OPTISONIC 6300 Quick Start

Ultrasonic clamp-on flowmeter

ER 4.0.0_

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

CAUTION!
Responsibility for the use of the measuring devices with regard to suitability, intended use and corrosion resistance of the used materials against the measured fluid lies solely with the operator.

INFORMATION!
The manufacturer is not liable for any damage resulting from improper use or use for other than the intended purpose.

The **OPTISONIC 6300** is designed exclusively for bi-directional measurements on conductive and / or non-conductive fluids. Excess of contaminations (gas, particles, 2 phases) disturb the acoustic signal and thus must be avoided.

The overall functionality of the **OPTISONIC 6300** flowmeter, is the continuous measurement of actual volume flow, mass flow, flow speed, velocity of sound, gain, SNR, totalized flow mass and diagnosis values.

2.2 Scope of delivery

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

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!
The field device will arrive in two cartons. One carton contains the converter and one carton contains the sensor.

INFORMATION!
Make sure to combine the sensor and the converter correctly, so they match by the devices serial number.

The underneath accessories can be ordered optionally:

- GDC interface set
- Coupling grease; mineral (standard versions) or high-temperature contact (XT versions)
- Coupling pads

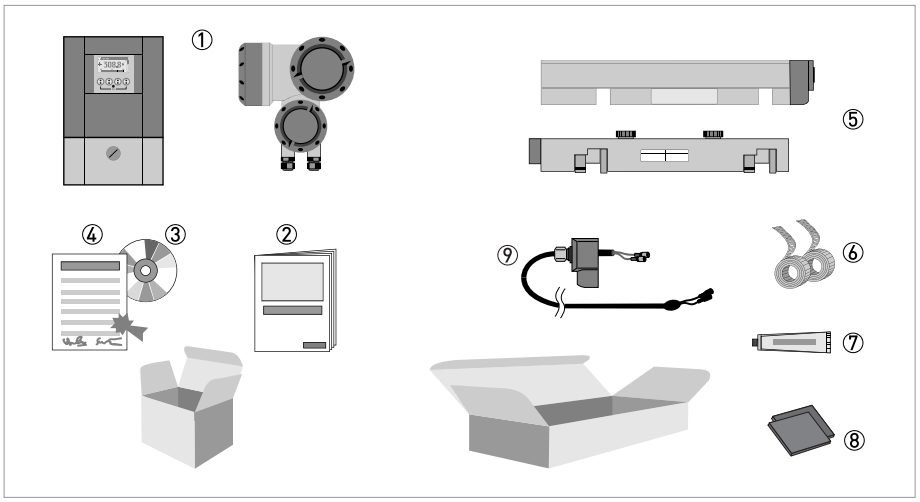


Figure 2-1: Scope of delivery

① Signal converter, wall version or field version
② Quick Start
③ CD rom with applications and drivers
④ Factory calibration report
⑤ Sensor plus cover (stainless steel / XT version without cover)
⑥ Metal strap
⑦ Mineral coupling grease (standard versions) or high temperature contact gel (XT versions)
⑧ Coupling pads
⑨ Signal cable plus connector cap (XT versions have a protection sleeve around the signal cable).

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.

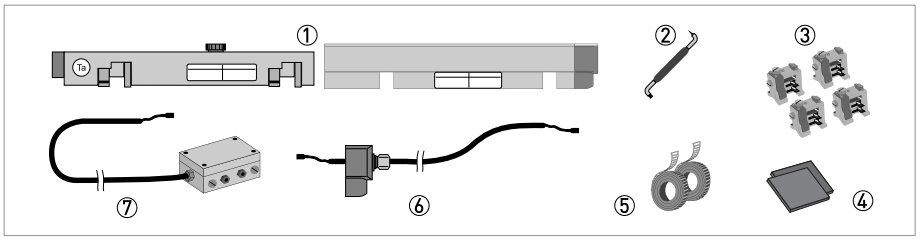


Figure 2-2: Additionally for large version

① 2nd sensor plus cover
② 90 degree screw driver
③ 4 fixing units
④ Coupling pads
⑤ 2 metal straps
⑥ Signal cable plus connector cap
⑦ Cable box plus signal cable

INFORMATION!
No special tools, no training required!

2.3 Device description

The ultrasonic clamp-on flowmeter can be fitted on the outside of piping to measure the flow rate of liquids. The device is a combination of the sensor(s) and an ultrasonic flow converter.

INFORMATION!
Product specific information and extensive product specification is available using PICK, the Product Information Center KROHNE web-tool.
PICK can be found via the service menu button on the KROHNE.com website.

PICK up your information

Device versions

The ultrasonic clamp-on flowmeter is available in different versions and with two separate flow converters (wall-mount or field version).

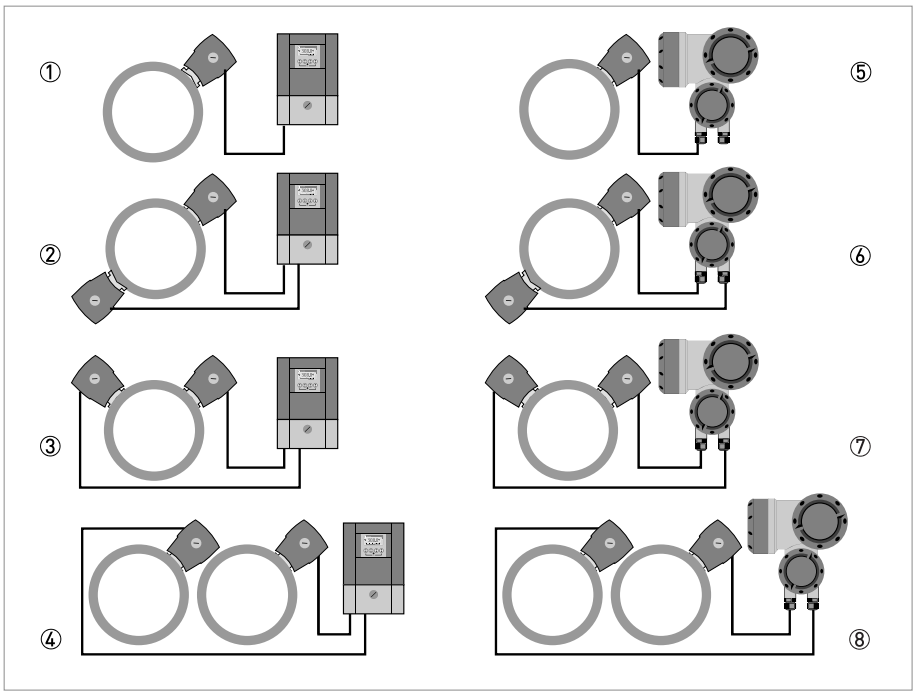


Figure 2-3: System configuration possibilities

① One sensor with a converter in wall-mount ① or field version ⑤
② Two sensors with a converter in wall-mount ② or field version ⑥ (X mode)
③ Two sensors with a converter in wall-mount ③ or field version ⑦ (2 path)
④ Two sensors with a converter in wall-mount ④ or field version ⑧ (1 path - 2 pipes)

INFORMATION!
For more information regarding the different device versions and configurations, please refer to Installation of the flowmeter on page 18.

2.4 Overview of the nameplates (examples)

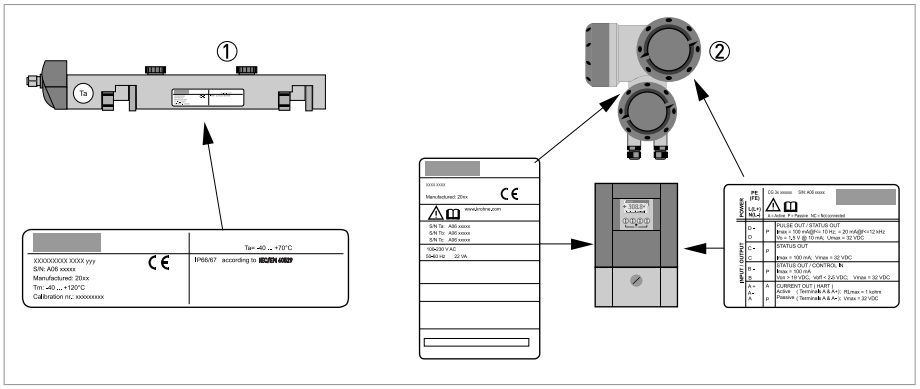


Figure 2-4: Visual check

① Flow sensor
② Signal converters (field or wall version)

2.4.1 Examples of nameplates on the signal converter

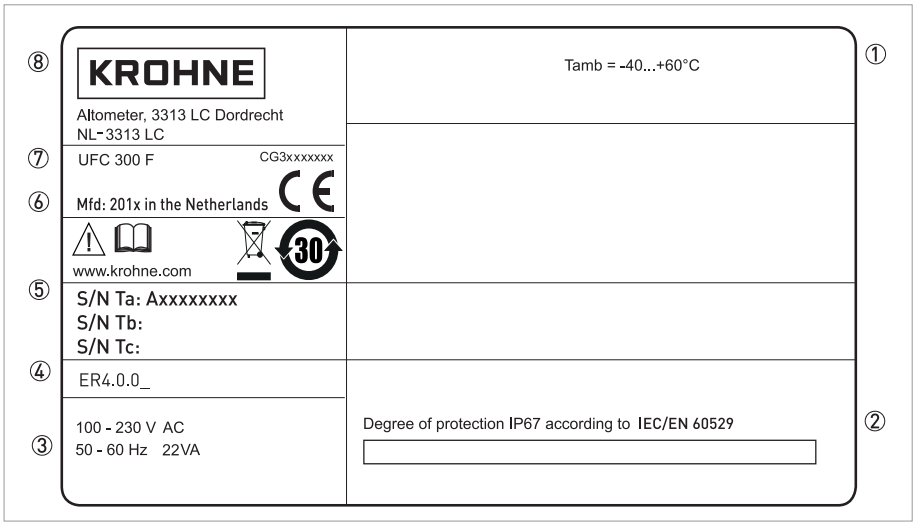


Figure 2-5: Example of nameplate UFC 300 F (field version)

① Ambient temperature
② Protection class and Tag number
③ Mains supply data
④ Electronic Revision number
⑤ Sensor serial number(s), corresponds with the number mentioned on type sticker
⑥ Manufacturing date and CE sign with number(s) of notified body/bodies
⑦ Type designation of the flowmeter with CG number
⑧ Name and address of the manufacturer

Example of the nameplate wall version

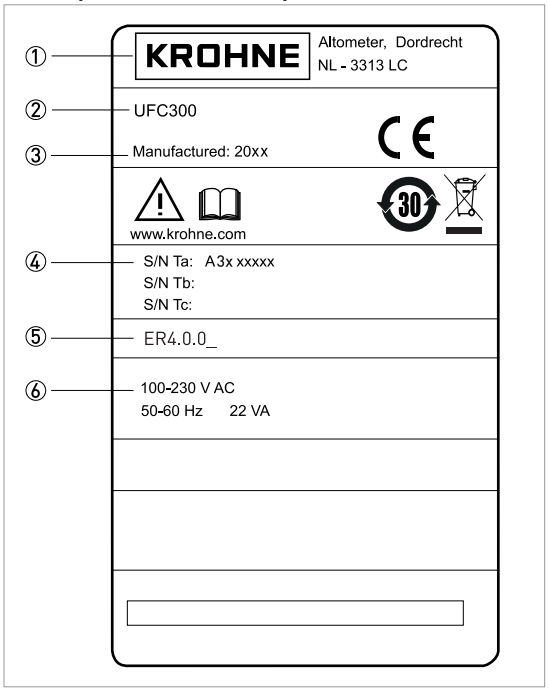


Figure 2-6: Example nameplate (wall version)

① Manufacturer
② Device type
③ Manufacturing year
④ Serial number sensor 1 + short code flow sensor
⑤ Electronic Revision number
⑥ Mains supply data

2.4.2 Nameplate for the measuring sensor

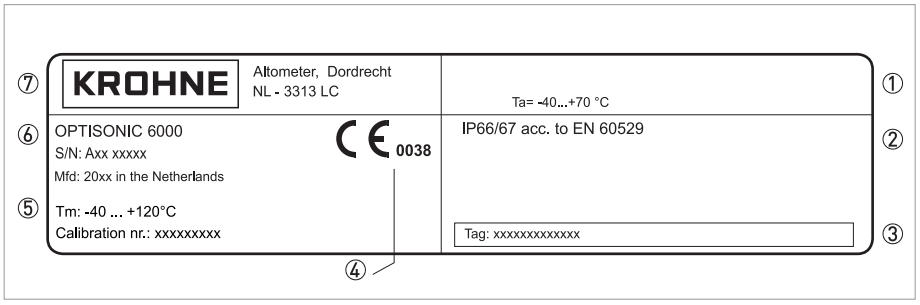


Figure 2-7: Nameplate of the flow sensor (example)

① Ambient temperature operating range
② Protection category
③ Tag number
④ CE sign with number(s) of notified body/bodies
⑤ Media temperature and calibration data
⑥ Type designation of the flowmeter
⑦ Name and address of the manufacturer

2.4.3 Example of IO nameplate

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

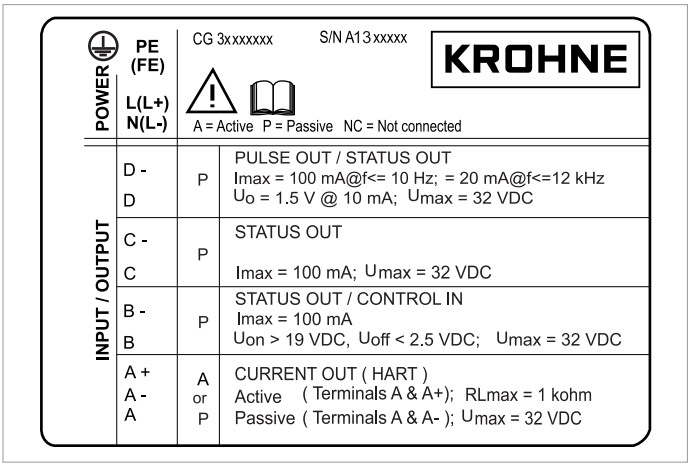


Figure 2-8: Nameplate inputs / outputs

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

2.5 Storage

- Store the flowmeter in a dry and dust-free location.
- Avoid lasting direct exposure to the sun.
- Store the flowmeter in its original packing.
- Storage temperature -50...+70°C / -58...+158°F

2.6 Transport

Signal converter

- Do not lift the signal converter by the cable glands.

Measuring sensor

- Do not lift the measuring sensor by the connected cables.

2.7 Pre-installation requirements

INFORMATION!
To assure a quick, safe and uncomplicated installation, we kindly request you to make provisions as stated below.

Make sure that you have all necessary tools available:

- Allen key (4 and 5 mm)
- Small screwdriver
- Wrench for cable glands and for pipe mounting bracket (remote version only); refer to *Mounting the field housing, remote version* on page 27

2.7.1 General requirements

INFORMATION!
The following precautions must be taken to ensure a reliable installation.

- *Make sure that there is adequate space on the sides.*
- *Protect the signal converter from direct sunlight and install a sunshade if necessary.*
- *Signal converters installed in control cabinets require adequate cooling, e.g. by fan or heat exchanger.*
- *Do not expose the signal converter to intense vibrations and mechanical shocks.*

2.8 Installation and safety instructions

INFORMATION!
To avoid measuring errors and malfunctioning of the flowmeter due to gas or air inclusions or an empty pipe, please observe the following precautions.

CAUTION!
Since gas will collect at the highest point of a pipe, installation of the flowmeter at that location should be avoided at all times. Also, installation in a down going pipe should be avoided since a completely filled pipe may not be guaranteed due to cascading effects. Additionally, flow profile distortion is possible.

CAUTION!
If you program the diameter, please note that you use the outer diameter of the pipe.

Specific for sensors

WARNING!

- *Be careful when locking the rail back onto the mounting units as your fingers may get stuck between rail and pipe it is mounted on. This may cause injury.*
- *Be careful when mounting the fixation units using the metal strap. The edge of the strap may cause injury.*

CAUTION!

- *Do not bend the metal mounting strap. This may cause improper mounting of the fixation units of the sensor rails.*
- *Protect the pipe contact side of the transducer. Scratches or other damages may have a negative impact on its proper functioning.*
- *Before fitting the transducer to the transducer knob in the sensor rail, check the connection groove of the transducer cover for damages or dirt. Clean or replace when dirty or damaged.*
- *Check sensor cabling at regular intervals for damages and wear, as this may cause improper functioning. Replace when necessary.*
- *Check the sensor rail sliding area regularly for dirt or other pollution or excess coupling fat, that may cause improper functioning.*

INFORMATION!

- *Check the presence of sufficient grease on the transducer pipe contact side in case of acoustic signal failure.*
- *Excess of coupling fat may be removed from the sensor rails and transducers with a dry piece of cloth. Coupling fat on the converter housing may be removed using soapy water.*

CAUTION!

The device should be protected from corrosive chemicals or gases and dust/particles accumulation.

2.8.1 Inlet, outlet and recommended mounting area

To perform an accurate flow measurement preferably mount the sensor rail at least 10 DN downstream of a flow disturbance like elbow, valve, header or pump. Please follow the installation recommendations in the next installation position examples.

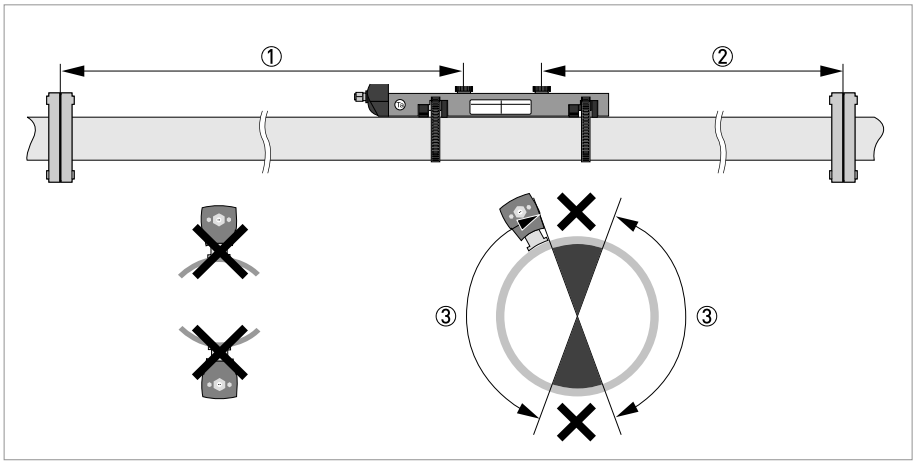


Figure 2-9: Inlet, outlet and recommended mounting area

① ≥ 10 DN
② ≥ 5 DN
③ OK, 120°

Note: especially for XT (eXtended Temperature) versions:

CAUTION!

- *Always install the sensor at a non-insulated part of the pipe. Remove any insulation if necessary!*
- *After installation, the sensor can be completely insulated. The sensor cable must be kept away from the hot pipe surface.*
- *Always wear protective gloves.*

2.8.2 Long horizontal pipes

- Install on slightly ascending pipe section.
- If not possible, ensure adequate velocity to prevent air, gas or vapour from collecting in the upper part.
- In partially filled pipes, the clamp-on flowmeter will report incorrect or no flow rates.

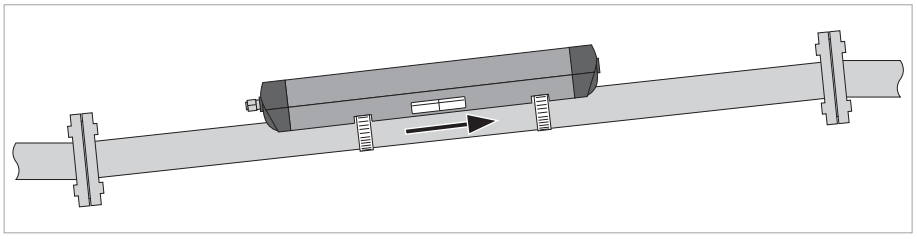


Figure 2-10: Long horizontal pipes

2.8.3 Bends in 2 or 3 dimensions

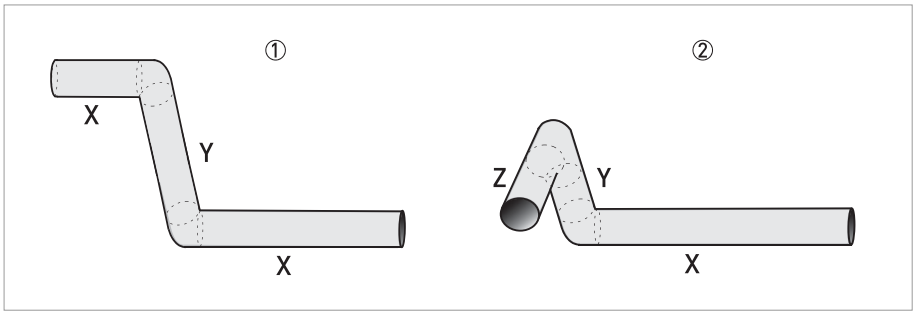


Figure 3-3: 2 and/or 3 dimensional bends upstream of the flowmeter

① 2 dimensions = X/Y
② 3 dimensions = X/Y/Z

for 2 path using bends in 2 dimensions: ≥ 10 DN; when having bends in 3 dimensions: ≥ 15 DN
for 1 path using bends in 2 dimensions: ≥ 20 DN; when having bends in 3 dimensions: ≥ 25 DN

INFORMATION!
*2 dimensional bends occur in a vertical **or** horizontal plane (X/Y) only, while 3 dimensional bends occur in both vertical **and** horizontal plane (X/Y/Z).*

2.8.4 T-section

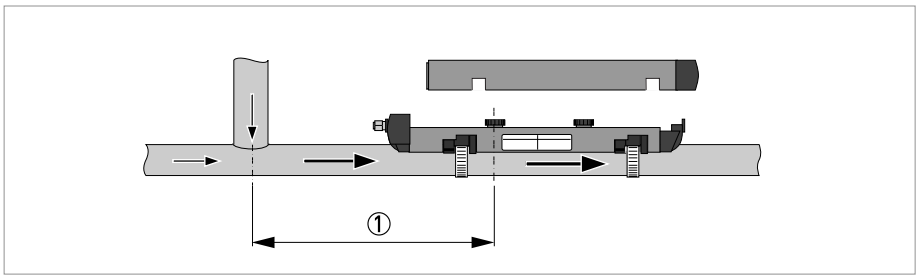


Figure 2-12: Distance behind a T-section

① ≥ 20 DN

2.8.5 Bends

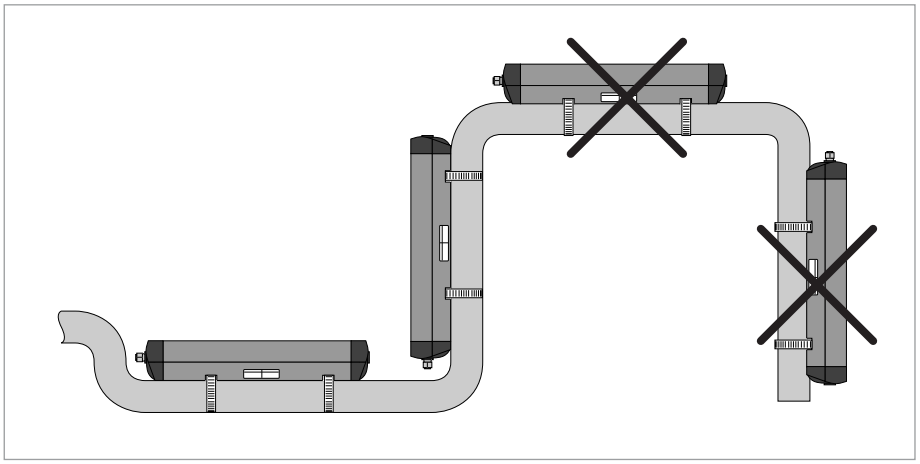


Figure 2-13: Installation in bending pipes

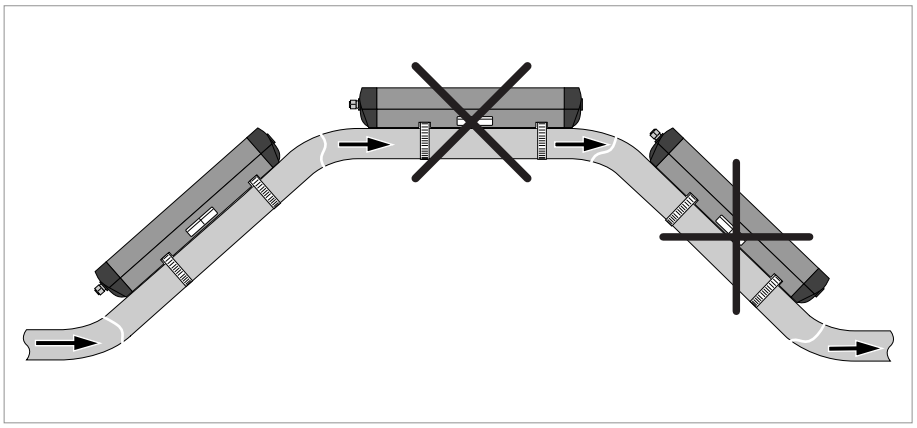


Figure 2-14: Installation in bending pipes

2.8.6 Open feed or discharge

Install the meter on a lowered section of the pipe to ensure a full pipe condition through the meter.

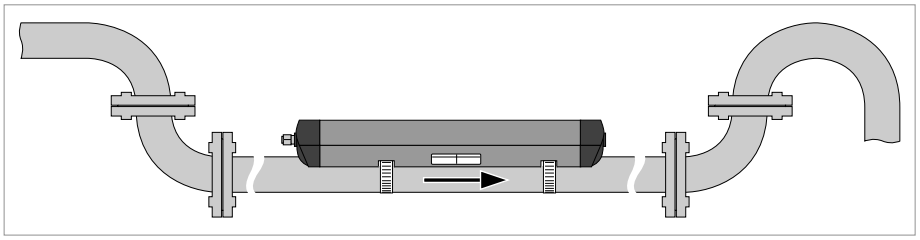


Figure 2-15: Open feed or discharge

2.8.7 Position of pump

CAUTION!
Never install the flowmeter at a pump suction side in order to avoid cavitation or flashing in the flowmeter.

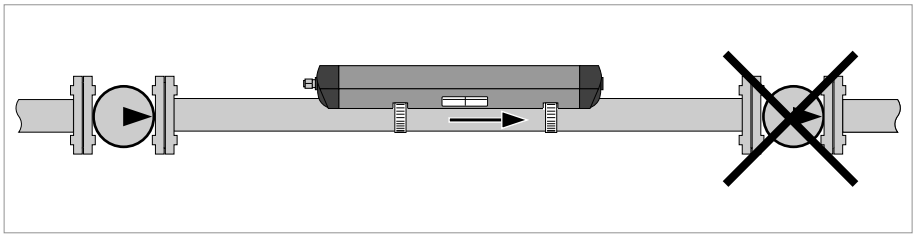


Figure 2-16: Position of pump

2.8.8 Position of control valve

Always install control valves downstream of the flowmeter in order to avoid cavitation or distortion of the flow profile.

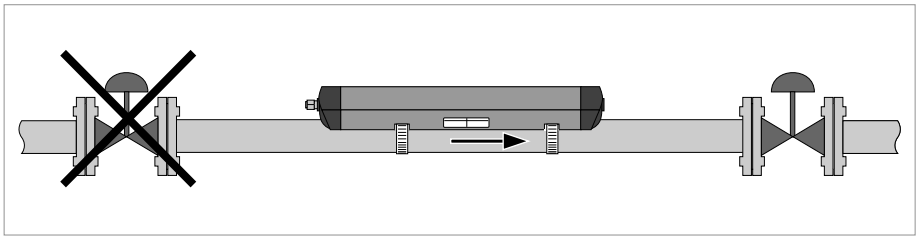


Figure 2-17: Position of control valve

2.8.9 Pipe diameters and sensor construction

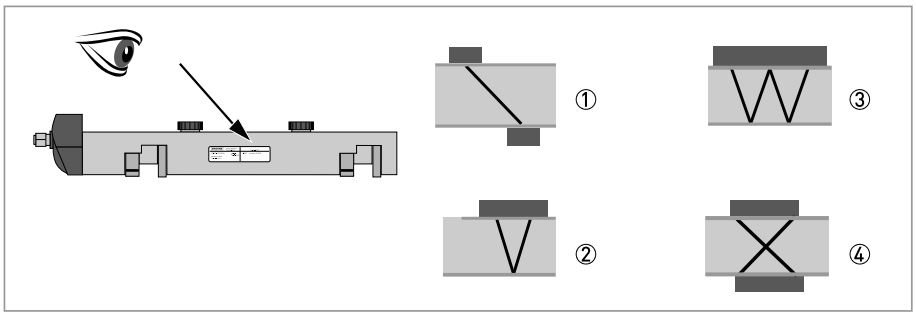


Figure 2-18: Measuring modes

① Z-mode
② V-mode
③ W-mode
④ X-mode

Overview version and measuring modes

Rail version	Diameter range	Preferred measuring modes	Possible measuring modes
Small	DN15...100 / 0.5...4"	< DN25: W-mode (4 traverses)	Small: V mode
		≥ DN25: V-mode (2 traverses)	
Medium	DN50...400 / 2...16"	V-mode (2 traverses)	
	DN200...1250 / 8...50"	X-mode (2 x 1 traverses)	
Large	DN200...4000 / 8...160"	Z-mode (1 traverse)	Large: V mode (2 traverses)

Table 2-1: Version and preferred measuring mode

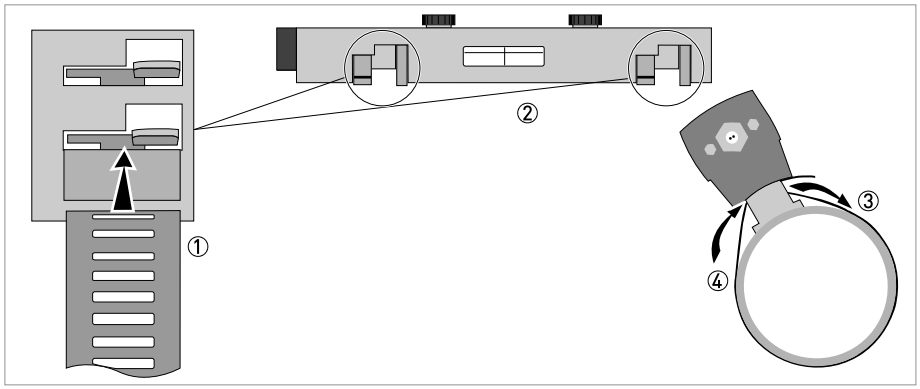
2.8.10 Pipe and media parameters

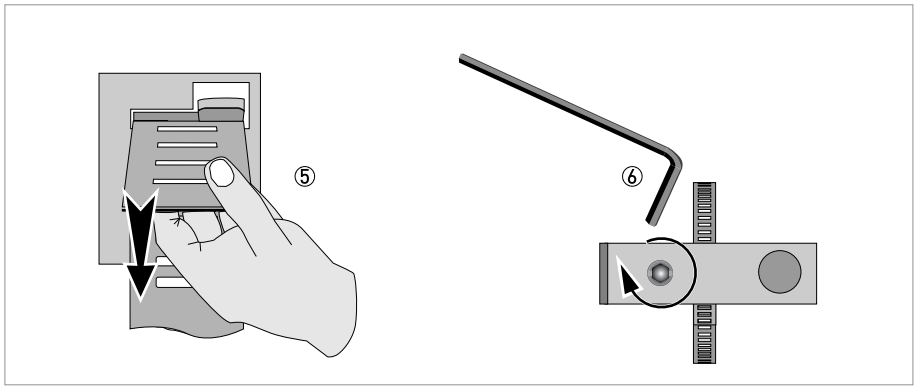
INFORMATION!
Detailed databases of most pipe and media parameters are on the supplied CD.

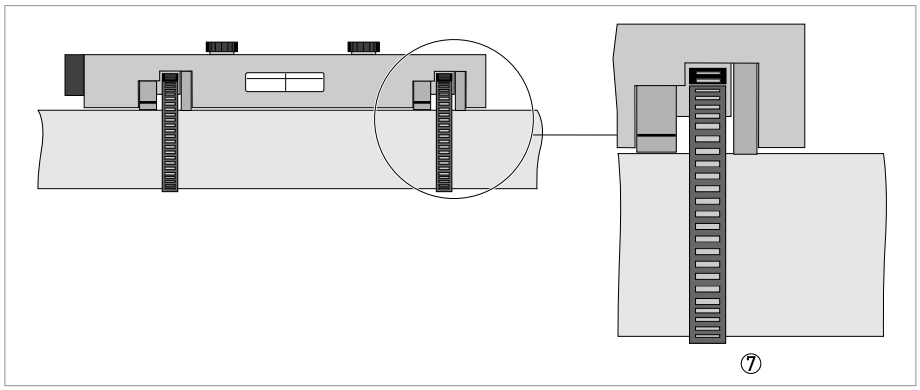
2.9 Installation of the flowmeter

2.9.1 General mechanical installation

Installation of the rails with the metal straps



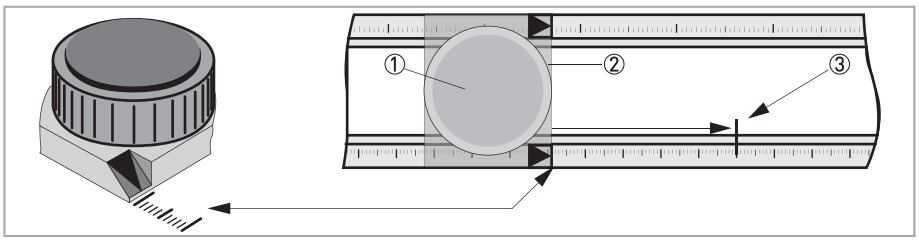




- ① guide one end of the metal strap through the lower strap lock on both the side of the sensor rail ②.
- ③ + ④ wrap both metal strap around the piping.
- ⑤ return the other end of the metal strap through the upper strap lock on both the side of the sensor rail ②.
- ⑥ tighten and lock the strap locks with an Allen wrench.

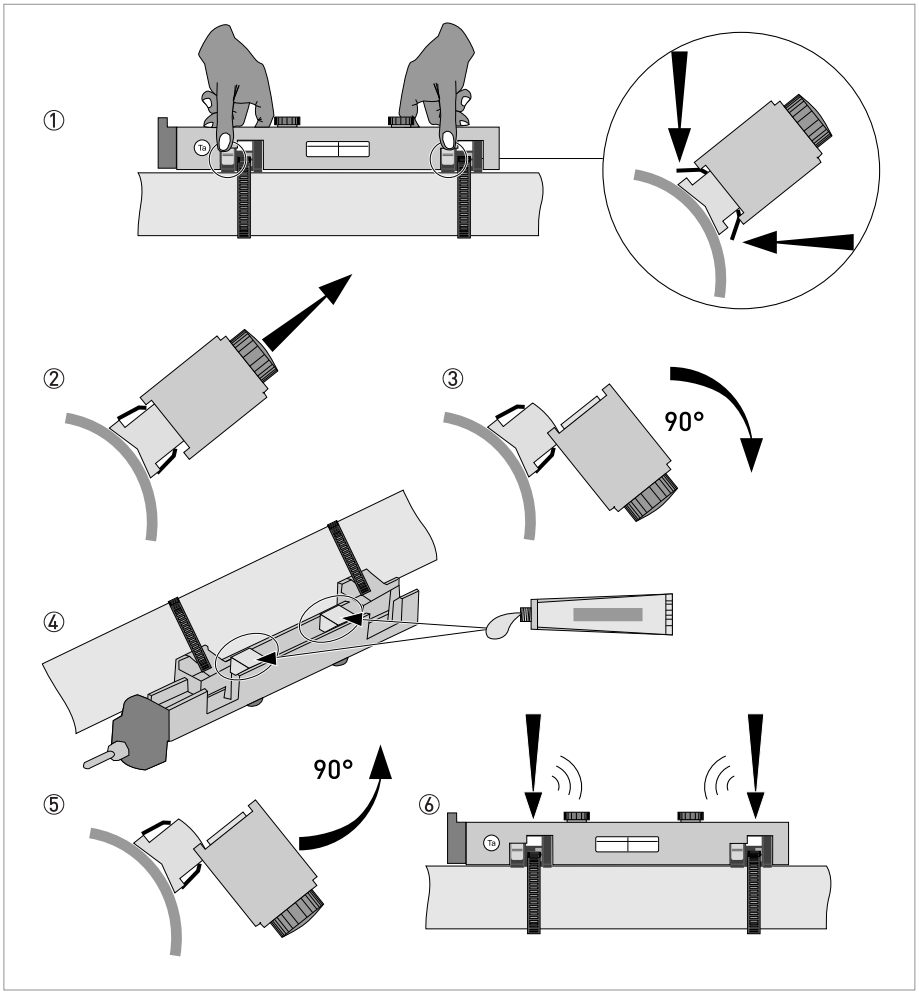
➲ Both sides from sensor rail are secured on the piping ⑦.

Change the position of the transducer



- Unlock the floating transducer ② by turning the locking knob ① counter-clockwise.
- Slide the transducer ② to the advised mounting distance ③ (menu X7.2.3).
- Lock the transducer by turning the locking knob ① clockwise.

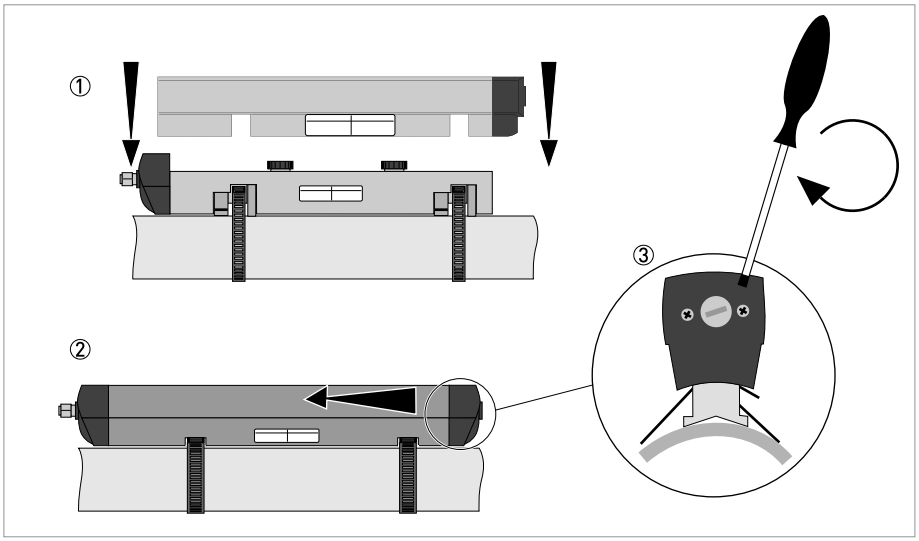
Greasing the transducer surfaces



- ① press in both locking strips on the left and right end of the sensor rail.
- ② lift the cover in vertical movement, then tilt over the cover 90° ③.
- ④ put grease on the contact surfaces of the transducers.
- ⑤ put back cover by tilting back in a 90° angle.
- ⑥ press the cover back vertically on the locking strips until you hear them click.

INFORMATION!
Not applicable for stainless steel / XT versions. These are delivered without cover.

Mounting the cover



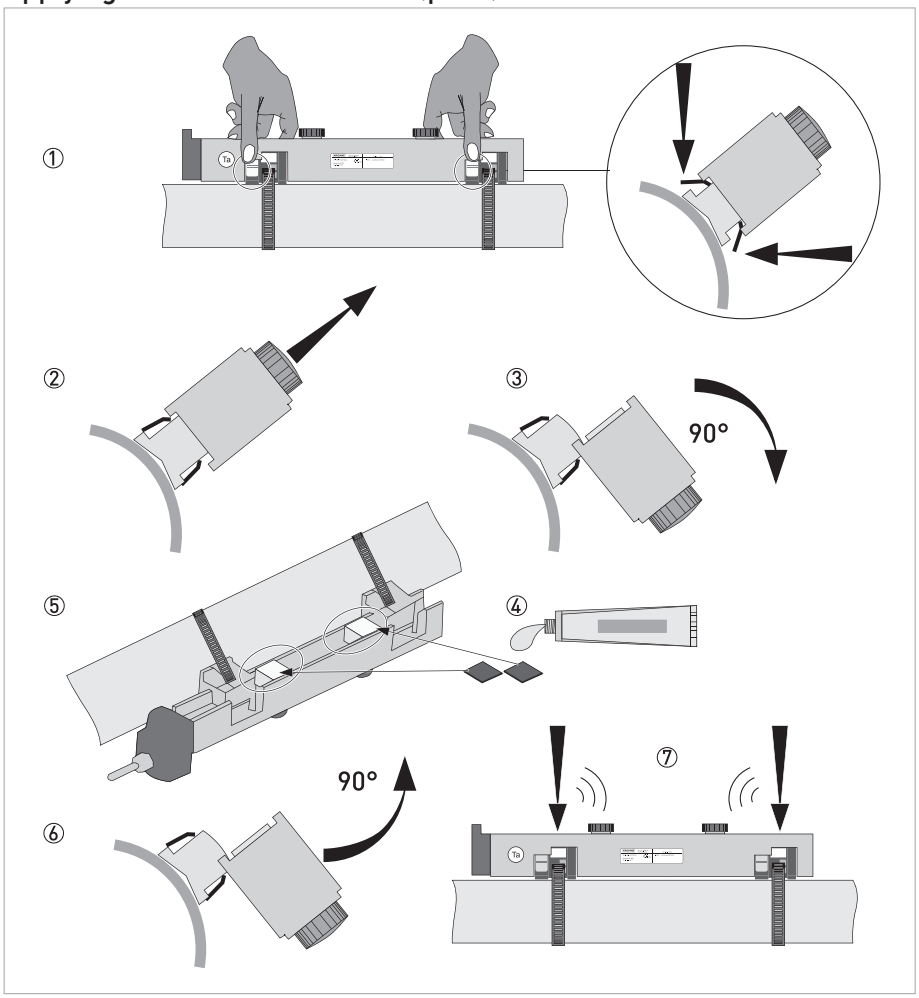
- ① put back the cover, vertically onto the rail
- ② slide cover sidewards and close housing
- ③ secure the cover on the rail housing by turning screw on the side

2.9.2 Installation of solid contact material

Solid contact material cause lower signal quality compared to contact grease. The signal strength will be stable over time and therefore lower start up signal strength is acceptable. In case of insufficient signal strength only contact grease can be used.

Installation and optimization should first be done using contact grease. After finding the optimal position use the click and turn mechanism to install the pads. Apply a thin layer of grease on both sides of the pad and place it on the transducer surface. Click and turn the rail back on the pipe.

Applying solid contact material (pads)



- ① press in both fixing units on the left and right end of the sensor rail.
- ② lift the sensor rail in vertical movement, then tilt over the sensor rail 90° ③.
- ④ put grease on both sides of the pads.
- ⑤ place the pads on the transducer surfaces.
- ⑥ put back sensor rail by tilting back in a 90° angle.
- ⑦ press the sensor rail back vertically on the fixing units until you hear them click.

2.9.3 Installation instructions for small and medium version

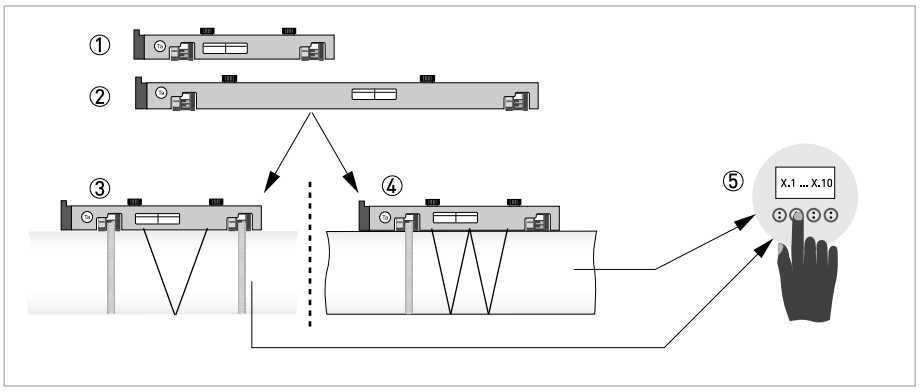


Figure 2-19: Procedure for installation of small or medium version

① Rail, small version
② Rail, medium version
③ Choose for V-mode or ...
④ Choose for W-mode
⑤ Make settings in converter

Standard installation options

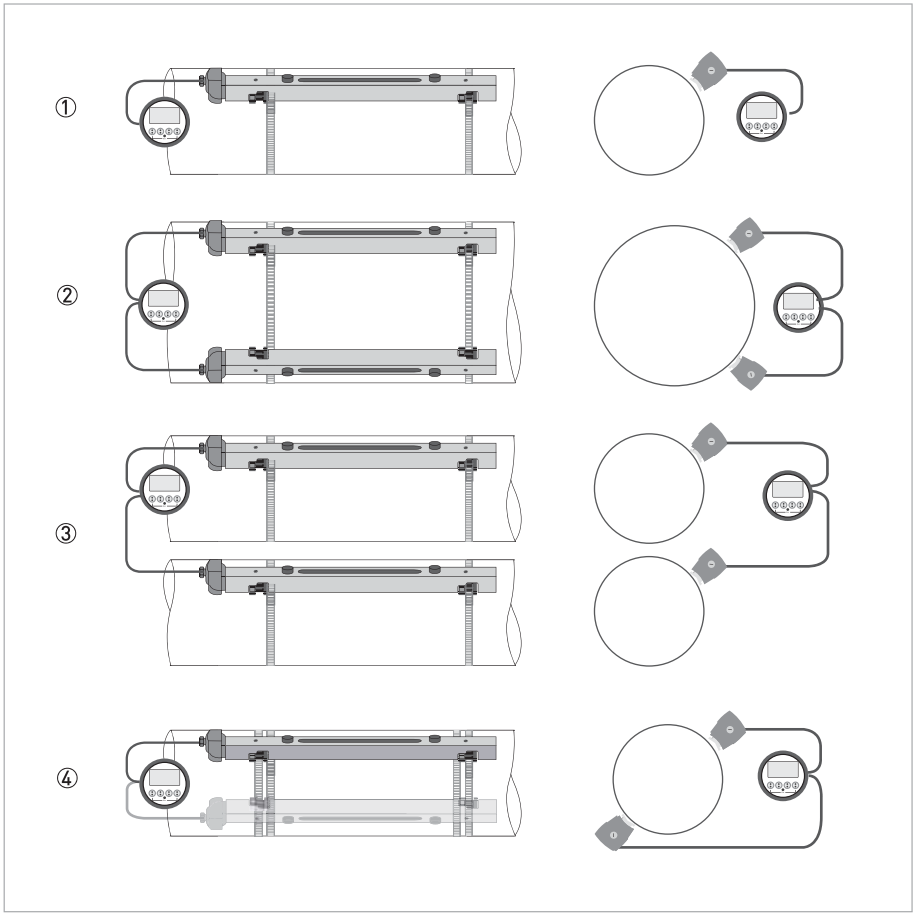


Figure 2-20: Device configurations "Small and Medium"

① Single pipe/single path version
② Single pipe/dual path version
③ Dual pipe/single path version
④ Single pipe/dual path in "X Mode"

INFORMATION!
Refer to the manual of the OPTISONIC 6300 for more information regarding "X mode".

2.9.4 Mechanical installation of large version

INFORMATION!
You need a calculator, measuring band and pen & paper to install a large version.

2.9.5 Mounting the UP rail

CAUTION!
Make sure that you mount the rail parallel to the pipe. Mount the fixing units and the cable box as shown below.

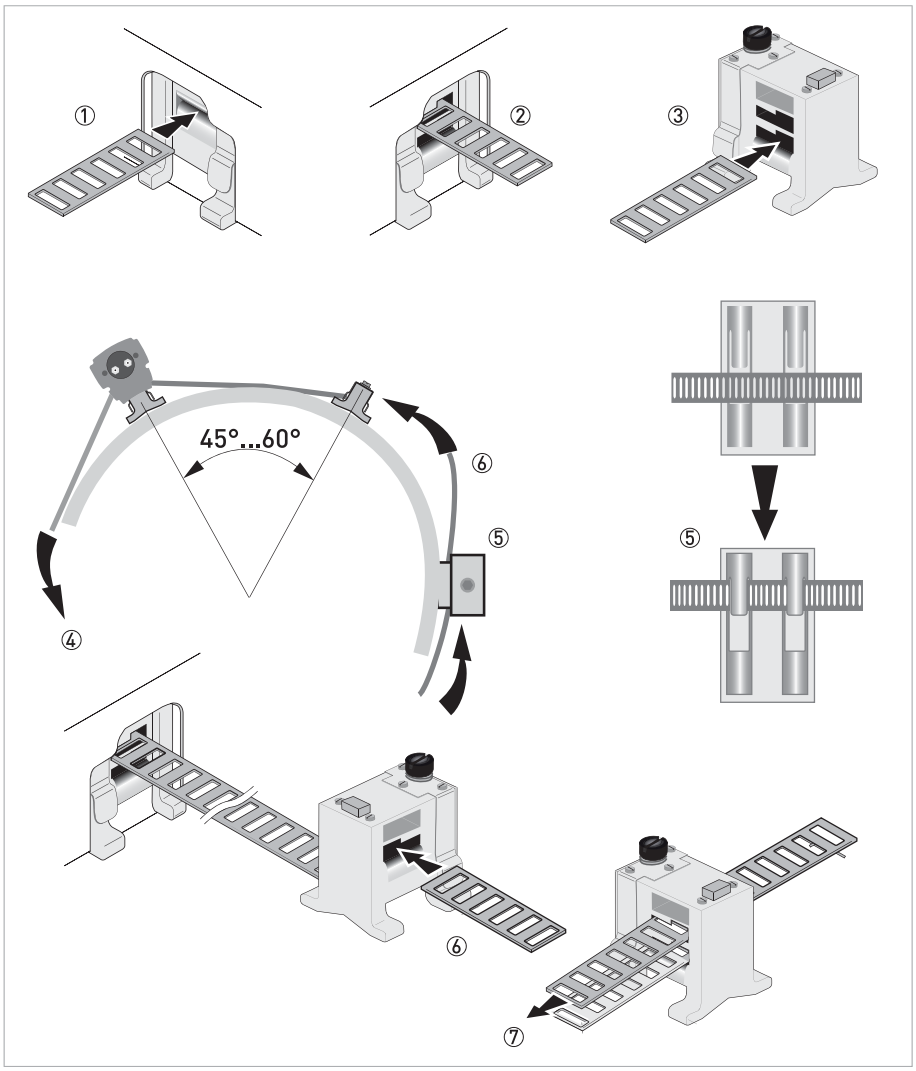


Figure 2-21: Mounting large version rail

① Pull the metal strap through the upper slit of the UP rail.
② Take the metal strap around the pipe (45...60°).
③ Push the end of the metal strap into the lower slot of the fixing unit.
④ Take the other side of the metal strap around the pipe to the fixing unit.
⑤ Mount the cable box (only for the downstream metal strap).
⑥ Push the metal strap through the upper slot of the fixing unit.
⑦ Pull the metal strap moderately tight by hand.

- Secure by turning screws clockwise.

2.9.6 Mounting the DOWN rail

Measure the circumference of the pipe with a measuring band.

For Z-mode, you must install the DOWN rail at the opposite location at the pipe.
The two most common ways to find the exact location are with the use of a fixed reference point or determination of transducer position with the use of a paper/plastic material roll.
For more details refer to *Mechanical installation for large version* on page 48.

2.9.7 Configuration instructions for large version

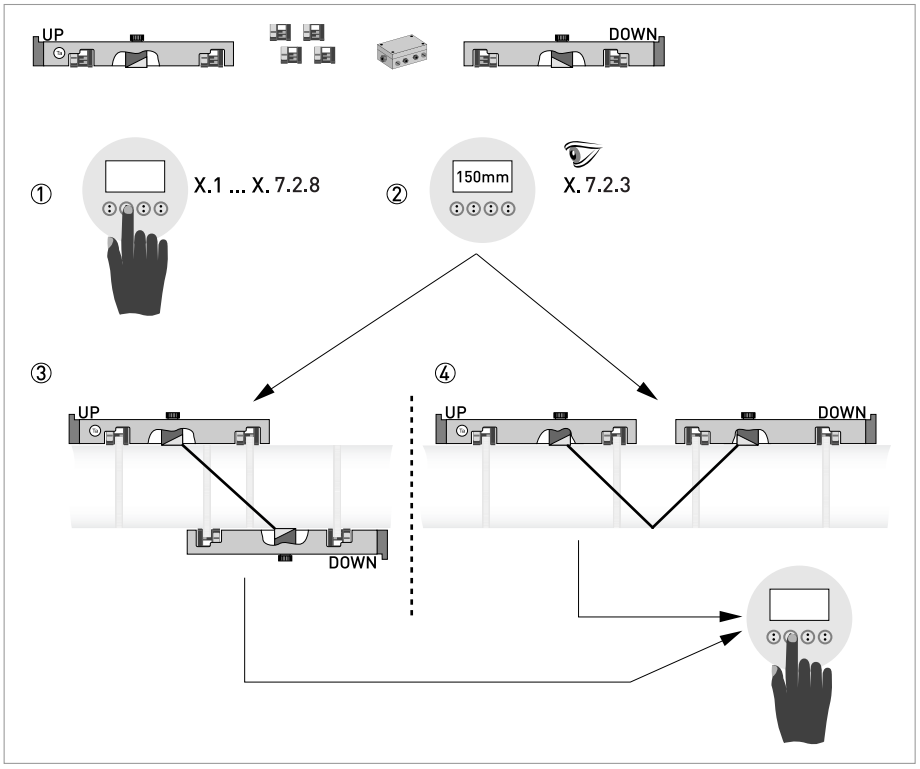


Figure 2-22: Procedure for installation of large version

① Enter the values for the installation menu, X1...X7.2.8
② Read the advised mounting distance in menu X7.2.3
③ Choose for Z-mode (default) or
④ Choose for V-mode

- Finish the installation menu

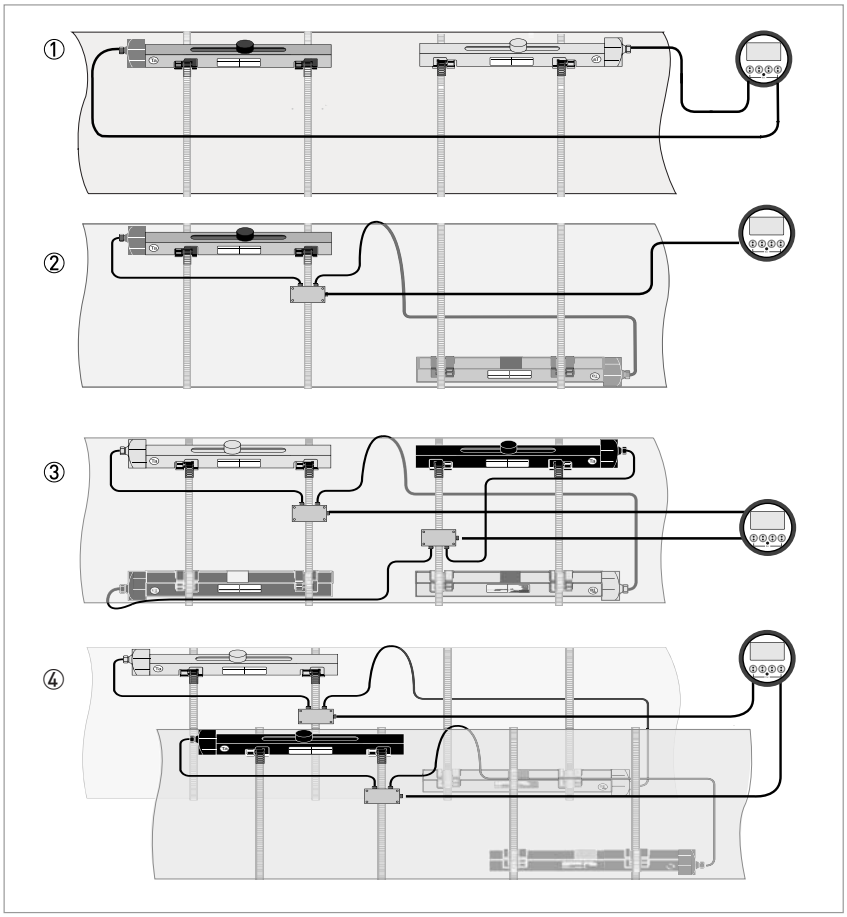


Figure 2-23: Device configurations for "Large" versions

① Single pipe, single path with cable ≤ 5 m
② Single pipe, single path with cable ≥ 10 m
③ Single pipe, dual path
④ Dual pipe

INFORMATION!
Option ① can not be used in case of a 2 path configuration.
For detailed information of the programming and settings refer to General instructions for programming on page 44 or Start measurement of large version on page 46.

INFORMATION!
Information and details for the mechanical installation refer to the manual of the OPTISONIC 6300 and for the electrical connections refer to Electrical connections signal converter on page 32.

2.10 Mounting the field 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.

2.10.1 Pipe mounting

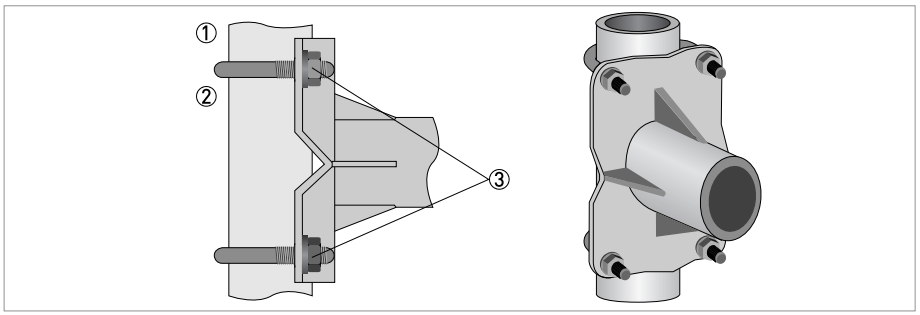


Figure 2-24: Pipe mounting of the field housing

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

2.10.2 Wall mounting

Mounting the field version (F) on the wall

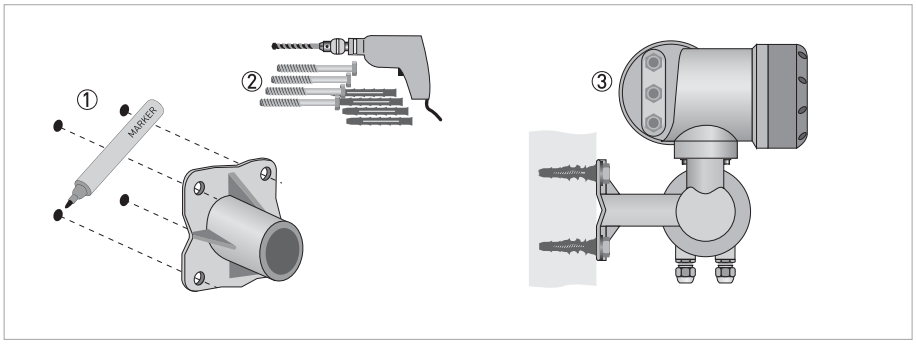


Figure 2-25: Wall mounting of the field housing

① Prepare the holes with the aid of the mounting plate.
further information refer to *Mounting plate of field housing* on page 55.
② Use the mounting material and tools in compliance with the applicable occupational health and safety directives.
③ Fasten the housing securely to the wall.
④ Screw the signal converter to the mounting plate with the nuts and washers.

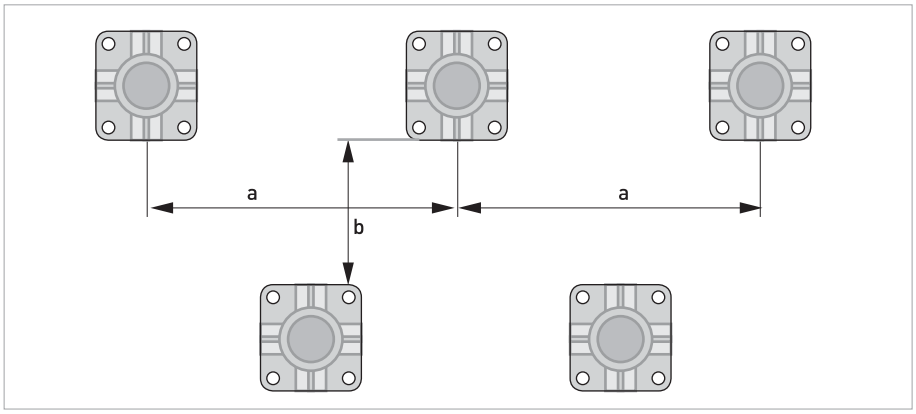


Figure 2-26: Mounting multiple devices next to each other

a ≥ 600 mm / 23.6"
b ≥ 250 mm / 9.8"

Mounting the wall version (W)

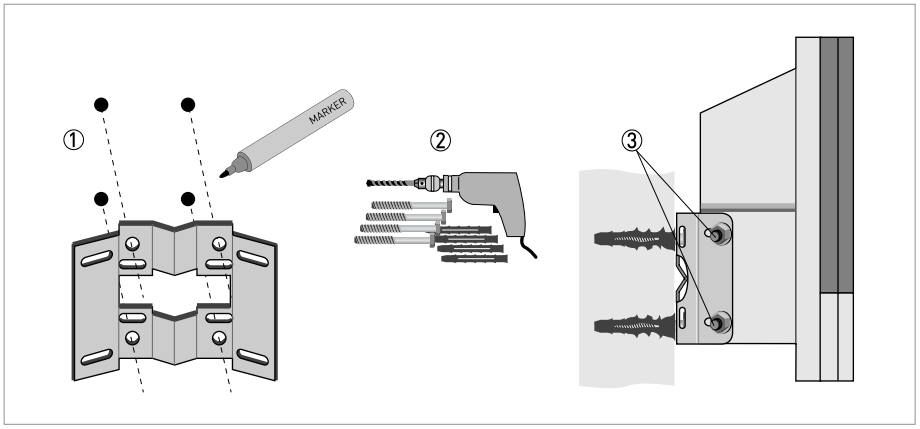


Figure 2-27: Wall mounting of the wall-mounted housing

① Prepare the holes with the aid of the mounting plate. For further information refer to *Mounting plate of wall-mounted housing* on page 55.
② Fasten the mounting plate securely to the wall.
③ Screw the signal converter to the mounting plate with the nuts and washers.

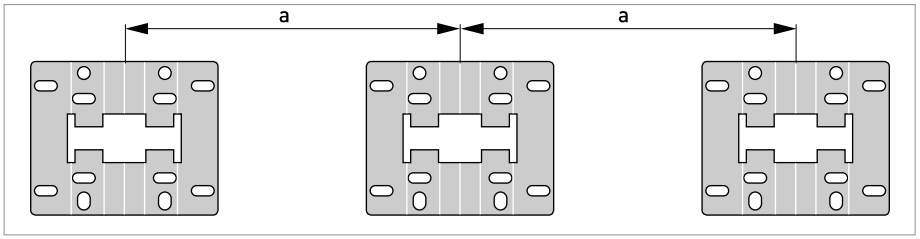


Figure 2-28: Mounting multiple devices next to each other

a ≥ 240 mm / 9.4"

2.10.3 Turning the display of the field housing version

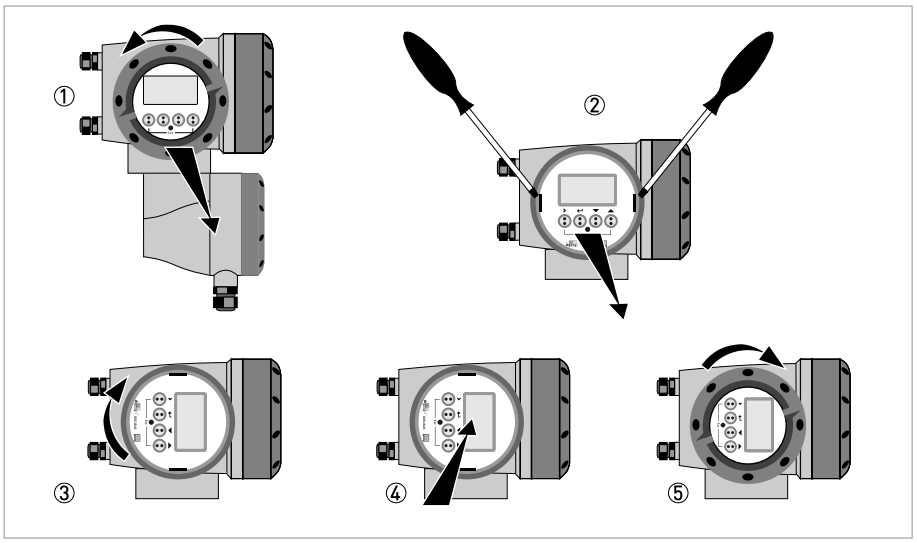


Figure 2-29: Turning the display of the field housing version

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

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

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

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

3.1 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 Laying electrical cables correctly

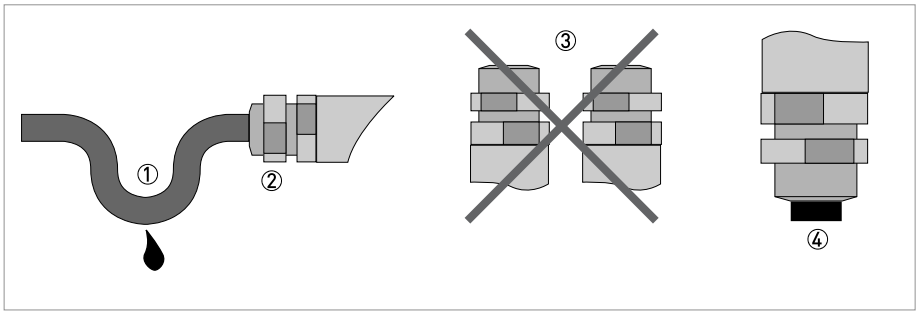


Figure 3-1: Protect housing from dust and water

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.

3.3 Electrical connections signal converter

The connection of the flow sensor(s) to the signal converter depends on the version of the converter ordered.

Field version

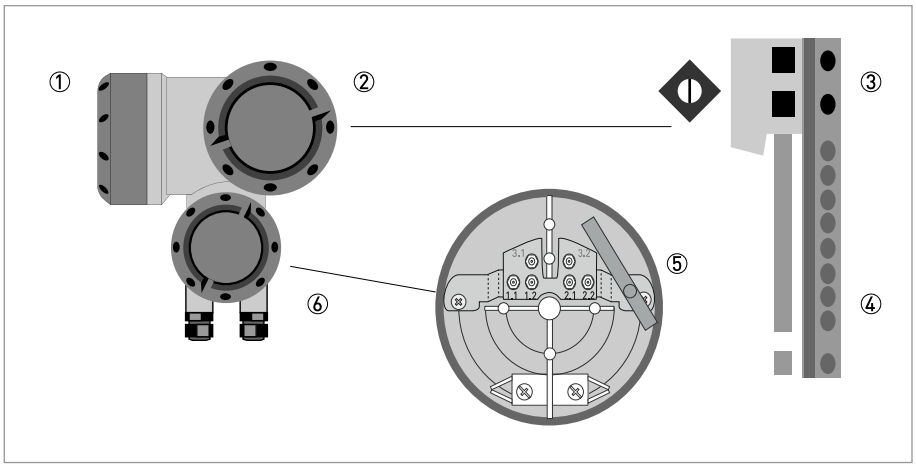


Figure 3-2: Construction of field version

① Cover, electronics compartment
② Cover, terminal compartment for power supply and inputs/outputs
③ Connectors for power
④ Connectors for inputs/outputs
⑤ Connectors for sensor cable
⑥ Cover, sensor terminal compartment

Wall version

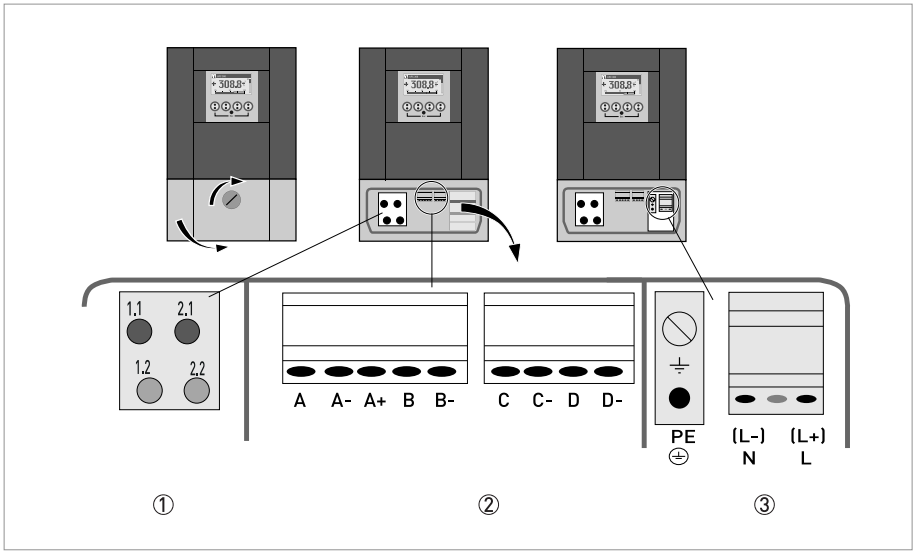


Figure 3-3: Construction of wall version

① Signal cable for sensors
② Communication I/O
③ Power supply: 24 VAC/DC or 100...230 VAC

WARNING!
This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

3.4 Power supply

WARNING!
If this device is intended for permanent connection to the mains, it is required (for example for service) to mount an external switch or circuit breaker near the device for disconnection from the mains. It shall be easily reachable by the operator and marked as the disconnecting device for this equipment.
The switch or circuit breaker and wiring has to be suitable for the application and shall also be in accordance with the local (safety) requirements of the (building) installation (e.g. IEC 60947-1 / -3).

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

INFORMATION!
The power terminals in the terminal compartments are equipped with additional hinged lids to prevent accidental contact.

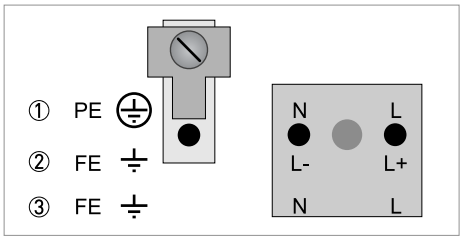


Figure 3-4: Power supply connection

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

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

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

- Note the power supply voltage and frequency (50...60 Hz) on the nameplate.
- The protective ground terminal **PE** of the power supply must be connected to the separate U-clamp terminal in the terminal compartment of the signal converter.

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

24 VDC (tolerance range: -55% / +30%)
24 VAC/DC (tolerance ranges: AC: -15% / +10%; DC: -25% / +30%)

- Note the data on the nameplate!
- For measurement process reasons, a functional ground **FE** must be connected to the separate U-clamp terminal in the terminal compartment of the signal converter.
- When connecting to functional extra-low voltages, provide a facility for protective separation (PELV) (acc. to VDE 0100 / VDE 0106 and/or IEC 60364 / IEC 61140 or relevant national regulations).

INFORMATION!
For 24 VDC, 12 VDC-10% is included in the tolerance range.

3.4.1 Signal converter power supply connections

Field version

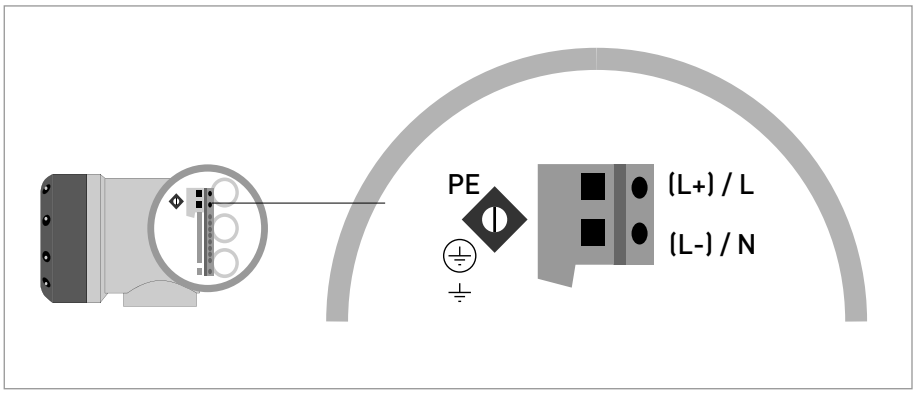


Figure 3-5: Signal converter field version, power supply connections

Wall version

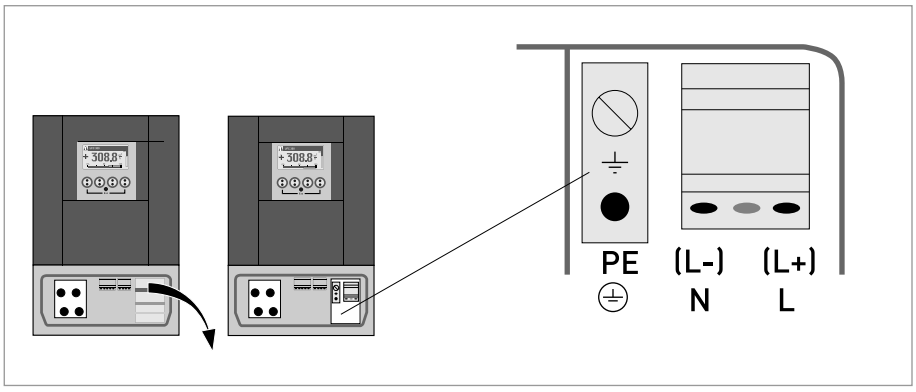


Figure 3-6: Signal converter wall version, power supply

3.5 Signal cable to flow sensor

The special EMC gland is mounted (hand tight) already on the signal cable and has to be fastened correctly after connecting both the coax signal cables and securing the cap on the flow sensor. Draw back the cable carefully and finish with tightening the EMC gland with a proper wrench.

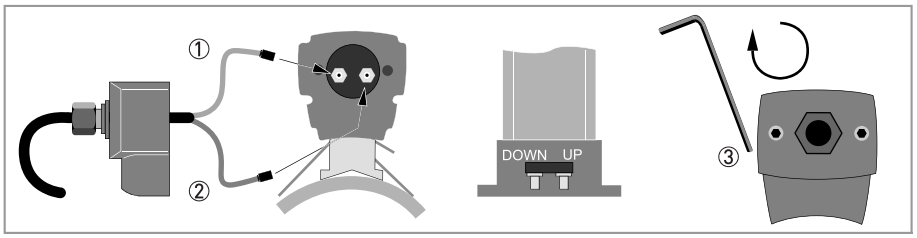


Figure 3-7: Connecting the signal cable to the rail (small and medium version)

① Connect the green cable to "DOWN"
② Connect the blue cable to "UP"
③ Turn the screws clockwise to secure the cap

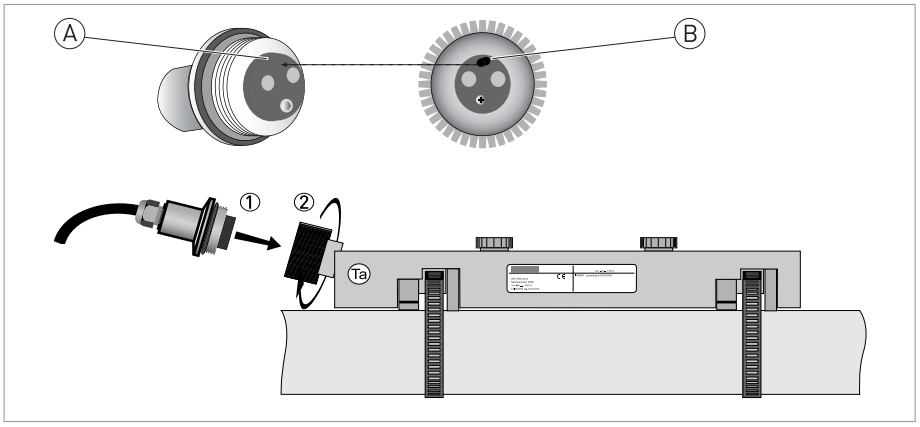


Figure 3-8: Connect the signal cable in case of stainless steel / XT version.

① Put in the connector
② Turn knob to secure the connector
A = positioning notch in connector (female) on cable
B = positioning cam in connector (male) on sensor device

CAUTION!
When attaching the connector, make sure that the cam (B) is positioned correctly and fits into notch (A).

CAUTION!
For XT versions: check if the signal cable is heat protected with the protection sleeve of 1 meter / 40".

INFORMATION!
The signal cable delivered with the device has to be connected correctly with a minimum bending radius of 100 mm / 4".

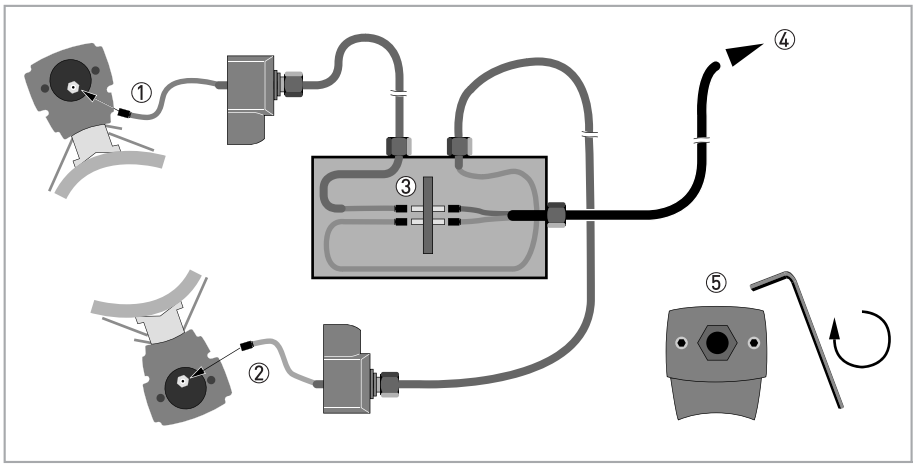


Figure 3-9: Connections in cable box (large version)

① Connect the blue cable to the UP rail
② Connect the green cable to the DOWN rail
③ Make connections in cable box
④ Cable to converter
⑤ Turn the screws clockwise to secure the caps

CAUTION!
To ensure smooth functioning, always use the signal cable(s) included in the delivery.

CAUTION!
When installing the EMC gland, make sure that the shield of the cable has a good contact with the internal metalised insert of the EMC gland.

3.6 Signal cable to converter

The flow sensor is connected to the signal converter via one signal cable, with (labelled) inner coax cables for the connection of the acoustic paths.

INFORMATION!
Connect the cable to the connector with similar numeral marking.

Field version

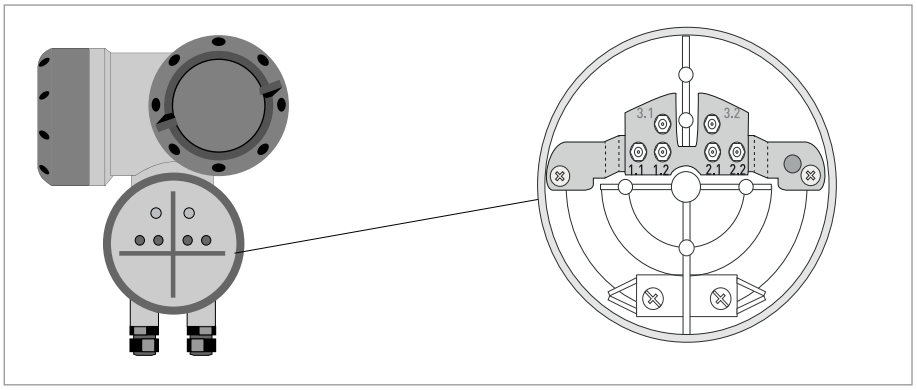


Figure 3-10: Connect signal cable

Construction of console (F-version)

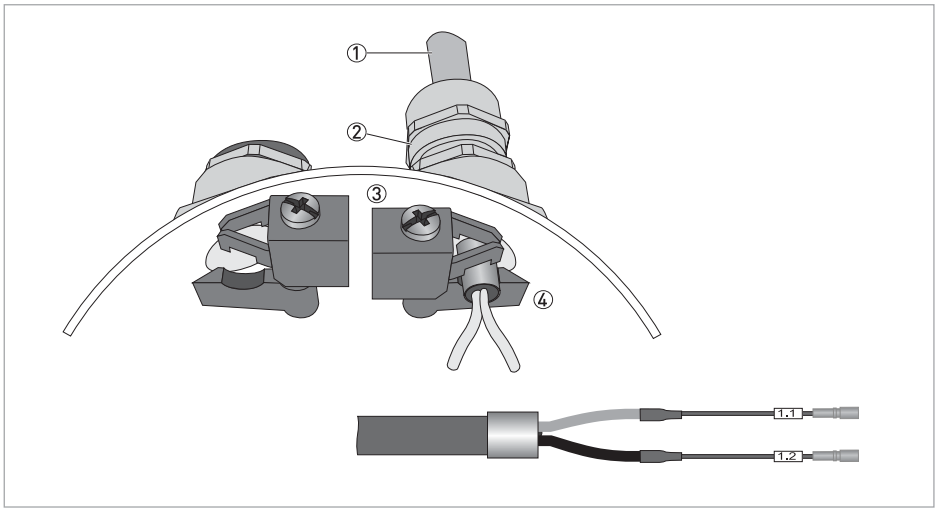


Figure 3-11: Inserting cable and secure with clamp on shielding bush

① Cables
② Cable glands
③ Grounding clamps
④ Cable with metal shielding bush

CAUTION!
Re-connecting of the coax connectors is limited. Make sure that the male connector on the coax cable, is always put straight on the female connector in the connection terminal of the unit. Excessive dis- / re-connection and/or positioning the connectors skewed to each other will damage the inside clips of the connectors. This results in an improper contact and measurement errors.

Cable insert and usage connector tool

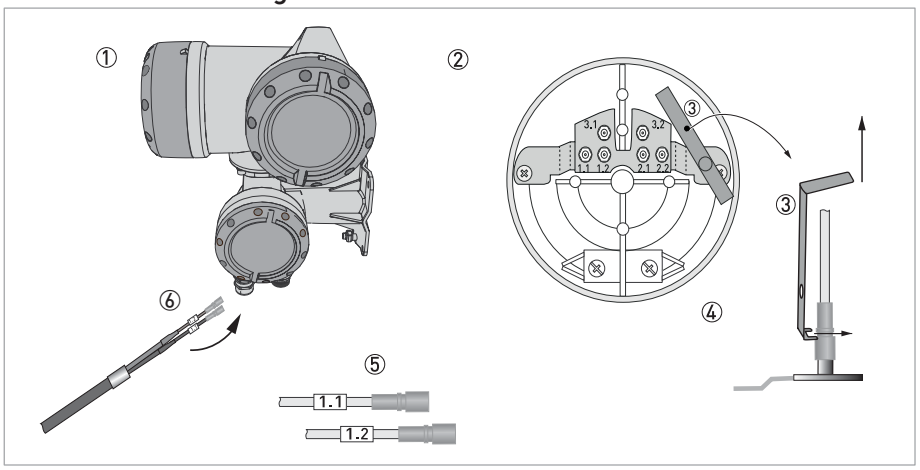


Figure 3-12: Construction of field version

① Signal converter
② Open connection terminal
③ Tool for releasing connectors
④ How to use the release tool
⑤ Marking on the cables
⑥ Insert cable(s) into connection terminal

Construction of console (W-version)

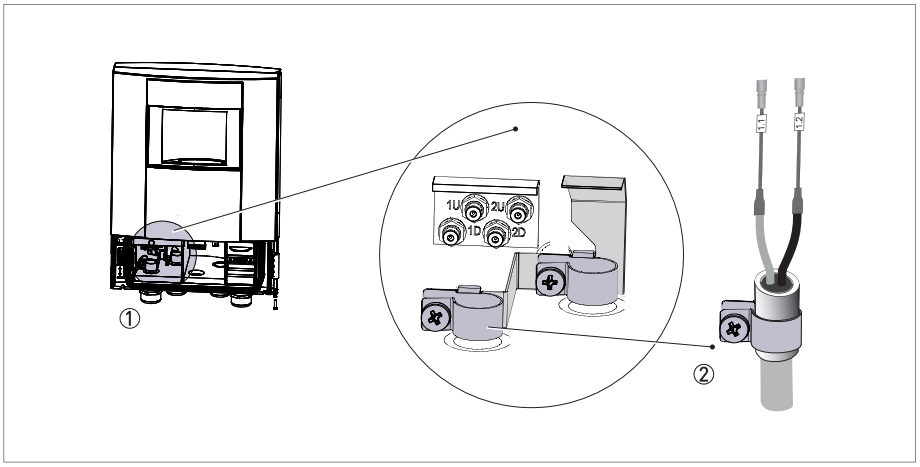


Figure 3-13: Inserting cable and secure with clamp on shielding bush

① Connection compartiment sensor cable(s)
② Grounding clamp with metal shielding bush of sensor cable

Wall version

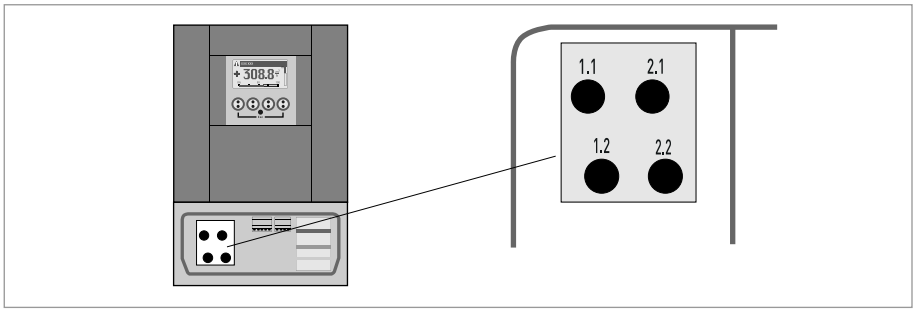


Figure 3-14: Connect signal cable

3.7 Modular inputs/outputs connections

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

INFORMATION!
For frequencies above 100 Hz, shielded cables are to be used in order to reduce effects from electrical interferences (EMC).

CAUTION!
Observe connection polarity.

Field version

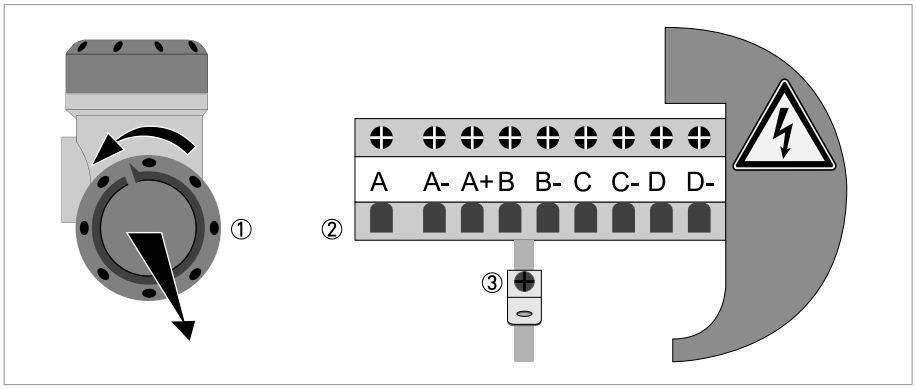


Figure 3-15: Terminal compartment for inputs and outputs of the field housing

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.

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

Wall version

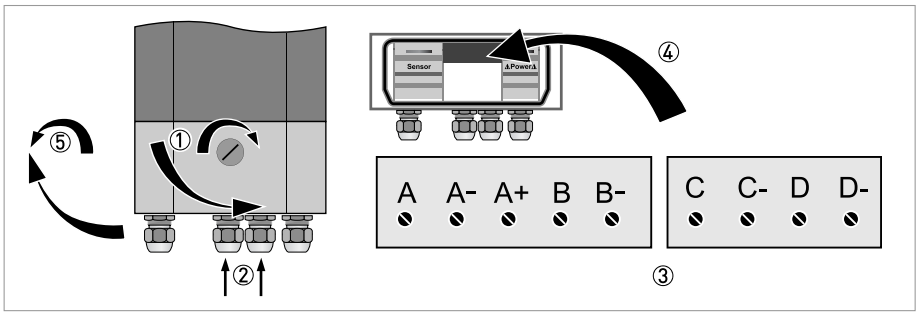


Figure 3-16: Terminal compartment for inputs and outputs of the wall-mounted housing

- Open the lock of the housing cover ① with screw driver (clockwise).
- Open bottom cover (terminal compartment).
- Push the prepared cable through the cable entry ② and connect the necessary conductors ③.
- Connect the shield if necessary ④.
- Close the cover of the terminal compartment.
- Lock ⑤ the housing cover with screw driver (counter clockwise).

3.8 Inputs and outputs, overview

3.8.1 Description of the CG-number

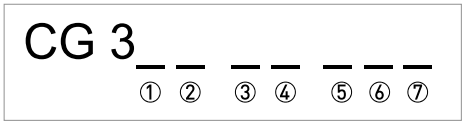


Figure 3-17: Marking (CG number) of the electronics module and input/output variants

① ID number:7
② ID number: 0 = standard
③ Power supply option / measuring 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.

Examples for CG number

CG 370 x1 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 370 x1 7FK	100...230 VAC & standard display; modular I/O: I_a & P_N/S_N and optional module P_N/S_N & C_N

Description of abbreviations and CG identifier for possible optional modules on terminals A and B

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 acc. 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 acc. to NAMUR 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
2 x IIn_a	5	Two active current inputs (for Ex i I/O)
-	8	No additional module installed
-	0	No further module possible

3.8.2 Fixed, non-alterable input/output versions

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

- The grey boxes in the tables denote unassigned or unused connection terminals.
- In the table, only the final digits of the CG 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	
2 5 0		IIn_a active		IIn_a active					

① Function changed by reconnecting
② Changeable

- The grey boxes in the tables denote unassigned or unused connection terminals.
- Connection terminal A+ is only operable in the basic input/output version.

3.8.3 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 IOs (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

Modbus (option)

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

① Changeable
② Not activated bus terminator

4.1 General instructions for programming

After installation of the flow sensor(s) and the electrical connection of the converter, the device can be switched on and is now ready to be programmed.

Start installation menu

- Connect converter to power supply and power up converter.

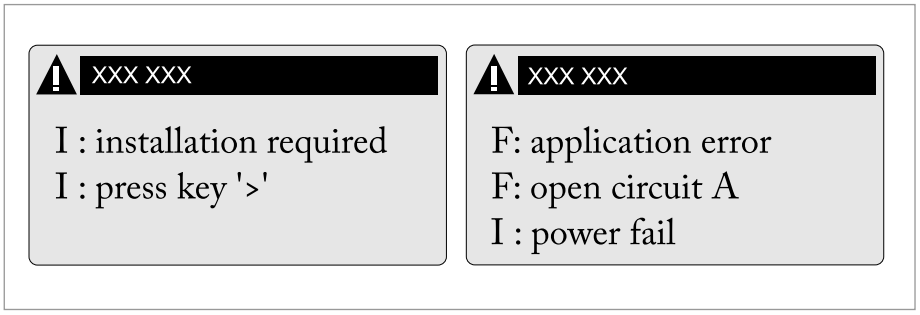


Figure 4-1: First and second page appear intermittently

- Keep left button ">" pressed, until in display appears "release key now".

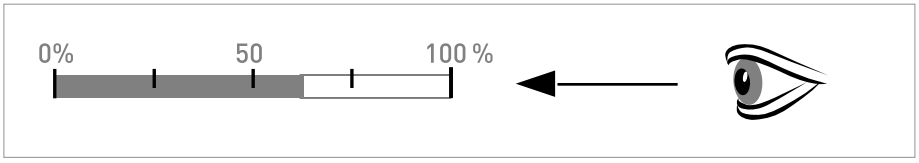
CAUTION!

- *If you program the diameter, use the outer diameter of the pipe.*
- *For improved accuracy fill in as much details as possible.*
- *Fill in the actual transducer distance at menu X7.2.6 (and X8.2.6 if applicable)*
- *Run the optimization loop until the transducer distance changes no more than 0.5%.*

4.2 Start measurement (standard setup)

Step through the installation program to setup the configuration for the small / medium version. For the large version a pre installation is necessary. Before continuing, complete pre- and mechanical installation refer to *Start measurement of large version* on page 46.

- Power up the converter (do not mount and/or connect the rails yet)
- Fill in menu X1...X7 (see section "Installation menu" in chapter "General instructions for programming")
- X7.1: Check the reading with the sensor code (Ta/Tb) on rail. Press enter
- X7.2.1: Check the reading with the calibration number on the nameplate. Press enter
- X7.2.2: Check the factory preset number of traverses (default: 2, for DN<25: 4)
- X7.2.3: Read the advised mounting distance and position the transducer at that distance . Press enter
- X7.2.4: Read the preliminary volume flow. Press enter
- X7.2.5: Read the actual signal strength



INFORMATION!
Advice on signal strength:
Signal > 75%: *good signal, optimization loop not needed*
Signal 50...75%: *fairly good signal, optimization loop can improve the signal*
Signal 10...50%: *low signal, optimization loop needed*
Signal < 10%: *bad or no signal, check settings in menu X5, increase transducer distance and/or go into the optimization loop.*

- X7.2.6: Confirm or adjust the reading with the actual distance on the rail.
- Optimization loop. Repeat steps X7.2.7 until the advised mounting distance does not change more than 0.5%.
- X7.2.7: Optimise distance? (yes/no).
  - read actual velocity of sound of fluid.
  - new velocity of sound of fluid? (yes/no).
  - confirm or adjust velocity of sound.

  Read the advised mounting distance and position the transducer at that distance.
  Press enter.
- X7.2.8: Read the actual volume flow.
- X7.2.9: Path ready? (yes/no).
- X7.2.11: End Installation? Enter "No". If you have:
  1 path or pipe: you are finished, proceed with X8 for next transducer.
  2 paths: go to X4.2 for the 2nd path.
  2 pipes: go to X6 for the 2nd pipe.
- X7.2.11: End Installation? Enter "Yes" to save the installation. The measurement screen will appear.
- Mount the cover.

4.3 Start measurement of large version

Before installation

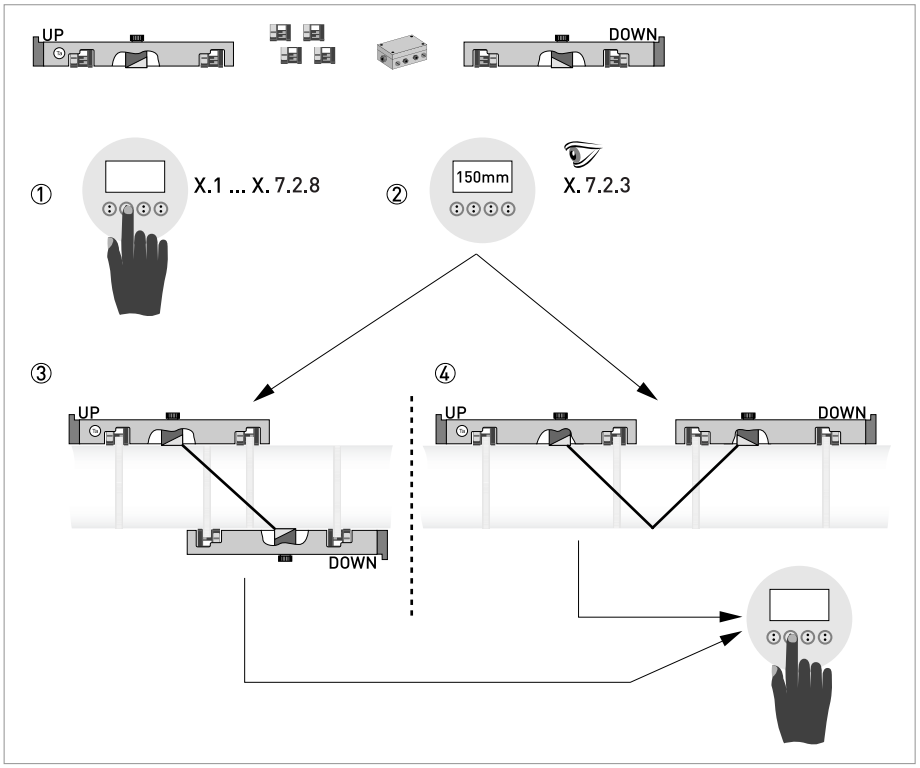


Figure 4-2: Procedure for installation of large version

① Enter the values for the installation menu, X1...X7.2.8
② Read the advised mounting distance in menu X7.2.3
③ Choose for Z-mode (default) or
④ Choose for V-mode

- Power up the converter (do not mount and/or connect the rails yet)
- Fill in menu X1...X5 refer to *General instructions for programming* on page 44
  Select "1 path" initially in X4
- X7.1: Check the reading with the sensor code (Ta/Tb) on rail
- X7.2.1: Check the reading with the calibration number on the nameplate
- X7.2.2: Check the factory preset number of traverses (default: 1 for Z-mode)
- X7.2.3: Read the advised mounting distance. Write it down, you need it later. The installation menu can be closed, continue with mechanical and electrical installation.

➲ **Mounting distance**
The advised mounting distance is needed when continuing with the configuration.
Proceed with the mechanical installation of the rails: refer to *Mechanical installation of large version* on page 24.

After the mechanical installation of the rails, continue with the standard set up (configuration) refer to *Start measurement (standard setup)* on page 45.

CAUTION!
Choose between Z and V mode before you proceed. The advised distance (menu X7.2.3) must be > 246 mm / 9.7" for V-mode.

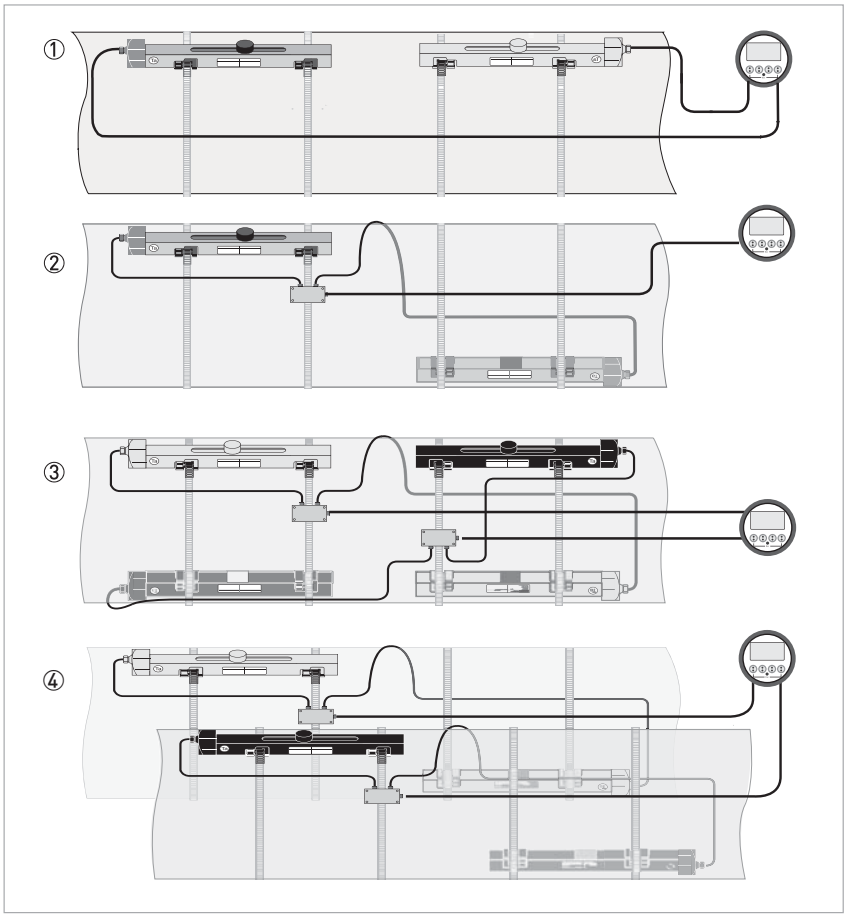


Figure 4-3: Device configurations for "Large" versions

① Single pipe, single path with cable ≤ 5 m
② Single pipe, single path with cable ≥ 10 m
③ Single pipe, dual path
④ Dual pipe

4.4 Mechanical installation for large version

INFORMATION!
You need a calculator, measuring band and pen & paper to install a large version.

CAUTION!
Make sure that you mount the rail parallel to the pipe. Mount the fixing units and the cable box as shown below.

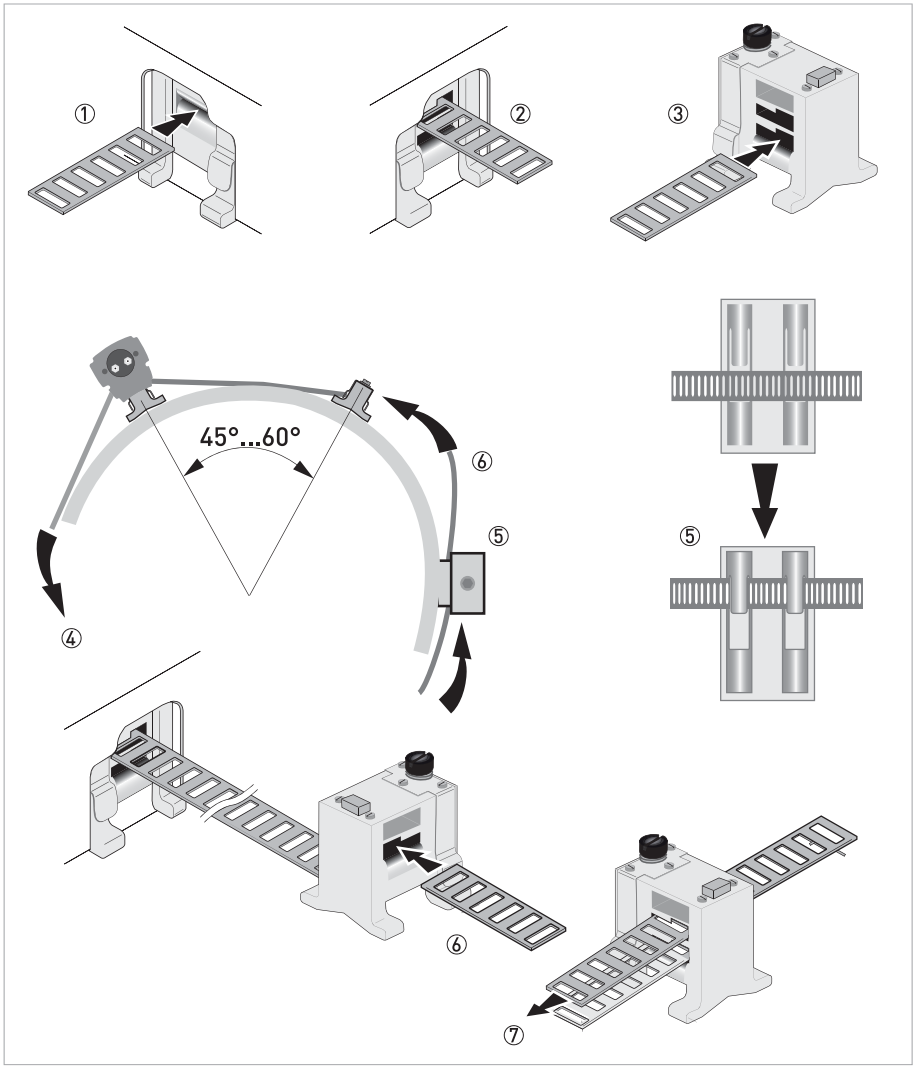


Figure 4-4: Mounting large version rail

① Pull the metal strap through the upper slit of the UP rail.
② Take the metal strap around the pipe (45...60°).
③ Push the end of the metal strap into the lower slot of the fixing unit.
④ Take the other side of the metal strap around the pipe to the fixing unit.
⑤ Mount the cable box (only for the downstream metal strap).
⑥ Push the metal strap through the upper slot of the fixing unit.
⑦ Pull the metal strap moderately tight by hand.

- Secure by turning screws clockwise.

Mounting the DOWN rail in Z-mode

Measure the circumference of the pipe with a measuring band.
For Z-mode, you must install the DOWN rail at the opposite location at the pipe. There are two possible ways to find the exact location:

Find the location with a fixed reference point

Calculate the half of the circumference. Mark this 180° alignment line on the pipe.

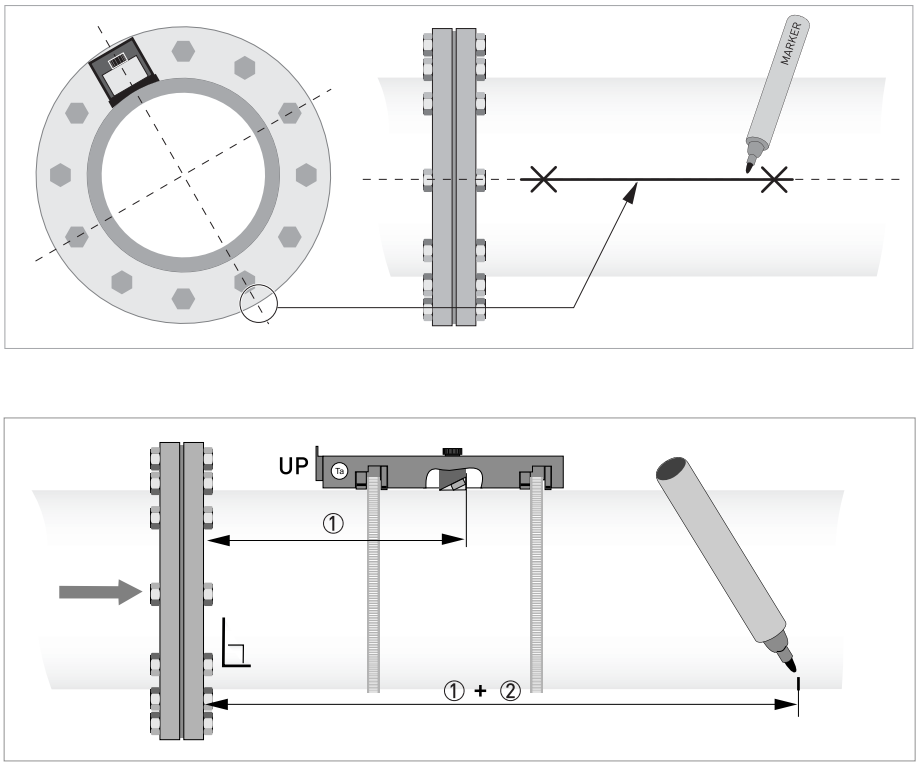


Figure 4-5: Find the opposite location with a reference point

① Measure the distance between the transducer of the UP rail and the reference point.
② Add the Advised Distance and mark the location on the alignment line.

- Mount the DOWN rail in such a way that the transducer is at the marked location.

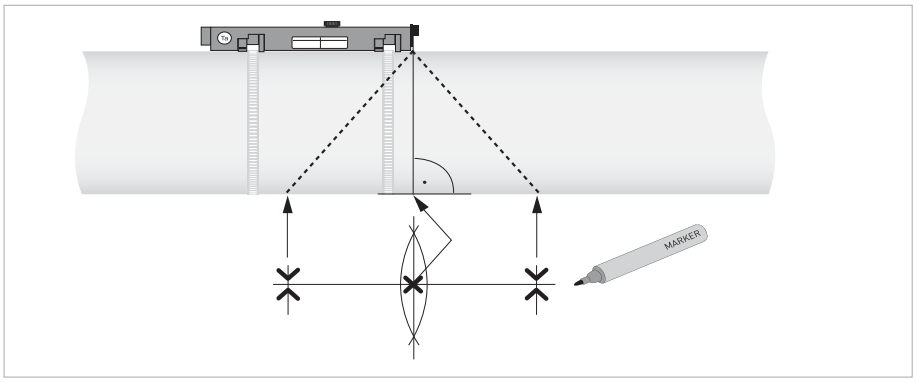


Figure 4-6: Marking the opposite location

Calculate the middle of the alignment line between the 4 V-marks as shown.

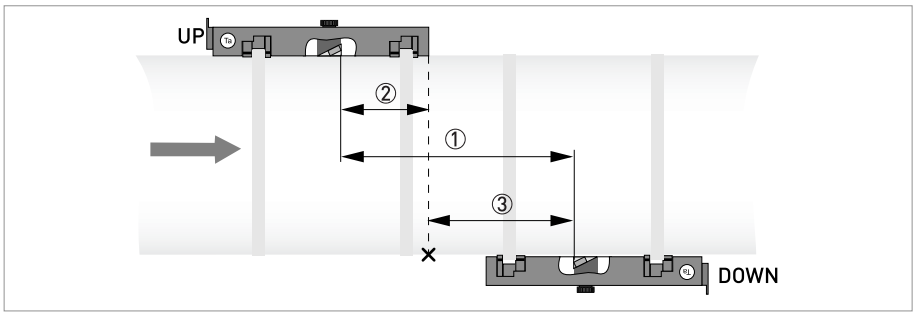


Figure 4-7: Finding the location for the DOWN rail

① Advised Distance as shown in menu X7.4
② Measure the distance between the transducer and the end of the UP rail.
③ Determine and mark the location of the transducer of the DOWN rail: ③ = ① - ②

- Mount the DOWN rail in such a way that the transducer is at the marked location.
- Grease all transducers, see "General mechanical installation".

INFORMATION!
It can be necessary to install the DOWN rail as shown below.

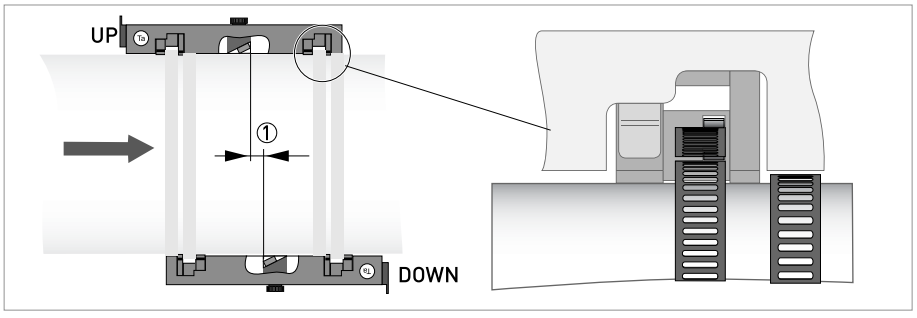


Figure 4-8: Transducers almost opposite, distance small ①

The installation of the rails are (more or less) facing straight and metal straps are mounted close beside each other.

Mounting the DOWN rail in V-mode

For V-mode, you must install the DOWN rail in line with the UP rail. It is easier to install than the Z-mode, but you need more free pipe length. V-mode is possible for DN450/600...2000 (minimum depends on application).

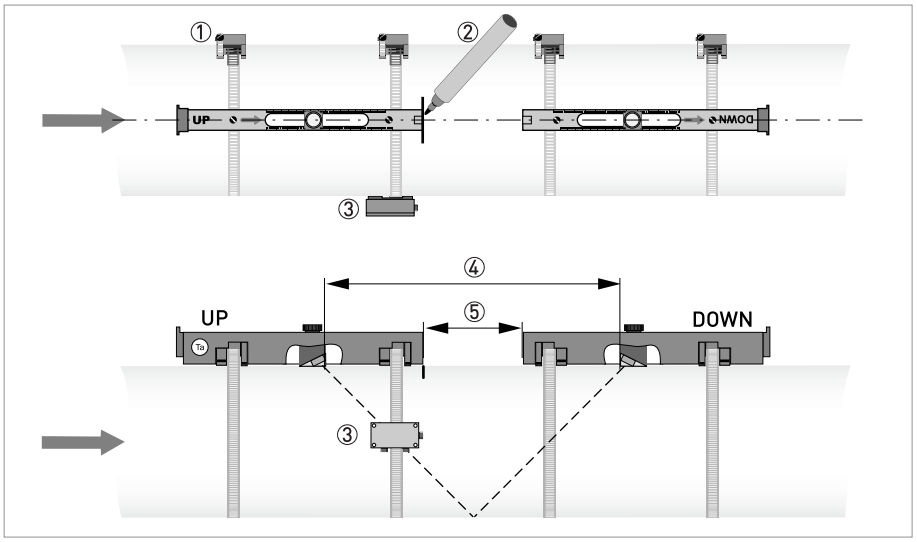


Figure 4-9: Mounting large version in V-mode

① Fixing units
② Reference marking
③ Cable box
④ Advised Distance, X7.4
⑤ Minimum distance between UP and DOWN rail: 110 mm / 4.3"

Electrical connections

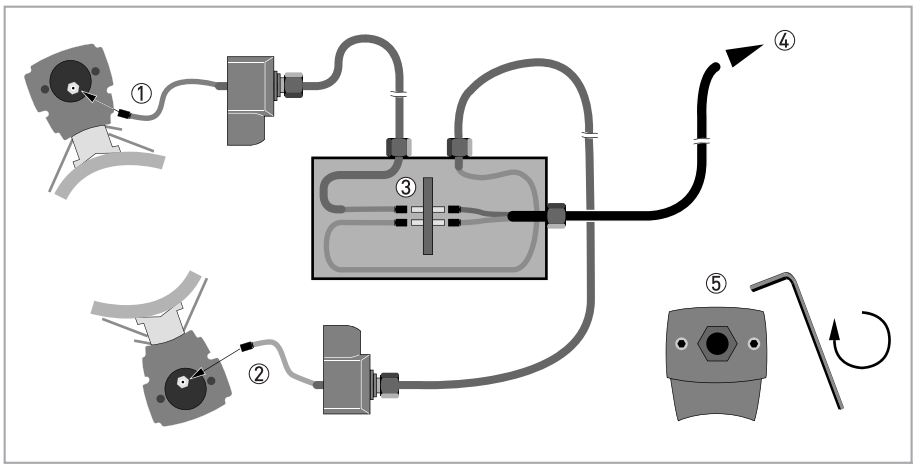


Figure 4-10: Connections in splitter- (cable) box (large version)

① Connect the blue cable to the UP rail
② Connect the green cable to the DOWN rail
③ Make connections in splitter- (cable) box
④ Cable to converter
⑤ Turn the screws clockwise to secure the caps

INFORMATION!
See also the previous sections "Installation" and "Electrical connections".

5.1 Dimensions and weight

5.1.1 Clamp-on sensor and splitter- (cable) box

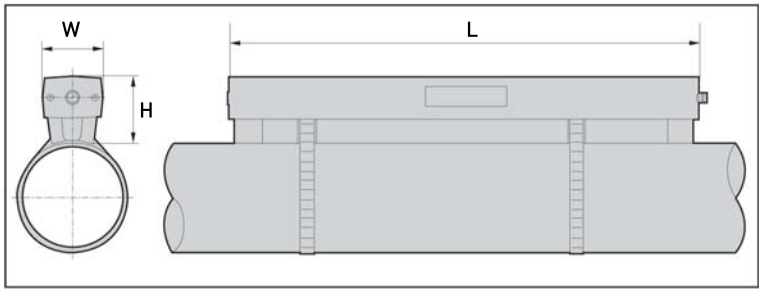


Figure 5-1: Dimensions clamp-on sensor

Version	Dimensions [mm]			Approx. weight (without cable / strip) [kg]
	L	H	W	
Small	496.3	71	63.1	2.5
Medium	826.3	71	63.1	3.4
Large	496.3 ①	71 ①	63.1 ①	4.6
Small - stainless steel / XT ②	493	65.5	48	2.0
Medium - stainless steel / XT ②	823	65.5	48	2.6

Table 5-1: Dimensions and weight clamp-on sensor (mm - kg)

① value for one of the 2 delivered rails
② delivered without cover

Version	Dimensions [inches]			Approx. weight (without cable / strip) [lbs]
	L	H	W	
Small	19.5	2.8	2.5	5.5
Medium	32.5	2.8	2.5	7.6
Large	19.5 ①	2.8 ①	2.5 ①	10.2
Small - stainless steel / XT ②	19.4	2.6	1.9	4.4
Medium - stainless steel / XT ②	32.4	2.6	1.9	5.7

Table 5-2: Dimensions and weight clamp-on sensor (inch - lb)

① value for one of the 2 delivered rails
② delivered without cover

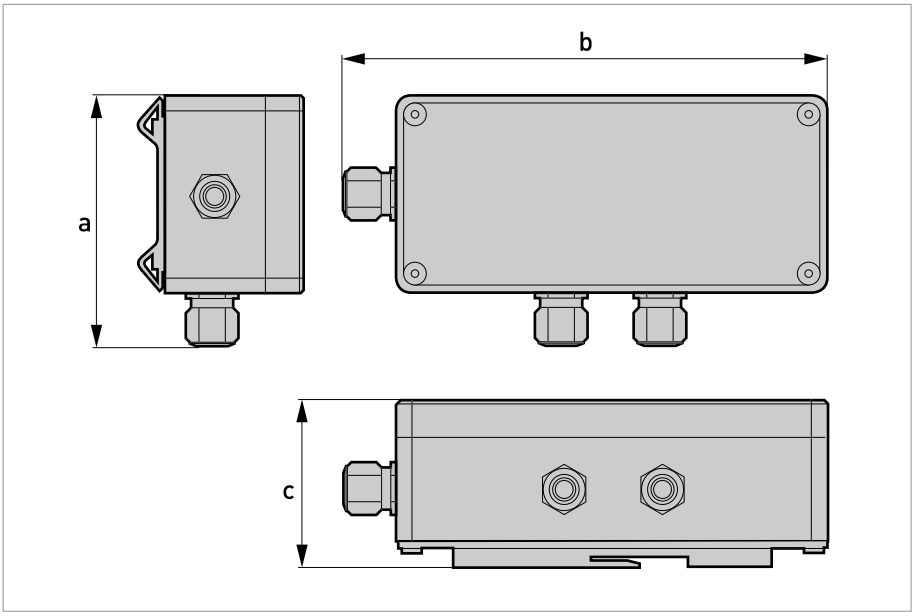


Figure 5-2: Dimension splitter- (cable) boxbox

	Dimensions [mm]			Approximately weight without cable [kg]
	a	b	c	
Cable box	115	210	67	0.9

Table 5-3: Dimensions and weight splitter- (cable) box (mm - kg)

	Dimensions [inches]			Approximately weight without cable [lbs]
	a	b	c	
Cable box	4.53	8.27	2.64	2.0

Table 5-4: Dimensions and weight splitter- (cable) box (inch - lb)

5.1.2 Mounting plate of field housing

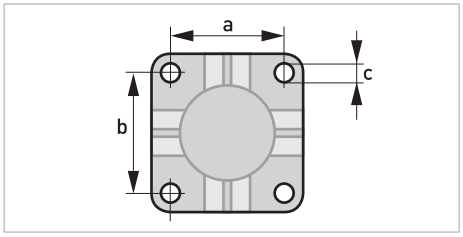


Figure 5-3: Dimensions for mounting plate of field housing

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

Table 5-5: Dimensions in mm and inch

5.1.3 Mounting plate of wall-mounted housing

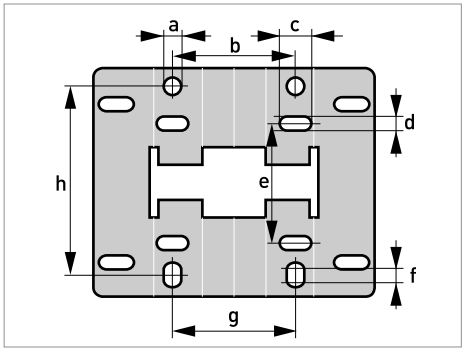


Figure 5-4: Dimensions of mounting plate of wall-mounted housing

	[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 5-6: Dimensions in mm and inch

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