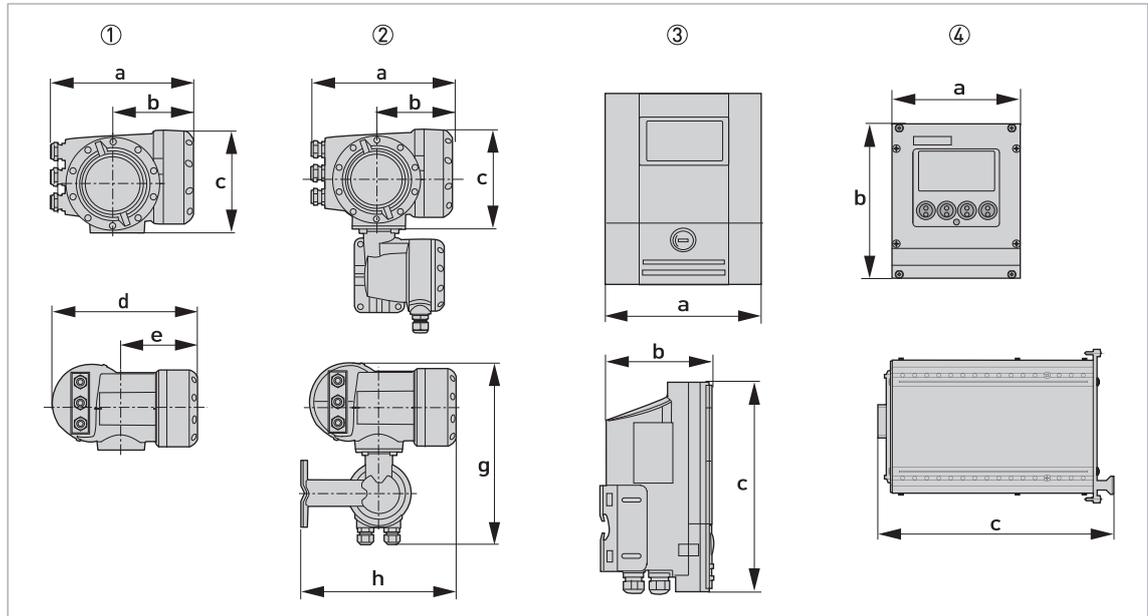


Figure 2-1: Dimensions of housing

- ① Compact version (C)
- ② Field housing (F) - remote version
- ③ Wall-mounted housing (W) - remote version
- ④ Rack-mounted housing (R) - remote version

Version	Dimensions [mm / inch]							Weight [kg / lb]
	a	b	c	d	e	g	h	
C ①	240 / 9.49	120 / 4.75	160 / 6.3	260 / 10.2	137 / 5.4	-	-	4.2 / 9.3
F ②	240 / 9.49	120 / 4.75	160 / 6.3	-	-	305 / 12.0	277 / 10.9	5.7 / 12.6
W ③	198 / 7.8	138 / 5.4	299 / 11.8	-	-	-	-	2.4 / 5.3
R ④	107 / 4.21 (21 TE)	129 / 5.08 (3 HE)	190 / 7.48	-	-	-	-	0.98 / 2.16

Table 2-2: Dimensions and weight

*The total dimensions and weight of the compact device are depending on the nominal diameter and the material of the flow sensor.*

*For detailed information please refer to the relevant flow sensor documentation.*

### 2.2.2 Mounting plate of field housing

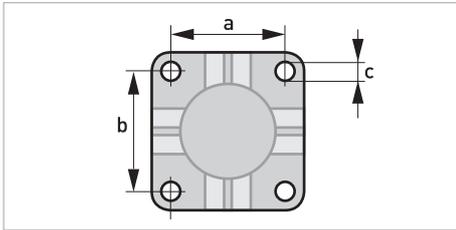


Figure 2-2: Dimensions for mounting plate of field housing

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

Table 2-3: Dimensions in mm and inch

### 2.2.3 Mounting plate of wall-mounted housing

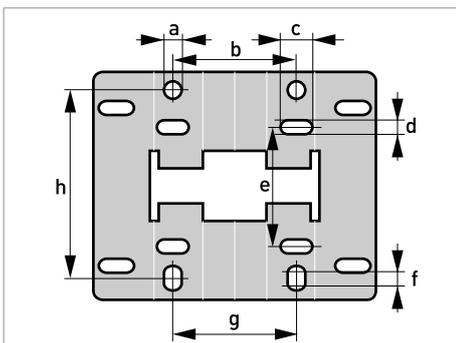


Figure 2-3: Dimensions of mounting plate of wall-mounted housing

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

Table 2-4: Dimensions in mm and inch

## 2.3 Flow tables

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

Table 2-5: Flow rate in m/s and m<sup>3</sup>/h

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

Table 2-6: Flow rate in ft/s and US gallons/min

### 3.1 Intended use

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

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

*For devices used in SIL applications, additional safety notes apply. For detailed information refer to the "OPTIFLUX x400 Safety manual".*

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

*This device is in general a Group 1, Class B device as specified within CISPR11, intended for both residential and industrial environments.*

*Only the variants with 24 VAC power supply are classified as Class A device, intended for use in an industrial environment.*

*There may be potential difficulties in ensuring electromagnetic compatibility in other environments, due to conducted as well as radiated disturbances.*

### 3.2 Installation specifications

*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. sunshade) 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 devices are tested for a vibration level as described in the chapter "Technical data".*
- *Avoid using high pressure jets close to the device. The measuring devices are tested for an ingress protection level as described in the chapter "Technical data".*

### 3.3 Mounting of the compact version

*Turning the housing of the compact version is not permitted.*

*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.*

### 3.4 Mounting the field housing, remote version

#### 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!

#### Remarks concerning vibration on process line

Due to excessive vibration impact, the mounting of the signal converter on the process pipe is not allowed.

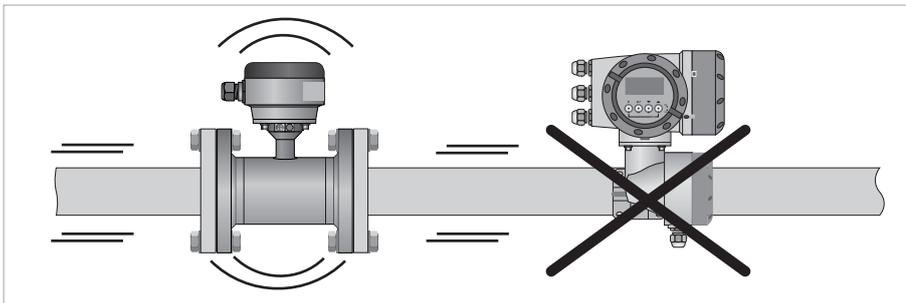


Figure 3-1: Not allowed mounting of the remote signal converter on the process pipe

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.

#### 3.4.1 Pipe mounting

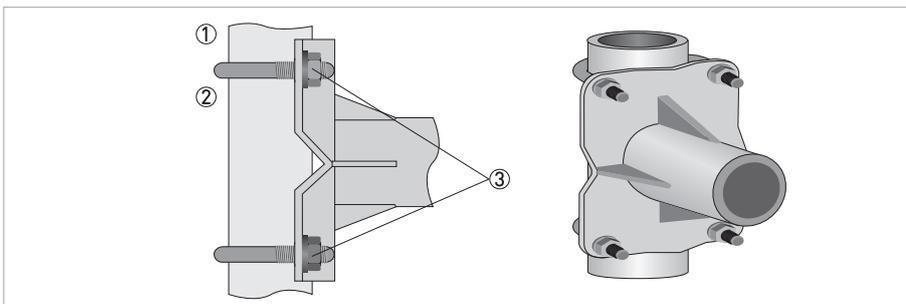


Figure 3-2: Pipe mounting of the field housing

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

### 3.4.2 Wall mounting

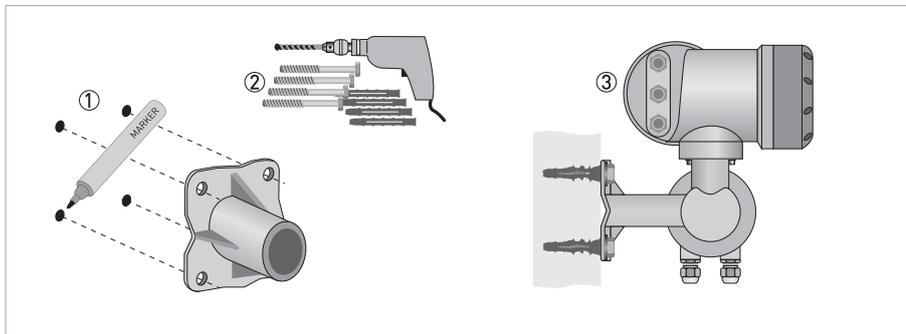


Figure 3-3: Wall mounting of the field housing

- ① Prepare the holes with the aid of the mounting plate. For further information refer to *Mounting plate of field housing* on page 22.
- ② Fasten the mounting plate securely to the wall.
- ③ Screw the mounting bracket of the signal converter to the mounting plate with the nuts and washers.

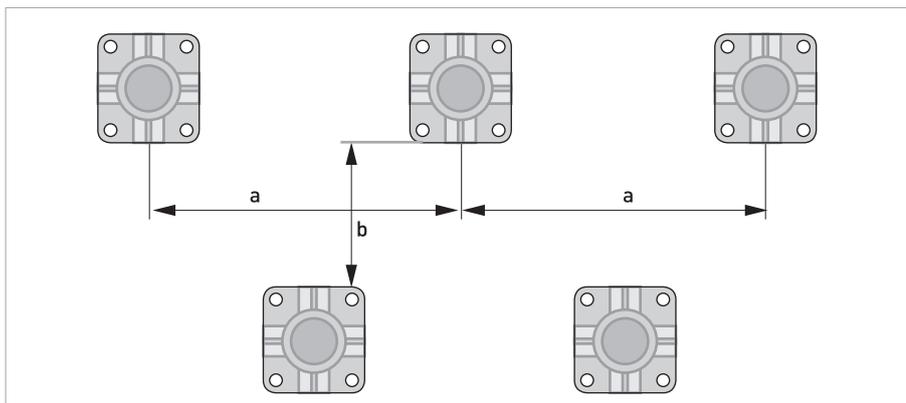


Figure 3-4: Mounting multiple devices next to each other

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

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

### 3.5 Mounting the wall-mounted housing, remote version

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

#### 3.5.1 Pipe mounting

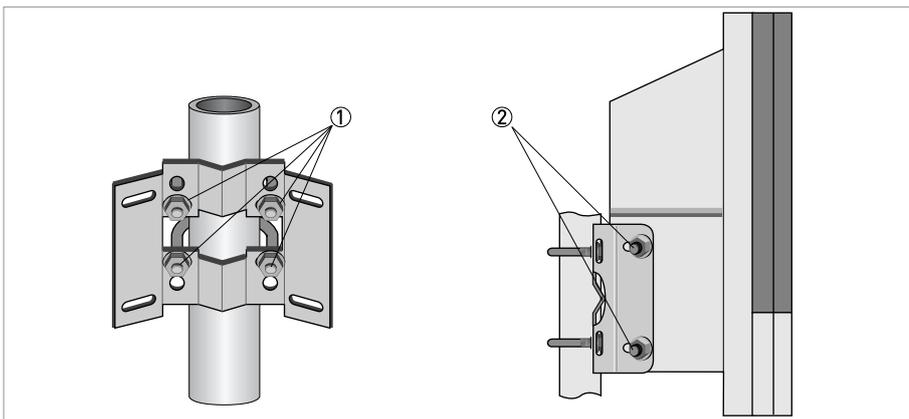


Figure 3-5: Pipe mounting of the wall-mounted housing

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

### 3.5.2 Wall mounting

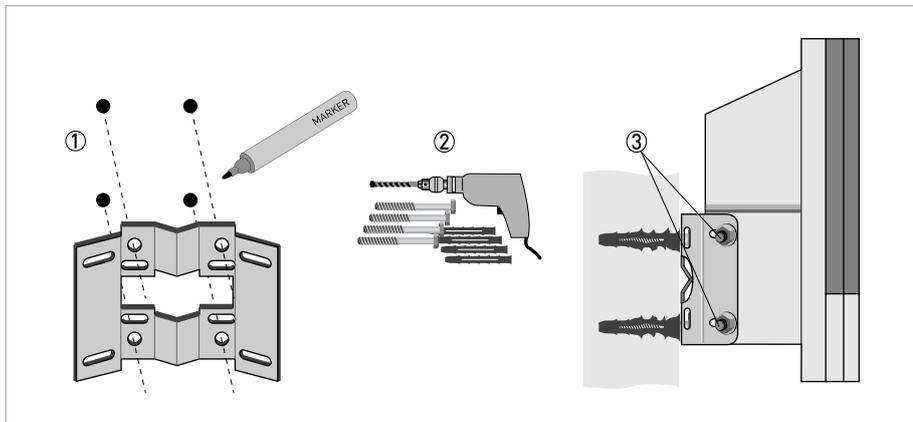


Figure 3-6: Wall mounting of the wall-mounted housing

- ① Prepare the holes with the aid of the mounting plate. For further information refer to *Mounting plate of wall-mounted housing* on page 22.
- ② Fasten the mounting plate securely to the wall.
- ③ Screw the signal converter to the mounting plate with the nuts and washers.

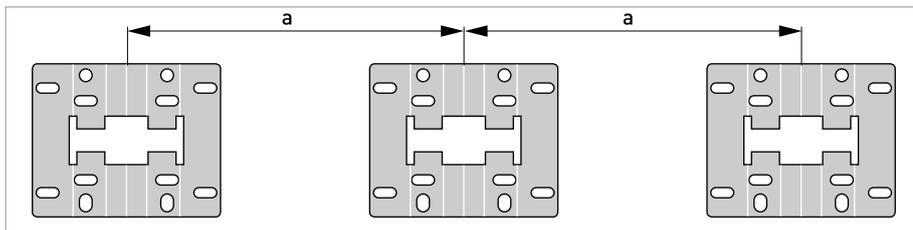


Figure 3-7: Mounting multiple devices next to each other

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

## 4.1 Important notes on electrical connection

*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.*

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

- 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 serial number (refer to nameplates) is identical.

## 4.2 Preparing the signal and field current cables

### **SIL devices:**

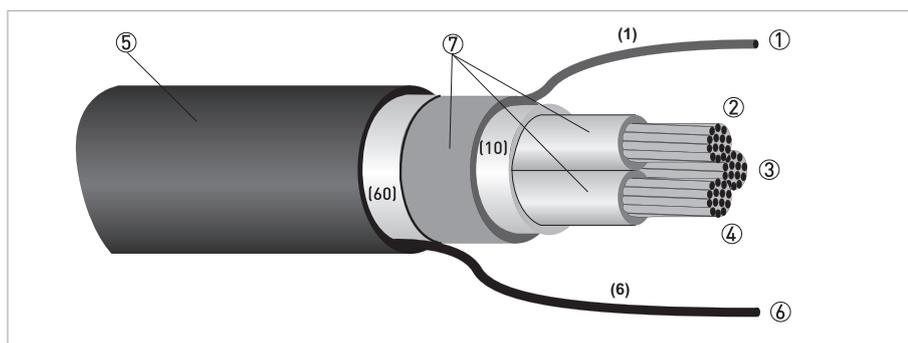
*The DS 300 signal cable cannot be used for SIL devices.*

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

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

### 4.2.1 Signal cable A (type DS 300-3), 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**

- ① Stranded drain wire (1) for the inner shield (10), 1.0 mm<sup>2</sup> Cu / AWG 17 (not insulated, bare)
- ② Insulated wire, 0.5 mm<sup>2</sup> Cu / AWG 20
- ③ Insulated wire, 0.5 mm<sup>2</sup> Cu / AWG 20
- ④ Insulated wire, 0.5 mm<sup>2</sup> Cu / AWG 20
- ⑤ Outer sheath
- ⑥ Stranded drain wire (6) for the outer shield (60)
- ⑦ Insulation layers

## 4.2.2 Length of signal cable A

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

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

Table 4-1: Length of signal cable A

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

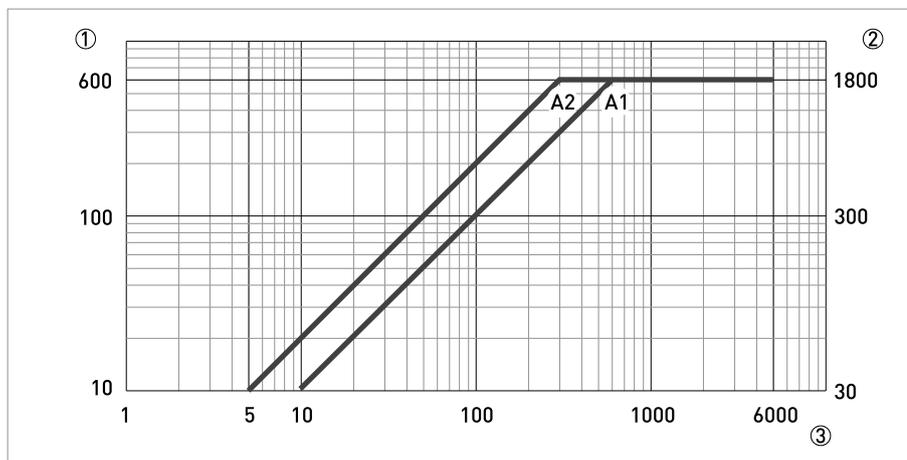


Figure 4-2: Maximum length of signal cable A

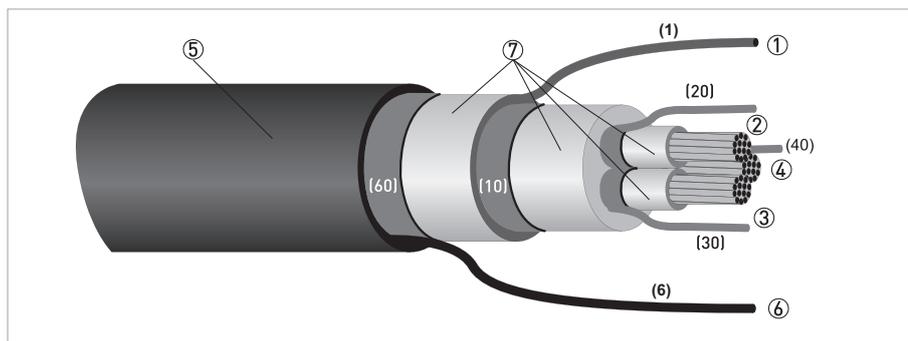
- ① Maximum length of signal cable A between the flow sensor and signal converter [m]
- ② Maximum length of signal cable A between the flow sensor and signal converter [ft]
- ③ Electrical conductivity of the medium being measured [ $\mu\text{S}/\text{cm}$ ]

### 4.2.3 Signal cable B (type BTS 300-3), construction

**SIL devices:**

For cable lengths > 50 m / 164 ft used with SIL devices refer to the "OPTIFLUX x400 Safety manual".

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



**Figure 4-3: Construction of signal cable B**

- ① Stranded drain wire (1) for the inner shield (10), 1.0 mm<sup>2</sup> Cu / AWG 17 (not insulated, bare)
- ② Insulated wire (2), 0.5 mm<sup>2</sup> Cu / AWG 20 with stranded drain wire (20) of shield
- ③ Insulated wire (3), 0.5 mm<sup>2</sup> Cu / AWG 20 with stranded drain wire (30) of shield
- ④ Insulated wire (4), 0.5 mm<sup>2</sup> Cu / AWG 20 with stranded drain wire (40) of shield
- ⑤ Outer sheath
- ⑥ Stranded drain wire (6) for the outer shield (60), 0.5 mm<sup>2</sup> Cu / AWG 20 (not insulated, bare)
- ⑦ Insulation layers

#### 4.2.4 Length of signal cable B

**SIL devices:** For cable lengths > 50 m / 164 ft used with SIL devices refer to the "OPTIFLUX x400 Safety manual".

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

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

Table 4-2: Length of signal cable B

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

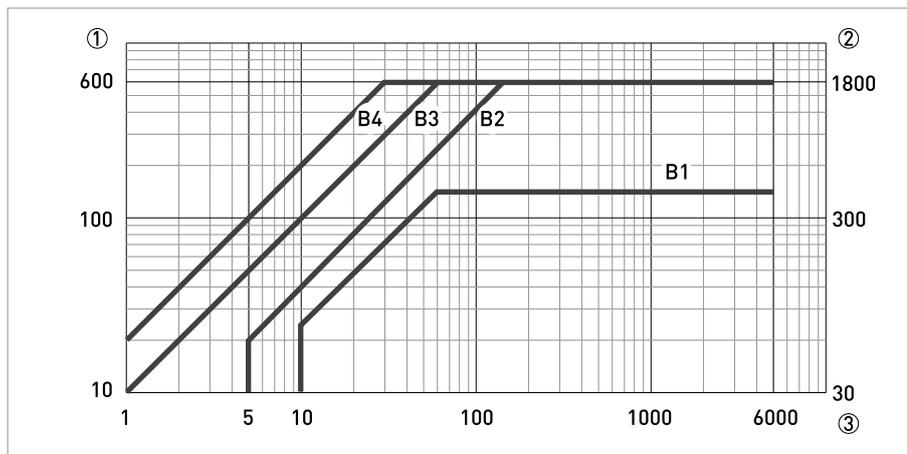


Figure 4-4: Maximum length of signal cable B

- 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 [ $\mu\text{S}/\text{cm}$ ]

### 4.3 Connecting the signal and field current cables

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

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

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

*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.*

### 4.3.1 Connection diagram for flow sensor, field housing

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

- **SIL devices:**  
A shielded 3-wire copper cable is required for the field current cable.  
The shield **MUST** be connected in the housing of the signal converter.
- **Non-SIL devices:**  
A shielded field current cable is **not** required.
- The outer shield of signal cable A or B in the signal converter housing is connected via the strain relief terminal.
- Bending radius of signal and field current cable:  $\geq 50 \text{ mm} / 2''$
- The following illustration is schematic. The positions of the electrical connection terminals may vary depending on the device variant.

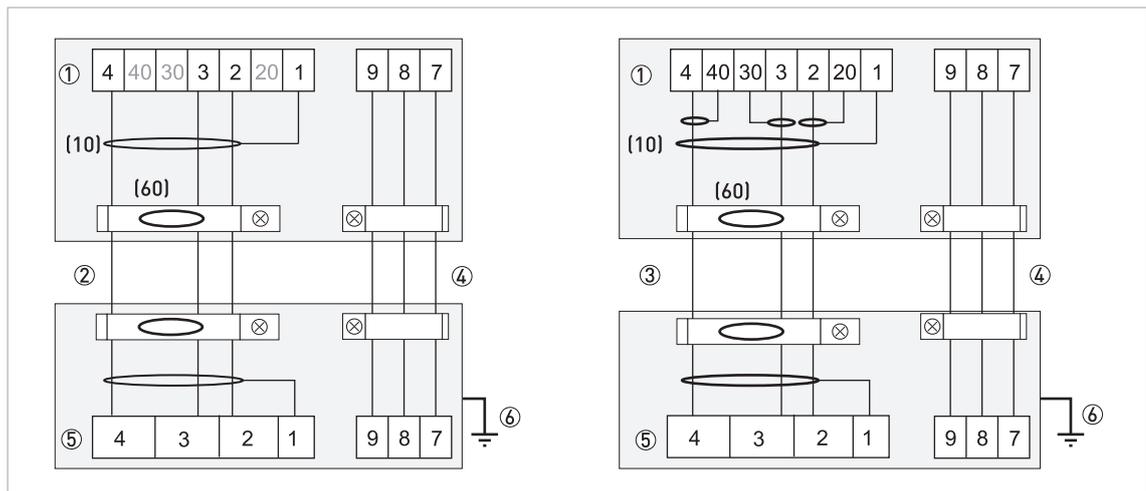


Figure 4-5: Connection diagram for flow sensor in combination with field housing

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

### 4.3.2 Connection diagram for flow sensor, wall-mounted housing

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

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

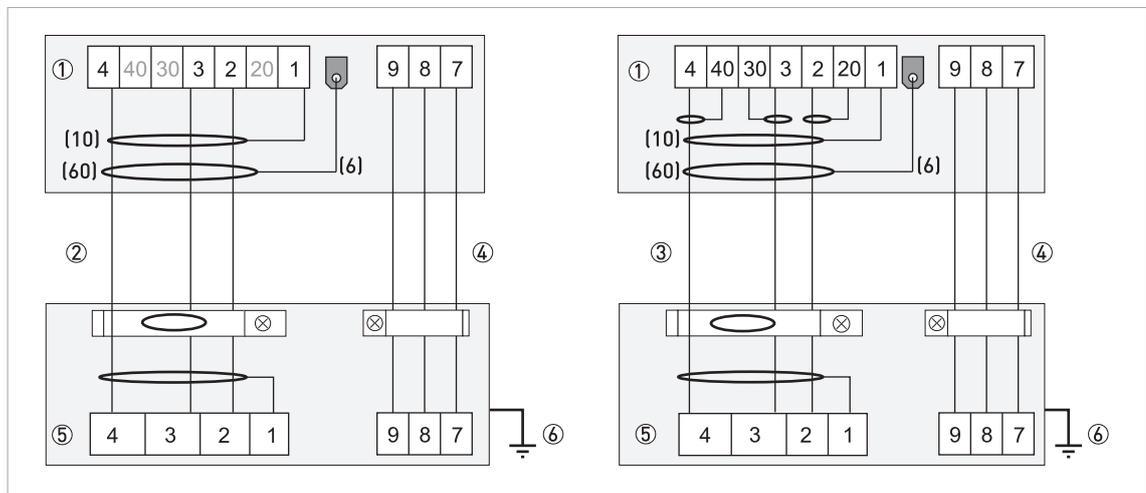


Figure 4-6: Connection diagram for flow sensor, wall-mounted housing

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

### 4.3.3 Connection diagram for flow sensor, rack-mounted housing

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

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

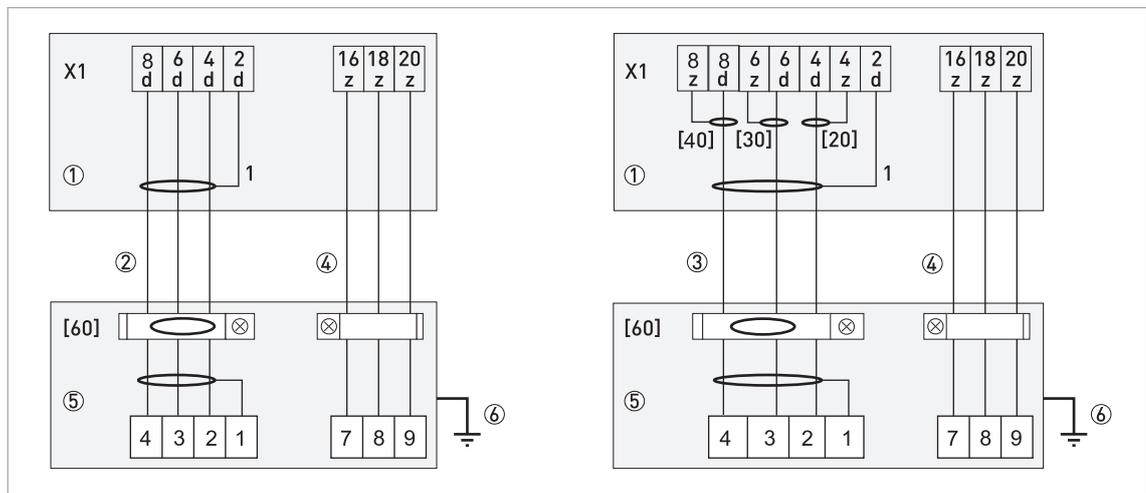


Figure 4-7: Connection diagram for flow sensor, rack-mounted housing

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

## 4.4 Power supply connection

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

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

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

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

- Note the power supply voltage and frequency (50...60 Hz) on the nameplate.
- Colour of connector: green

### 24 VAC/DC (tolerance range: AC: -15% / +10%; DC: -55% / +30%)

- AC: Note the power supply voltage and frequency (50...60 Hz) on the nameplate.
- DC: Note the power supply voltage on the nameplate.
- Colour of connector: red
- 24 VAC/DC OVCIII, test voltage 1400 VAC

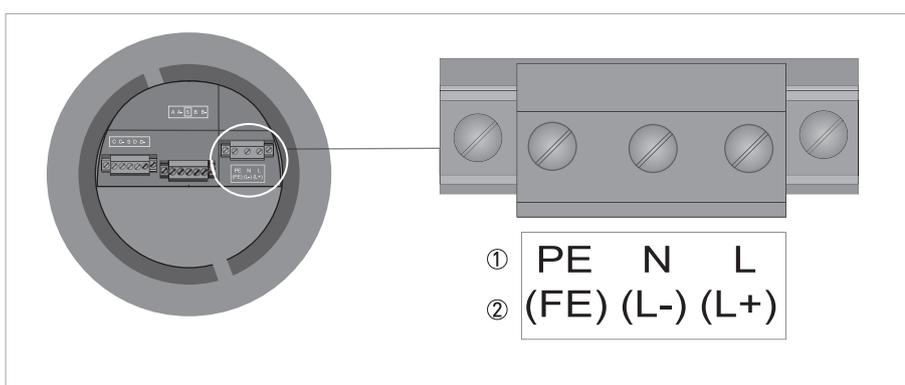


Figure 4-8: Power supply connection for field housing

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

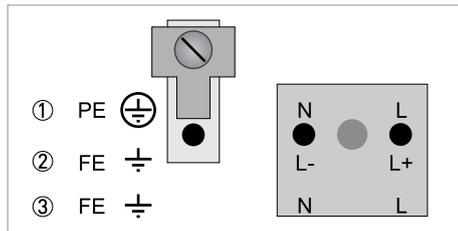


Figure 4-9: Power supply connection for wall-mounted housing

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

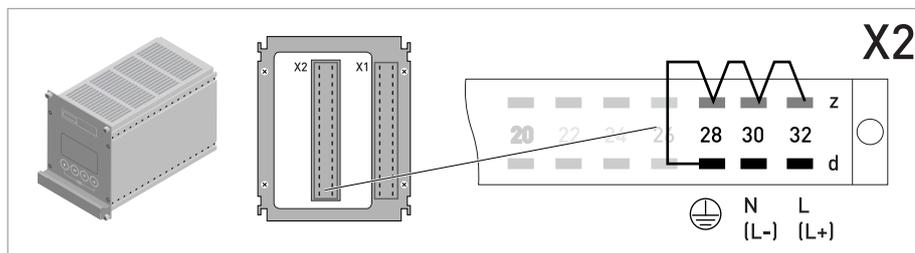


Figure 4-10: Power supply connection for rack-mounted housing (21 TE)

*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.*

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

## 4.5 Inputs and outputs, overview

### 4.5.1 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.

#### Modular version

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

#### Ex i version

- Depending on the task, the device can be configured with various output modules.
- Current outputs can be active or passive.

#### 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.

#### Backward compatible version

- For the backward compatible version (IFC 400 electronic unit fitted into IFC 300 signal converter housing), please refer to the chapter "Electrical connections" in the handbook of the IFC 300.

### 4.5.2 Description of the CG number

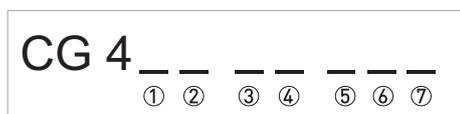


Figure 4-11: Marking [CG number] of the electronics module and input/output options

- ① ID number: 0
- ② ID number: 0 = standard; 9 = special
- ③ Power supply option / flow sensor option
- ④ Display option
- ⑤ Input/output option (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 400 31 4AC	100...230 VAC & advanced HMI; modular I/O: I <sub>a</sub> & P <sub>a</sub> /S <sub>a</sub>
CG 400 T1 320	24 VAC/DC & advanced HMI; I <sub>p</sub> & P <sub>N</sub> /S <sub>N</sub> and Ex i option I <sub>p</sub> & P <sub>p</sub> /C <sub>p</sub>

Table 4-3: Examples for CG number

Marking for ③	Power supply options
1...6	Standard: 100...230 VAC (-15% / +10%), 50/60 Hz
R...W	Option: 24 VAC/DC (AC: -15% / +10%, 50/60 Hz; DC: -55% / +30%)

Table 4-4: Power supply options

Marking for ④	Display options
G...L	Standard display
1...4	Advanced display with additional mechanical keys, Bluetooth® interface (optional), colour status backlight and real time clock for logging

Table 4-5: Display options

Abbreviation	Identifier for CG no. ⑥ and ⑦	Description
I <sub>a</sub>	A	Active current output
I <sub>p</sub>	B	Passive current output
P <sub>a</sub> / S <sub>a</sub>	C	Active pulse output, frequency output, status output or limit switch (changeable)
P <sub>p</sub> / S <sub>p</sub>	E	Passive pulse output, frequency output, status output or limit switch (changeable)
P <sub>N</sub> / S <sub>N</sub>	F	Passive pulse output, frequency output, status output or limit switch according to NAMUR (changeable)
C <sub>a</sub>	G	Active control input
C <sub>p</sub>	K	Passive control input
C <sub>N</sub>	H	Active control input to NAMUR Signal converter monitors cable breaks and short circuits according to IEC 60947-5-6.
-	8	No additional module installed
-	0	No further module possible

Table 4-6: Description of abbreviations and CG identifier for possible optional modules on terminals A and B

### 4.5.3 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 number are depicted.

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

#### Basic I/O

1 0 0	S <sub>p</sub> passive		S <sub>p</sub> / C <sub>p</sub> passive ①		I <sub>a</sub> + HART® active / passive ①		P <sub>p</sub> / S <sub>p</sub> passive ①	
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#### Ex i I/O

2 0 0					I <sub>a</sub> + HART® active		P <sub>N</sub> / S <sub>N</sub> NAMUR ①	
3 0 0					I <sub>p</sub> + HART® passive		P <sub>N</sub> / S <sub>N</sub> NAMUR ①	
2 1 0	I <sub>a</sub> active		P <sub>N</sub> / S <sub>N</sub> NAMUR C <sub>p</sub> passive ①		I <sub>a</sub> + HART® active		P <sub>N</sub> / S <sub>N</sub> NAMUR ①	
3 1 0	I <sub>a</sub> active		P <sub>N</sub> / S <sub>N</sub> NAMUR C <sub>p</sub> passive ①		I <sub>p</sub> + HART® passive		P <sub>N</sub> / S <sub>N</sub> NAMUR ①	
2 2 0	I <sub>p</sub> passive		P <sub>N</sub> / S <sub>N</sub> NAMUR C <sub>p</sub> passive ①		I <sub>a</sub> + HART® active		P <sub>N</sub> / S <sub>N</sub> NAMUR ①	
3 2 0	I <sub>p</sub> passive		P <sub>N</sub> / S <sub>N</sub> NAMUR C <sub>p</sub> passive ①		I <sub>p</sub> + HART® passive		P <sub>N</sub> / S <sub>N</sub> NAMUR ①	

Table 4-7: Fixed, non-alterable input/output versions

① Menu configurable

### 4.5.4 Alterable input/output versions

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

- In the table, only the final digits of the CG number are depicted.
- The signal converter is delivered preset with respect to active / passive / NAMUR according to the customer order.

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

#### Modular I/O

4 __	max. 2 optional modules for terminal A + B				I + HART® active/passive ①		P/S active/passive/ NAMUR ①	
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Table 4-8: Alterable input/output versions

① Software configurable

## 4.6 Laying electrical cables correctly

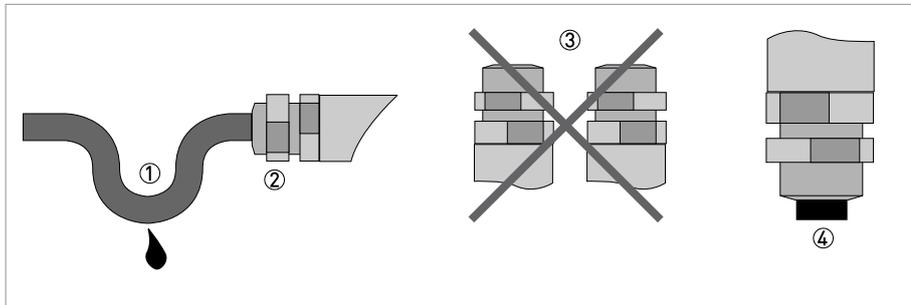


Figure 4-12: Protect housing from dust and water

- 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.

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